

**TECHNICAL NOTES**

**DEPARTMENT OF CIVIL ENGINEERING**

**SYED AMMAL ENGINEERING COLLEGE**

**RAMANATHAPURAM**

# BASICS OF CIVIL ENGINEERING

## 1.1 STONES

Rocks from which stones are obtained may be classified in the following three ways:

- a) Geological classification
- b) Physical classification
- c) Chemical classification.

**a) Geological classification** On the process of formation, rocks are classified as igneous rocks, sedimentary rocks and metamorphic rocks.

**Igneous Rocks:** These are the rocks formed by cooling of magma. These rocks are strong and durable. They are further classified as:

*Volcanic rocks:* Cooling of magma at earth's surface – extremely fine grained and glossy.

Examples: Basalt and trap.

*Hypahyssal rocks:* Cooling of magma at shallow depth – fine grained crystallized structure.

Examples: Quartz, dolerite and gneis .

*Plutonic rocks:* Cooling of magma at considerable depth – very strong and crystalline structure.

Examples: Granite and dolerite.

1. **Sedimentary Rocks:** Disintegrated rock material s carried by flowing water and **deposited** elsewhere. Year after year new layers of materials are deposit d and consolidated under pressure, heat and chemical action. Hence, the rocks so formed are uniform, fine grained and bedded. Examples: sandstones, mudstones, limestones.
2. **Metamorphic Rocks:** These are the rocks formed after igneous rocks and sedimentary **rocks** undergo changes due to pressure, heat and chemical actions. These rocks have folia ed structure. For example:
  - Granite becomes gneiss.
  - Basalt changes to schist and laterite
  - Limestone changes to marble
  - Mudstone becomes slate.

**(B)Physical classification** Based on the structure, rocks may be classified as stratified, unstratified and foliated rocks.

1. **Stratified Rocks:** They have layered structure. Examples: Sandstones, limestones, mudstones.
2. **Unstratified Rocks:** They possess crystalline and compact grains. Examples: Granite, trap, marble.
3. **Foliated Rocks:** They have foliated structure. Along the planes of foliation they split easily. These planes are not parallel to each other.

**(C). Chemical classification**

**Siliceous Rocks:** Main constituent is silica. These rocks are hard and durable. Examples: Granite, trap, sandstone.

**Argillaceous Rocks:** Clay is the main constituent. These rocks are brittle. They cannot withstand shock. Examples: Slate, laterite.

**Calcareous Rocks:** Calcium carbonate is the main constituent. Examples: Limestone, marble.

## 1.2 CHARACTERISTICS OF GOOD BUILDING STONES

It should possess fine grained structure, uniform and pleasing colour. It should be free from soft patches, flaws and cracks.

The minimum strength of  $3.5 \text{ N/mm}^2$  is required for stone to be used for load bearing walls. It should not absorb more than 5% water.

The specific gravity should not be less than 2.5.

In attrition test, it should not show wear of more than 2%.

Toughness index should be more than 10.

It should have good resistance to shocks and it should be durable.

**Quarrying** It is the process of extracting stones from rockbed, located near the earth's surface *and* exposed to sun.

Quarrying may be done using hand tool, channeling machine or by blasting.

- (a) Quarrying using hand tools: In soft rocks hand tools like chisels, hammers, pick axes **and** shovels may be used. Heating technique is suitable for getting aggregates. Wedging technique **is** suitable for quarrying in thin bedded rocks.
- (b) Quarrying using channelling machine: This is suitable for large size quarrying in soft rocks like marble and limestone. Channels are 50 to 75 mm wide and 2.4 to 3.6 m deep. After channelling with machine wedges and drills are used to get stones.
- (c) Quarrying by blasting: It consists of boring, charging, tamping and firing. The gas produced **in** the blast tries to come out by breaking the rock in all directions and succeeds in scaping **along the Line of Least Resistance (LLR)**.

**Dressing of stones** The aim of preliminary dressing is to bring the size of stone approximately to the required size and reduce the transportation cost to great extent. Final dressing is as per the requirement of the user. The different methods of final dressing are:

- (1) Hammer face; (2) Chisel drafted face; (3) Polished face and (4) Tooled finish.

**Seasoning of stones** The process of removing sap from the pores is known as seasoning. The best method of seasoning is to allow the stones to dry for a period of 6 to 12 months in a shed.

**Preservation of stones** The following preservatives are used:

- (A) Linseed oil; (2) Solution of alum and soap; (3) Solution of barium hydroxide; (4) Coal tar;
- (5) Paint and (6) Paraffin.

### **Tests on stones**

#### *Field Tests*

- ( ) **Smith's test:** It is to check whether the stone contains 'muddy' substance. A sample of stone is kept in a glass of distilled water for 24 hours and stirred well to remove muddy substance.
- (A) **Toughness test:** Stone is hit with a hammer and metallic sound is indication of strong stone.
- (B) **Hardness test:** Mohr's hardness may be found by scratching the stone with knife.

#### *Laboratory Tests*

**Crushing strength test:**  $40 \times 40 \times 40$  mm cubes are used for testing. Load is applied in a compression testing machine at the rate  $14 \text{ N/mm}^2$  per minute. A stone with crushing strength more than  $100 \text{ N/mm}^2$  is treated as good stone.

**Water absorption test:** For good stone water absorption after 24 hours immersion in water, should not exceed 0.60.

**Attrition test:** Los Angeles abrasion test is conducted to find the resistance of the stone to surface

wear. Los Angeles value recommended are (a) for bitumen mix: 30%, (b) for base course 50%.

**Impact test:** Impact testing machine consists of a frame with guides. A metal hammer weighing 13.5–15 kg falls from a height of 380 mm. Recommended values for various works are

For wearing coat  $\geq 30\%$

For bituminous mehadam  $\geq 35\%$

For water bound mehadam  $\geq 40\%$

**Acid test:** Sandstones are checked for the presence of calcium carbonate. Sample of 50–100 gm of stone is kept in 1% hydrochloric acid for seven days. If calcium chloride is present, edges are broken and powder is formed.

**Common building stones** Basalt, granite, sandstones, limestones, marble, quartzite, laterite *and* slate. Solid and hollow concrete blocks are known as artificial stones.

### 1.3 TIMBER

Living tree, yielding good timber is called standing timber. After felling and separating branches it is known as rough timber. When bark is removed and stem is roughly converted into pieces of suitable length it is known as log. After the log is seasoned and converted into commercial sizes like planks, battens, posts and beams, it is known as converted timber.

#### Classification

(B) On the basis of mode of growth timber is classified as exogenous and endogenous. Exogenous trees grow outward adding a distinct ring every year while endogenous trees grow inwards. Example of exogenous trees are mahogany, sal, teak, babul while examples of endogenous trees are bamboo and cane. Exogenous trees are further classified as coniferous and deciduous. Coniferous trees have cone shape and their leaves do not fall till new ones grow. Deciduous trees have broad leaves and they fall in autumn and new ones appear in the spring.

In the cross section of deciduous trees the following components are clearly visible from inside to outside. Pith, heartwood, sapwood, cambium layer, inner bark, outer bark and medullary rays. Sapwood contains annual rings, count of which gives the age of the tree.

2. Classification based on durability: Durability test is conducted by Forest Research Institute of India, Dehradun by burrying  $600 \times 50 \times 50$  size specimen upto half their length and observing them over several years. Then timber is classified as

**High durability:** Average life of more than 10 years

**Moderate durability:** Average life 5 to 10 years

**Low durability:** Average life is less than 5 years.

(D) Classification based on grading: On the basis of strength, defects, etc. IS: 12326–1976 classifies timber as special grade, Grade – I and Grade – II.

(E) Classification based on Availability:

X : Most common, 1415 m<sup>3</sup> or more every year

Y : Common, 335 m<sup>3</sup> to 1415 m<sup>3</sup> per year

Z : Less common, less than 335 m<sup>3</sup> every year.

**Seasoning of timber** Seasoning is the process of reducing moisture content in a freshly cut tree to the desired level. Seasoning makes timber more durable and stable. The various methods of seasoning used are:

- Natural seasoning: Air seasoning or water seasoning.
- Artificial seasoning: Boiling, kiln seasoning.
- Chemical seasoning or electrical seasoning.

**Conversion of timber** Market names of converted timber are battens, plank, pole, scanting, *beams*, etc. They are available in different sizes and length. They are obtained by sawing logs. The various methods adopted for sawing are: ordinary, quarter, tangential and radial.

**Defects in timber** Defects may be due to natural forces, attack by fungi or insects or due to *erroneous* seasoning. The defects due to natural causes are knots, shakes, insect galls, upsets, twisted fibres, wind cracks, burls, dead wood, foxiness and stain.

**Preservation of timber** The widely used preservatives are coal tar, solignum paints, chemical *salt*, creosote and ASCU. ASCU is a special preservative developed by FRI, Dehradun.

**Industrial timber** Veneers, plywood, fibreboards, particle boards, block boards, hard boards and Glulam.

**Indian timber trees** Babul, Bamboo, Casurina, Deodar, Jack, Mango Mahogany, Rosewood, Teak, Sandalwood, Sisso.

## 1.4 BRICKS

• Standard sizes are 190 × 90 × 40 mm, with mortar the size comes out to be 200 × 100 × 50 mm.

However, the old size of  $8\frac{3}{4}'' \times 4\frac{1}{4}'' \times 2\frac{5}{8}''$  giving masonry of  $9'' \times 4\frac{1}{4}'' \times 3''$  are still used in many parts of India.

Clay suitable for making bricks contain Alumina – 20 to 30% is Silica – 50%

Lime – 5% is desirable

• Iron oxide – 5 to 6%

Magnesia – A small quantity only

(A) Pebbles, vegetable and organic matter, excess lime, iron pyrites, sulphates of calcium and potassium are harmful.

(B) Manufacture of bricks involves preparation of clay, moulding, drying and burning processes.

**Preparation of clay:** It involves unsoiling, digging, cleaning, weathering, blending and tempering; pug mills are used for tempering.

**Moulding:** It may be by hand moulding or by machine moulding.

**Drying:** It may be by natural drying or by artificial drying.

**Burning:** It may be in clamps or in kilns. Intermittent and continuous kilns are used depending upon the demand in the locality. Bull's trench kiln, Hoffman's kiln and Tunnel kilns are the continuous kilns.

### (C) Classification of Bricks

Based on strength, bricks are classified as class 3.5, 5.0, etc. to mean compressive strength is  $3.5 \text{ N/mm}^2$ ,  $5.0 \text{ N/mm}^2$ , etc. Each class is subdivided into *A* and *B* on the basis of tolerances in sizes.

However, in practice the bricks are classified as first, second, third and fourth class.

High duty bricks; (2) Perforated bricks; (3) Hollow bricks; (4) Specially shaped bricks; (5) Fire clay bricks; (6) Paving bricks; (7) Facing bricks; (8) Sol ng bricks; (9) Sewer bricks.

#### • Tests on Bricks

( ) Field tests: Observing size, colour, structure, hardness by scratching, sound test by striking **two** bricks with each other and strength test by dropping from a height of 1 m.

(A) Laboratory tests conducted on bricks are:

Crushing strength test; (b) Absorption test; (c) Shape and size test; (d) Efflorescence test. Requirement of good bricks are:

Compressive strength  $> 3.5 \text{ N/mm}^2$

Water absorption  $\leq 20\%$

Variation in sizes should be within the tolerances prescribed by code. They should not show white patches when soaked in water for 24 hours.

To meet local requirement, the following materials substitute for bricks:

1. Stabilized soil bricks; 2. Sand + lime blocks; 3. Fly ash bricks; 4. Concrete blocks.

### 1.5 CLAY PRODUCTS

Apart from bricks, the following clay products are used by burning, glazing and vitrifying clay.

(1) Tiles; (2) Terracotta; (3) Earthenware and (4) Stoneware.

**1. Tiles** Different types of tiles used are roofing tiles, ceiling tiles, ridge tiles, flooring and wall tiles, drain tiles.

The following roofing tiles are used in India:

(a) Half round tiles; (b) Corrugated tiles; (c) Pan tiles; (d) Allahabad tiles and (e) Mangalore tiles. Ceiling tiles are flat tiles provided under roofing tiles to give good appearance when viewed from below. Ridge tiles are specially shaped tiles to cover ridges in sloping roofs. Clay tiles, glazed tiles and vitrified tiles are used for flooring and to give finishing to walls. Drain tiles are laid in waterlogged areas to drain the water.

**1. Terracotta** Terracotta means baked earth. It may be manufactured in different colours also. There are two types of terracotta, viz. porous terracotta and polished terracotta. They are used for making art pieces and lavatory fittings.

2. **Earthenware** It is a type of terracotta in which the moulded product is burnt at low temperature to get semi-vitrified surface. These products are used for making cheap lavatory fittings and drain pipes.
3. **Stoneware** These are the pipes manufactured from refractory clays to which ground flint *and* crushed pottery are added and ground. During grinding pigments are also added. They are produced under pressure and then burnt at high temperature. They are used for making wash-basins, gully traps, jars and sewer pipes.

## 1.6 FERROUS METALS

Metals which contain iron predominantl are termed ferrous metals. By varying carbon content slightly, ferrous materials of different varieties are manufactured. By hot rolling, cold drawing and heat treatment properties of ferrous materials can be mod fied. Cast iron, wrought iron and steel are the three popular varieties.

- ( ) **Cast iron** Carbon content is 2 to 4%. The varieties of cast iron are: Grey cast iron, white cast *iron*, molten cast iron, chilled cast iron, toughened cast iron, ductile cast iron and malleable cast iron. Cast irons are coarse, crystalline and fibrous. They cannot be welded. They ar used for water pipes, sanitary pipes and manhole covers. They are also used for making ornamental castings like gates, lamp posts, spiral railings, rail chairs etc.
- ( ) **Wrought iron** It contains less than 0.15% carbon. It is fibrous and has silky lustre. It can absorb shocks. It is used for making nails, nuts, bolts, chains, roofing sheets, grills and straps.
- (A) **Steel** It contains 0.25 to 1.5% carbon. It is equally strong in tension and compression. It is suitable for all construction purposes. The types of steel are mild steel, medium carbon steel, high carbon steel. In the market they are available as rolled steel sections, tubes, flats, plates, sheets, corrugated sheets, expanded metal, bars and weld meshes. Thermo-mechanically treated (TMT) bars are manufactured by sudden quenching of red hot steels by spraying water, which results into high strength at the surface while the core portion is mild steel. These are ideally suited for R.C.C. works.

## 1.7 NON-FERROUS METALS

Copper, aluminium, zinc, lead and tin are commonly used non-ferrous materials.

- (A) **Copper** By roasting, smelting, converting and electrolytic refining copper ores like cuprite, glance, malachite or copper pyrites, copper is produced. Market forms of copper are ingots sheets, wires and tubes. Copper is brown in colour but becomes greenish when exposed to atmosphere. It is malleable, ductile, a good conductor of heat and electricity, copper wires are used as electric cables. Copper straps are used as electric conductors and for closing construction joints. It is used as an alloy for making brass and bronze.
- (B) **Aluminium** Aluminium is extracted mainly from bauxite ( $Al_2O_3 \cdot 2H_2O$ ). It is silvery white with bluish tinge. Its strength-weight ratio is favourable for construction. It is marketed in the following forms:
  - 1) Casting based, (2) Extrusion based, (3) Foil and powder form, (4) Sheet form, and (5) Wires.
 Aluminium is used for doors, windows, partitions, decorative laminates, false ceiling, cable trays, sealing construction joints, transmitting electricity and for making paints.
- (D) **Zinc** Zinc ores are zinc calamine ( $ZnCO_3$ ) which contains 65% zinc and zinc blende ( $ZnS$ ) which

contains 50% zinc. When heated at  $1100^{\circ}\text{C}$ , zinc is liberated in the form of vapour which is collected and condensed. Zinc is a bluish white metal which is a good conductor of heat and electricity. It is used for making electrical cells and batteries, for galvanizing iron plates and in making paints and brass.

- ( ) **Lead** Lead is extracted from the ore galena ( $\text{PbS}$ ), which contains 86% lead. The ore is **roasted**, mixed with coke, smelted in blast furnace and reverberatory furnace. It is bluish grey in colour. It is poisonous. It is used as pigments in paints, for making storage battery solders and for making sanitary fittings.

(A) **Tin** Tin ore is found as cassiterite ( $\text{SnO}_2$ ). The ore is crushed, roasted, smelted and refined **by** electrolysis. It is a silvery white lustrous metal. It withstands corrosion. It is used to provide protective coating to iron, copper, brass and lead. It is used for silvering mirrors and its foils are used for protecting food products.

## 1.8 ALLOYS

Alloy is an intimate mixture of two or more metals. Aluminium alloys, copper alloys and steel alloys are commonly used alloys.

### 1. Aluminum alloys

(a) Duralumin; (b) Aldural; (c) Aluminum bronze; (d) Y-alloy.

**Copper alloys** Brass and bronze are copper alloys. Brass is the alloy of copper and zinc. White brass, yellow brass, red brass, delta metal, cartridge brass and low brass are different types of brasses. Bronze is an alloy of copper, tin and minor percentage of other materials. Beryllium bronze, phosphor bronze, green metal, bell metal, speculum metal are different types of bronzes.

**Alloys of steel** Alloying of steel with other metals is made to increase strength, hardness, toughness, resistance to wear. Varieties of steel alloys found in market are:

Stainless steel (2) Nickel steel (3) Tungsten steel (4) Invar steel (5) Manganese steel (6) Molybdenum steel and (7) Chromium steel.

## 1.9 CEMENT

Cement is a reliable bonding material. It is obtained by burning calcareous material (lime) and argillaceous material (clay) and then grinding. Cement was first produced by Joseph Aspidin, a mason from England. As its colour resembled a variety of sandstone found in Portland, he named it Portland cement (1842).

Limestones containing 20 to 40 per cent clay may be burnt and crushed to powder to get natural cement. Best variety of natural cement is known as Roman cement. Artificial cement is manufactured by mixing argillaceous and calcareous materials in suitable proportions and burning at a temperature  $1400^{\circ}\text{C}$  to  $1450^{\circ}\text{C}$  to get clinkers, which are then ground to get cement. Ordinary Portland cement (OPC) contains lime (60 – 67%), silica (17 – 25%), alumina (3 – 8%) iron oxide (0.5 – 5.0%), calcium sulphate (3 – 4%), magnesia (0.1 – 3.0%), sulphur oxide (1 – 3%) and alkalis (0.4 – 1.3%). Lime imparts strength. Silica contributes to strength by forming dicalcium and tricalcium silicates. Excess silica prolongs setting lime. Alumina imparts quick setting property. Iron oxide provides colour, hardness and strength. Calcium sulphate increases the initial setting time. Magnesia provides hardness and colour. Sulphur makes cement unsound. Alkalies, if in excess, cause efflorescence.

OPC contains the following chemical compounds



Tricalcium silicate  $3\text{CaO} \cdot \text{SiO}_2$  ( $\text{C}_3\text{S}$ ) 40%  
 Dicalcium silicate  $2\text{CaO} \cdot \text{SiO}_2$  ( $\text{C}_2\text{S}$ ) 30%  
 Tricalcium aluminate  $3\text{CaO} \cdot \text{Al}_2\text{O}_3$  ( $\text{C}_3\text{A}$ ) 11%  
 Tetracalcium aluminoferrite  $4\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$  ( $\text{C}_4\text{AF}$ ) 11%

It also contains small quantities of impurities like calcium oxide ( $\text{CaO}$ ) and magnesium oxide ( $\text{MgO}$ ). When water is added

- $\text{C}_3\text{A}$  is first to react and sets generating heat
- $\text{C}_3\text{S}$  hardens early and develops strength in first 28 days.
- $\text{C}_2\text{S}$  hydrates slowly and increases strength over a year and contributes to ultimate strength.
- $\text{C}_4\text{AF}$  is a comparatively inactive compound.

Physical requirements of OPC are:

**Fineness:** The material retained on 90 micron sieve should not be more than 10%. In terms of specific surface, it should not be less than  $2250 \text{ cm}^2/\text{gm}$  [ $225 \text{ m}^2/\text{kg}$ ].

**Setting time:** Minimum initial setting time should be 30 minutes and maximum final setting time should be 600 minutes.

**Soundness:** After the test is conducted in Le Chatelier mould, the indicator should not show more than 10 mm widening.

**Compressive strength:** Mortar cubes of size  $70.6 \text{ mm}$  ( $\sqrt{5000} \text{ mm}^2$ ) with 1 part cement, 3 parts of standard sand with specified water should give the strength as shown in Table 1.1.

Table 1.1 Compressive strength of cement in  $\text{N/mm}^2$

Age	Grade 33	Grade 43	Grade 53
3 days	16	23	27
7 days	22	33	37
28 days	33	43	53

Manufacture of cement consists of mixing, burning and grinding processes.

**Mixing:** It may be wet process or by dry process. In wet process wash mill is used which is a heavy cylinder of 2.5 to 3.0 m in diameter and 9 to 12 m in length. It is kept slightly inclined to the horizontal and can rotate at 15–20 revolutions per minute. The cylinder is provided with steel balls.

**Burning:** Burning is carried out in a rotary kiln, which is a steel tube of diameter 2.5 to 3.0 m and length 90 to 120 m, placed at an inclination 1 in 25 to 1 in 30. It rotates at a rate of 1 to 3 rotation per minute. Coal dust is injected from lower end and mix is fed from top end. The temperature at feed end is  $1400^\circ\text{C}$  to  $1500^\circ\text{C}$ .

**Grinding:** The clinkers from rotary kiln are fed into a ball mill or tube mill. During the **process** of grinding about 3 to 4 per cent of gypsum is added. The ball mill or tube mill contains steel balls.

**Storage of cement:** Cement absorbs moisture from air and hydrates, which results into loss of strength. Hence, cement should be stored on a raised platform in a covered room. First-in-first-out rule should be used while taking out cement. The drainage system on the roof and around the storage should be well maintained. Storage period should be as little as possible.

Types of cement are

- OPC: 33 grade, 43 grade and 53 grade (OPC)
- Portland Pozzolana cement (PPC)
- Fly ash cement
- Blast furnace slag cement

Acid resistant cement  
Sulphate resistant cement  
High alumina cement  
Quick setting cement – obtained by reducing the quantity of gypsum.  
Rapid hardening  
Expanding cement  
Low heat cement  
Hydrophobic cement  
White cement  
Coloured cement

## Fine and Coarse Aggregates

Sand, gravel, crushed stones which are the products of weathering or crushing of rocks are known as aggregates. Sources of fine aggregates on the basis of which sand is classified are: sea sand, river sand, stream sand, pit sand and manufactured sand. On the basis of grains size sand is classified as fine sand, coarse sand and gravelly sand. IS code classifies sand as grading zone - 1, Grading zone - 2, Grading zone - 3 and Grading zone - 4 on the basis of percentage of sand passing through different sized sieves.

**Function of sand:** It subdivides the cement paste into thin films and allows it to spread and adhere. It allows carbon dioxide from air to penetrate and improve setting. It prevents shrinkage and adds to density of mortar. It fills the gap between building blocks and gives level surface to mortar.

**Bulking of sand:** The increase in volume due to moisture content is known as bulking of sand. It is due to formation of thin films around sand particles. Increase in volume is as high as 30 – 37 per cent. At around 8% of moisture content, there is maximum bulking. Finer the sand more is the bulking. After about 20% moisture content, thin films start breaking and volume reduction takes place.

A good sand has the following properties:

Chemically inert; (2) Hard; (3) Contains sharp and angular grains; (4) Free from salt, clay and organic matter; (5) Well graded.

The field tests are possible to find presence of clay, salt and organic impurities. The size and shape of gains may be felt by touching it with fingers. Laboratory tests may be conducted to ascertain grading, bulking and to find fineness modulus. To determine fineness modulus sieves to be used are 10 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 micron, 300 micron and 150 micron. The cumulative percentage of weight retained on the above sieves divided by 100 gives fineness modulus (FM). If FM is between 2.20 and 2.60 it is fine sand, 2.6 to 2.9 FM indicates it is medium sand and more than 2.9 FM indicates it is coarse sand.

Coarse aggregate gives mass to concrete.

For structures like abutment, retaining walls and bed concrete 40 mm down size aggregates are used. For normal R.C.C. works like flooring roof and columns 20 mm down size aggregates are preferred. For thin members 12.5 mm sized aggregates are used.

The various tests conducted on coarse aggregates are to determine:

Flakiness and elongation indices  
Fineness and grain size distribution  
Specific gravity and water absorption  
Clay, silt and dust content

Resistance to crushing  
Resistance to impact  
Resistance to abrasion.

### 1.10 MORTAR

Mortar is an intimate mixture obtained by adding water to dry mixture of sand and binding material like clay, lime or cement.

Classification of Mortar:

**On the basis of bulk density:** Heavy weight, if weight is more than  $15 \text{ kN/m}^3$ , light weight, if its weight is less than  $15 \text{ kN/m}^3$ .

**On the basis of application:** Brick laying mortar, finishing mortar.

**On the basis of binding material:** Mud mortar, limemortar, surkhi mortar, cement mortar and gauged mortar.

The proportions of cement to sand for various works used are show in Table 1.2.

Table 1.2 Cement-sand proportions

<i>S. No.</i>	<i>Name of work</i>	<i>Cement: sand</i>
1.	Brickwork below ground level	1 : 3 to 1 : 4
2.	General brickwork and stone masonry	1 : 6
3.	For arch work	1 : 3
4.	Damp-proof course	1 : 2
5.	External plastering and ceiling plastering	1 : 4
6.	Internal plastering	1 : 5 to 1 : 6
7.	Pointing	1 : 2 to 1 : 3

The strength obtained with different proportion is as shown below:

1 : 3 Mix –  $10 \text{ N/mm}^2$ ; (2) 1 : 4 Mix –  $7.5 \text{ N/mm}^2$ ; (3) 1 : 5 Mix –  $5.0 \text{ N/mm}^2$ ; (4) 1 : 6 Mix –  $3.0 \text{ N/mm}^2$ ; (5) 1 : 8 Mix –  $0.7 \text{ N/mm}^2$ .

Cement mortar may be prepared by hand mixing or by machine mixing.

Mortars with special properties are also used: Fire resistant, sand absorbing, X-ray shielding, packing mortar and decorative mortars are the special mortars.

### 1.11 CEMENT CONCRETE

Cement concrete is an intimate mixture of cement, sand, coarse aggregates and water. Occasionally some admixtures are added to introduce special properties. Water lubricates aggregates, activates chemical reactions and give workability to mix. However, the quantity of water to be used should be determined carefully since workability of concrete increases with quantity of water but the strength decreases.

Various admixtures used with concrete are:

(1) Accelerators; (2) Retarders; (3) Air entraining agents and (4) Colouring agents.

Important properties of concrete in plastic stage (green concrete) are workability, segregation and bleeding.

The important properties of hardened concrete are:

(1) Strength; (2) Resistance to wear; (3) Impermeability and (4) Durability.

IS code classifies concrete mix as M 20, M 25, etc. which means mix of strength 20 N/mm<sup>2</sup>, mix of strength 25 N/mm<sup>2</sup>, etc. at the age of 28 days.

IS: 10262–1982 and SP 23–1982 give detailed procedure to design concrete mix of required strength.

For small works nominal mixes as shown in Table 1.3 may be used.

Table 1.3 Normal mixes for minor works

<i>Mix</i>	<i>Proportion</i>	<i>Nature of works</i>
M : 7.5	1 : 4 : 8	For bed concrete
M : 10	1 : 3 : 6	For sill concrete and mass concrete works
M : 15	1 : 2 : 4	For R.C.C. structural elements
M : 20		For water retaining structures
M : 25	$1 : \frac{1}{2} : 3$ 1 : 1 : 2	For heavily loaded columns, beams, etc.

## 1.12 CONCRETING

It involves mixing, transporting, placing, compacting and curing.

**Mixing:** One can adopt hand mixing or machine mixing. Coarse aggregate and fine aggregates are dry mixed, then cement is mixed till uniform colour is seen to the dry mix. The required quantity of water is mixed gradually while mixing process is kept continuous.

**Transportation:** Care should be taken to avoid segregation during transport.

**Placing:** Concrete should be placed to its final position by dropping it as close to final position as possible, in any case not more than 0.8 m.

**Compacting:** To remove entrapped air compacting of concrete is necessary. It may be **hand** compacting or by using vibrators. Over-compacting should be avoided to avoid segregation.

**Curing:** It is the process of maintaining satisfactory moisture and temperature in a freshly **laid** concrete. Curing should be done well in first 2 weeks and continued for another 1–2 weeks. If curing is not satisfactory shrinkage cracks may develop and durability is reduced. The various methods of curing are:

(1) Spraying water; (2) Covering with gunny bags; (3) Ponding; (4) Steam curing and (5) Applying curing compounds.

## Different Concrete Works

Plain concrete 2. R.C.C.

P.S.C. 4. Precast concrete

Special concrete.

To meet the requirements of special situations, the following types of concrete are manufactured:

Fibre reinforced concrete (FRC).

Polymer impregnated concrete (PIC)

High performance concrete

Light weight concrete

Self-compacting concrete.

## Tests on Concrete

To measure workability slump test, compaction factor test or Vee-Bee consistometer tests are conducted.

To find the strength, compression tests are conducted on  $150 \times 150 \times 150$  mm cubes after 28 days.

### 1.13 LIME

Lime has been used as cementing material from ancient times. It contains clay (8 to 10%), magnesium carbonate (not more than 30%) and very small quantities of soluble silica, alkalies, sulphate and iron apart from the main constituent calcium carbonate.

Lime is classified as fat lime, hydraulic lime and poor lime. Fat lime contains 95% of calcium oxide. When water is added, it slakes vigorously and its volume increases 2 to 2.5 times.

Hydraulic lime sets by chemically combining with water. It is classified as feeble hydraulic lime (5 to 10% clay), moderately hydraulic lime (10 to 20% clay), eminently hydraulic lime (20 to 30% clay). It is used for making mortar to be used for plastering and in damp-proof constructions. Lime containing more than 30% clay is poor lime.

Manufacture of lime involves preparation, burning and hydration (slaking). For burning clamps or kilns are used. The kiln may be intermittent or continuous.

IS: 1624–1974 specifies various tests to assess the quality of lime. The tests prescribed are:

Physical properties tests; (2) Acid tests; (3) Heat test; (4) Ball test; (5) Impurity test; (6) Plasticity test; (7) Workability test.

### 1.14 POZZOLANAS

Pozzolana is defined as a siliceous material that does not possess cementation property, but reacts with lime in the presence of water at normal temperature to form compounds.

Pozzolana is added to fat lime to produce hydraulic lime. Addition of pozzolana to cement makes product cheap, which is known as PPC. It gets strength slowly but final strength is same as that of OPC. It possesses better impermeability compared to OPC. Addition to concrete helps in getting dense concrete and it reacts with free lime. Hence, chances of blisters appearing later is eliminated. Heat of hydration is reduced, which is essential in mass concrete works.

Surkhi, blast furnace slag, fly ash, silica fume and rice husk ash are the pozzolanic materials.

### 1.15 PAINTS, VARNISHES AND DISTEMPERS

The surfaces of walls, ceiling, wood and metal works are coated with paints, varnishes or distempers to protect them and give them good appearance.

Paint is a mixture of solid pigments in liquid vehicles. The essential constituents of oil-borne paints are base, vehicle, solvent, pigment, filler and drier.

**Base:** It is a solid substance in a fine state forming bulk of the paint. White lead, red lead, zinc oxide, iron oxide, aluminium powder are commonly used base materials.

**Vehicle:** The liquid substance that holds the ingredients of paint is known as vehicle. Linseed oil, tung oil, poppy oil, nut oil, etc., are the commonly used vehicles.

**Solvents:** Solvents are the paint thinners. The common solvents are turpentine, petroleum spirit and naphtha.

**Pigment:** Pigments provide colour to the paint

Black – Lampblack, charcoal black

Brown – Burnt umber, burnt sienna

Blue – Persian blue, ultramarine

Green – Chrome green, copper sulphate

Red – Red lead, venetian red

Yellow – Zinc chrome, raw sienna chrome yellow.

**Fillers:** Fillers are inert materials added to reduce cost of paint. They make paint durable. Magnesia, alumina, gypsum, silicate, barite are the commonly used fillers.

**Driers:** Its function is to absorb oxygen from air and supply it to the vehicle. It is added just before painting. They are compounds like lead, manganese and cobalt.  
Types of paints are

**Oil paint:** These paints contain white lead as base.

**Enamel paint:** This paint is prepared by adding white lead or zinc to varnish. It is desirable to provide titanium under coat. It may be used for exterior walls also.

**Emulsion paint:** It contains binding material like polyvinyl acetate and polystyrene. Cobalt and manganese are the pigments and driers. The paint becomes surface dry within 15 minutes and hardens in 2 hours. The surface is washable.

**Cement paint:** It consists of white or coloured cement as base. It is available in the **form** of powder, which is mixed with water and used.

**Aluminium paint:** It consists of finely ground aluminium particles in suspension, in spirit or oil varnish. It is visible in darkness.

**Bituminous paint:** It is manufactured by dissolving asphalt of vegetable bitumen in **oil** or petroleum. It is black in colour. It is used for painting portions of wooden posts buried underground.

**Synthetic rubber paint:** It is prepared by dissolving chlorinated rubber in a solvent. It **may** be applied to concrete surfaces also.

**Celluloid paint:** It is prepared by dissolving celluloid sheets or n tro cotton in petroleum. **Castor** oil is added to improve adhesive property. It is used for painting vehicles.

**Asbestos paint:** It consists of fibrous asbestos. It is used for stopping leakag s in metal **roof**, basements. It is used for painting gutters.

**Plastic paint:** It consists of plastic as a base and water as a thinner. It gives attractive colours. This is widely used for painting walls in auditoriums and show rooms.

**Anticorrosive paint:** It consists of linseed oil as vehicle and lead or zinc chrome as base. Finely ground sand is added as filler. It is black in colour and gives protection from corrosion.

## Painting

**Plastered surfaces** Emulsion paints may be applied after a curing period of 4 – 6 weeks. Final coat is to be applied after 6 – 12 months only. Before painting the surface should be made dust free. For new surfaces primer coat is required.

**Concrete surface** Usually, two coats of cement paint are required. Painted surface should be cured for 10 – 15 days.

**Wood surface** Before painting a new surface all nail heads should be punched to a depth of 3 mm.

The surface should be made free from loose particles, dust and grease. Knots if any should be levelled and two coats of varnish applied. Fill all cracks, dents, loose joints with putty. Apply primer, two undercoats before the finishing coat. In case of old wood works clean the surface with sand paper and pumice stone wash with caustic soda solution of 200 gm in a litre of water. Apply primary coat, undercoat and finishing coats.

**Iron and steel surface** Remove dust with wire brushes. Remove grease by washing with caustic soda. Then apply the coats.

**Varnishes:** Varnish is a transparent solution containing resinous solutions like amber, coal, shellac, gum, etc. Solvent is turpentine or alcohol or water. The process of applying varnish is known as varnishing. It makes surface glossy.

**Distemper:** It is also called water paint. It is a paint with chalk as base and water as carrier. It is readily available in the market in the form of powder. There are two types of distempers: dry distempers and oil bound distempers.

## 1.16 MISCELLANEOUS MATERIALS

**1. Glass and glass wool** It is manufactured by fusion of silica with varying proportions of oxides of sodium, calcium, potassium and magnesia. They are fabricated by blowing, drawing, pressing, rolling or casting. After annealing they are given treatment by tempering, opaque making, silvering, bonding or cutting. It can be made stronger than steel and lighter than cork. Types of glass are many:

Common glass; (2) Soda lime glass; (3) Potash lime glass; (4) Potash lead glass; (5) Coloured glass; (6) Special glasses.

Special glasses are fibre glass, wired glass, safety glass, bullet proof glass, shielding glass, ultraviolet ray glass, structured glass, glass blocks, ribbed glass, perforated glass and glass wool, etc.

**Plastics** Plastic is a natural synthetic material, which has a property of being plastic at some *stage* of its manufacture. Synthetic material may be phenol, formaldehyde, cellulose vinyl, etc. At present there are more than 1000 varieties of plastic.

Synthetic of plastics are polymers. Polymerization is the process in which relatively small molecules, called monomers combine chemically to produce a very large network molecules, called polymers.

Classification of the plastics may be on various basis.

- . On the basis of structure: Homogeneous plastics and heterogeneous plastics.
- . On the basis of physical and mechanical properties. Rigid plastics, semi-rigid plastics, soft plastics and elastomers.
- . On the basis of thermal properties: Thermoplastics and thermosetting plastic. Thermoplastics soften on heating and harden on cooling. The process of softening and hardening can be repeated several times. Thermosetting plastic undergo chemical changes at 127 – 177° C and set into permanent shape under pressure. Reheating will not soften them.

Advantages of plastic are — they can be moulded easily, do not rust, resist chemical action, light in weight and possess high strength to weight ratio. Disadvantage is that they have low modulus of elasticity.

**Glass fibre reinforced plastics (GFRP)** In these glass fibres provide stiffness and strength while resin provides a matrix to transfer load to fibres. GFRP is used for door and window frames, partition walls, roofing sheets, skylights, water tanks, for making chairs and tables.

**Asbestos** Asbestos is a naturally available mineral substance. It is fire-proof, acid-proof. It is a good insulator of heat and electricity. It is used with cement to produce asbestos cement sheets for roofing, wall panelling, to cover fuse and electric boxes, for making downtake pipes, etc.

**Bitumen, asphalt and tar** These are called bituminous materials and their main constituent is hydrocarbon.

- (a) **Bitumen:** It is obtained by fractional distillation of crude petroleum. It is specified by term penetration, say 80/100 means penetration of standard needle is 80 to 100 mm at a temperature of 25°C. It is used for damp proof course, roofing felt.
- (b) **Asphalt:** It is bitumen mixed with inert material like sand, gravel and crushed stone. It is found in natural form. It is artificially manufactured also. It is used for waterproofing floors and roofs, lining reservoirs and swimming pools, for grouting expansion joints.
- (c) **Tar:** It is obtained by destructive distillation of coal, wood or mineral tar. It is used for **road work**, anti-termite treatment and waterproofing.

**Fly Ash** It is a by-product in coal based thermal plants. Its particles can fly in ordinary air. At one time it was considered a nuisance but now it is used as a useful material in manufacturing bricks, for stabilizing soil and to improve workability of concrete.

**Steel Putty** It is a plaster filler which can be applied with knife to fill dents in steel plates. It has good adhesive property and dries hard.

**Adhesive, sealants and joint fillers**

An adhesive is a material used to join two or more surfaces. Asphalt, shellac and cresin are natural adhesives which are used to glue papers. Rubber is another natural adhesive used to join plastic, glass and rubber. There are many synthetic varieties of adhesives like melamin resin, phenoil resin, urea resin and polyvinyl resin. They are used for joining plywood and laminated products. Starch glue, animal glue, casein glue (glue from skimmed milk), sodium silicate glue are also available for joining various materials.

**Sealants:** Sealants are the substances used to seal cracks or joints between wall and window frames, glazing and window frame or between roofing sheets. Elastomeric sealants are most efficient. They are based on silicon, acrylic or polysulphide.

**Joints fillers:** To prevent seepage of water through construction joints, these materials are used. They should be compressible and resilient. The common joint fillers used are built in strips of metals, bitumen treated felt and cork bound rubber.

**Heat, electrical and sound insulating materials**

Thermal comfort may be achieved by providing air spaces by using aerated concrete, hollow blocks, using blast furnace slag in mortar and concrete and providing insulators and reflecting paints.

Electric insulators are used to separate the conductors carrying electric current. Mica, asbestos, porcelain, rubber, leakalite are electrical insulators. Paraffin and chlorinated diphenyl are liquid insulators which are used in transformers. In refrigerators thermocol is used.

In auditoriums and cinema halls, sound insulators are required. The commonly used sound insulators are cellular concrete, asbestos, gypsum plaster, pulp boards, perforated plywood, glass mineral wool, etc.

**Waterproofing and damp-proofing materials**



Preventing passage of water from one side of a surface to other side under normal hydrostatic pressure is known as waterproofing while damp-proofing is to prevent transfer of water by capillary action.

Bituminous materials, integral compounds, epoxy based materials, slurry coat and elastomeric materials are various waterproofing materials.

*Thermocol* It is a general-purpose crystal polystyrene. It can be cut easily with knife or *saw*. It contains 3–6 million discrete cells/litre. It has insulating efficiency against heat, sound, humidity and shock. It is used as packing material and display board.

*Epoxy* It is a thermosetting polymer. It possesses excellent mechanical and adhesive properties. *It* is used with paints also.

*Polyurethane* It is a product produced by mixing polymeric diol or triol with a silicon *surfactant* and a catalyst. This has elasticity of rubber, combined with the toughness of metal. It is used for making gaskets, tiers, bushings, shoe soles, pipes, waterproofing chemicals, etc.

*Geosynthetics* These are synthetic materials made of nylon, PVC, polypropylene etc. They *last* long even when buried under soil. Geotextiles, geogrids, geomembranes and geocomposites are commonly used geosynthetics. These materials are used for soil stabilization.

*Ferrocement* Wire meshes embedded with cement and baby jelly is known as ferrocement. *They* are used for making door/window frames and shutters, partition walls, signboards, furnitures and even boats.

*Cladding materials* Cladding materials are used to enhance aesthetic appeal of walls, kitchen slab, stairs, roofs, ceiling, etc. Slate, granite, marble, clay tiles, mosaic, glass, wall papers etc. are the commonly used cladding materials in buildings.

*PVC building products* Polyvinyl chloride (PVC) is versatile plastic. Its properties can be easily modified by addition of other compounds. PVC pipes, door and window frames, partition walls, kitchen cabinets, tiles and false ceiling are very popular products.

## MULTIPLE-CHOICE QUESTIONS

### I. Stones

- The rocks formed due to solidification of molten mass are called
  - aqueous rocks
  - sedimentary rocks
  - metamorphic rocks
  - igneous rocks
- Granite is an example of
  - aqueous rocks
  - sedimentary rocks
  - metamorphic rocks
  - igneous rocks
- Solidification of molten magma at the surface of the earth results in the formation of
  - sedimentary rock
  - basalt and traps
  - granite
  - metamorphic rock

4..Solidification of molten magma within the earth's crust results in the formation of

- a. sedimentary rock
- b. basalt and trap
- c. granite
- d. metamorphic rack

5.Sedimentary rocks are formed due to

- a. solidification of molten mass
- b. gradual deposition of materials like sand, clay, generally by setting water
- c. alteration of original stones under heat and pressure
- d. none of the above

6.In the options given in question No. 5, identify the process responsible for the formation of metamorphic rocks.

7.Under metamorphism, which of the following changes is correct?

- a. granite changes to gnesis.
- b. trap and basalt change into laterite.
- c. limestones change into marble.
- d. all the above

8.Granite has

- a. crystalline, glossy and fused texture
- b. foliated structure
- c. layers of different compositions
- d. none of the above

9.The principal constituent of argillaceous rock is

- a. Sand
- b. lime
- c. clay
- d. all the above

10.Laterite is chemically classified as

- a. calcareous rock
- b. siliceous rock
- c. metamorphic rock
- d. argillaceous rock

11.Which of the following is an example of siliceous rock?

- a. granite
- b. gnesis
- c. quartzite
- d. all the above

12.Marble is an example of

- a. aqueous rock
- b. metamorphic rock
- c. sedimentary rock
- d. igneous rock

13.Slate is used for

- a. building walls
- b. road metal
- c. manufacture of cement

- d. roofing
14. Which one of the following takes polish very well?
- basalt and trap
  - granite
  - sandstone
  - quartzite
15. The colour of granite is
- grey
  - green
  - brown
  - all of these
16. A fine grained granite
- can be polished well
  - can be used for exterior facing of buildings
  - offers higher resistance to weathering
  - all of the above
17. Siliceous sand subjected to metamorphic action is known as
- laterite
  - murrum
  - quartzite
  - dolomite
18. When quarrying is to be done in hard and compact rocks, the usual method employed is
- wedging
  - using channeling machine
  - blasting
  - all of the above
19. Quarrying by using channeling machine is employed for quarrying in
- soft rock
  - hard rock
  - sandstones
  - all the above
20. Heating technique of breaking rocks is suitable if the aim is to get
- aggregates
  - slabs
  - building blocks
  - none of the above
21. The process of taking out stones of various sizes from natural rock is known as
- dressing
  - seasoning
  - polishing
  - quarrying
22. The process of giving required shape and size to stones is known as
- dressing
  - seasoning
  - polishing

d) quarrying

23. Boasted finish of dressing stone is

- a) making non-continuous parallel marks
- b) giving finish to a 20 mm margin only at edges
- c) providing continuous lines on the face
- d) working out 30–50 mm wide margin around the face with chisel

24. Dressing of the stone is made

- a) immediately after quarrying
- b) after three months of quarrying
- c) just before using for building works
- d) after seasoning

25. The most powerful explosive used in blasting is

- a) gunpowder
- b) guncotton
- c) dynamite
- d) cordite

26. Moisture absorption of a good stone should be less than

- a) 1%
- b) 5%
- c) 8%
- d) 12%

27. Most of the stones possess the specific gravity in the range of

- a) 1.2 – 1.6
- b) 1.6 – 2.0
- c) 2.4 – 2.8
- d) 3.0 – 4.0

28. Which of the following has the lowest strength?

- e) granite
- f) sandstone
- g) marble
- h) laterite

29. Limestone used for manufacture of cement is

- a) *kankar*
- b) magnesium limestone
- c) compact limestone
- d) granular limestone

30. Which of the following has the highest crushing strength?

- a) granite
- b) gneiss
- c) basalt
- d) trap

31. Which of the following stone has the highest resistance to fire?

- a) granite
- b) limestone
- c) sandstone

d) argillaceous material

32. Smith's test on stone is to check

a) toughness

b) hardness

c) compressive strength

d) presence of muddy substance

33. Los Angeles testing machine is used to find the following in stone

a) surface wear

b) hardness

c) compressive strength

d) presence of mud

34. Impact value of stone for road work specified are

a) wearing coat  $\geq$  30%

b) bituminous macadam  $\geq$  35%

c) water bound macadam  $\geq$  40%

d) all the above

35. Deterioration of stones takes place due to

a) temperature variation

b) freezing and thawing

c) rainwater

d) all of the above

36. Which one of the following is not a preservative of stone

a) coal tar

b) paraffin

c) linseed oil

d) ASCU

## Timber

37. After felling and separating branches the tree is known as

a) log

b) converted timber

c) rough timber

d) none of the above

38. Which one of the following does not belong to exogenous tree

a) deodar

b) pine

c) mahogany

d) bamboo

39. Which one of the following does not belong to endogenous trees

a) teak

b) coconut

c) bamboo

d) cane

40. On the basis of durability test, Forest Research Institute of India, Dehradun, a tree is highly durable if its average life is more than

- a) 5 years
- b) 10 years
- c) 15 years
- d) 20 years

41. The trees, of which leaves fall in autumn and new ones appear in spring are classified as

- a. coniferous trees
- b. deciduous trees
- c. endogenous trees
- d. none of the above

42. The oldest part of exogenous tree is

- a. pith
- b. heartwood
- c. sapwood
- d. cambium layer

43. Age of exogenous tree can be judged from

- a. medullary rays
- b. annual rings
- c. cambium layer
- d. inner bark

44. The layer between the dark and sapwood which is yet to be converted into wood is known as

- a. pith
- b. heartwood
- c. softwood
- d. cambium layer

45. Which one of the following is softwood

- a. deodar
- b. teak
- c. sal
- d. mahogany

46. Which one of the following is not a softwood:

- a. oak
- b. pine
- c. deodar
- d. bamboo

47. On the basis of availability, timber is classified as

- a. I, II, III Class
- b. grade I, II, and III
- c. A, B, C Class
- d. X, Y, Z Class

48. The main purpose of seasoning of timber is to

- i. reduce moisture content

- b. make it fire resistant
  - c. make it waterproof
  - d. none of the above
49. Seasoning makes timber
- a. durable
  - b. light, strong and stable
  - c. resistant to fungi and termites
  - d. all of the above
50. Which of the following statements is not correct?
- a. by kiln seasoning moisture content can be reduced to the desired extent.
  - b. kiln seasoning is quicker than natural seasoning.
  - c. kiln seasoning is superior to natural seasoning.
  - d. kiln seasoning needs less stacking place than natural seasoning.
51. In water seasoning
- a) timber is placed thicker end pointing upstream
    - a. timber is placed with thicker end pointing downstream
    - b. timber log is placed at right angle to the stream
    - c. timber may be placed in any direction
52. Most economical method of sawing wood is
- a. ordinary sawing
  - b. quarter sawing
  - c. tangential sawing
  - d. radial sawing
53. Sections of more uniform moisture content are obtained by
- a. ordinary sawing
  - b. quarter sawing
  - c. tangential sawing
  - d. radial sawing
54. The defect in timber due to broken branch of the tree during the tree growth is
- a. knot
  - b. shake
  - c. rind gall
  - d. burl
55. Due to improper cutting of the branches during the growth of the tree, the defect caused in timber is
- b) shake
  - c) rind gall
  - d) twisted fibre
  - e) burl
56. Stain appears in wood due to
- a. poor ventilation during storage
  - b. contact with water and chemicals for long time
  - c. shock when it was young
  - d. crushing during growth
57. Honeycomb and cracks may occur in timber due to

- a. erroneous conversion
  - b. erroneous seasoning
  - c. attack by fungi
  - d. contact with water for a long time
58. Which one of the following is not a preservative of timber
- a. solignum salt
  - b. chemical salt
  - c. creosote
  - d. solution of barium hydroxide
59. A thin sheet of wood sliced from \_\_\_\_\_ log is called
- a) plywood
  - b) lamin board
  - c) veneer
  - d) particle board
60. In a plywood the veneers are placed such that the grains of a layer are
- a. at  $45^\circ$  to the grains of a layer below it
  - b. at  $60^\circ$  to the grains of a layer below it
  - c. at right angles to the layer below it
  - d. at  $180^\circ$  to the grains of a layer below it
61. Plywood is identified by
- a. volume
  - b. weight
  - c. area
  - d. thickness
62. An assembled product made up of veneers and adhesives is called
- a. batten
  - b. plank
  - c. board
  - d. plywood
63. To get plywood of thickness 25 mm, minimum number of plies is
- a. 5
  - b. 7
  - c. 11
64. Particle boards are manufactured by using
- a. chips of wood, rice husk and bagasse
  - b. strips of wood of width 25–80 mm
  - c. wood pulp
  - d. none of the above
65. The wood that cannot be attacked by white ants is
- a. mahogany
  - b. rosewood
  - c. sissoo
  - d. teak
66. The standard size of bricks as per Indian Standards is
- a.  $230 \times 120 \times 80$  mm



- b.  $200 \times 100 \times 100$  mm
  - c.  $190 \times 90 \times 90$  mm
  - d.  $190 \times 100 \times 100$  mm
67. Red colour of brick is due to the presence of
- a. lime
  - b. silica
  - c. manganese
  - d. iron oxide
68. Excess of lime in the brick earth makes the bricks
- a. brittle and weak
  - b. crack and warp
  - c. melt and lose shape
  - d. improve durability
69. Excess of iron oxide in brick earth makes the bricks
- a. stronger
  - b. darker
  - c. brittle
  - d. crack
70. Alumina in brick earth gives the bricks
- a. strength
  - b. colour
  - c. plasticity
  - d. resistance to shrinkage
71. Excess of alkalis in the brick earth results into
- a. Brittleness
  - b. white patches
  - c. yellowish colour
  - d. porous structure
72. Pug mill is used to
- a. blend clay
  - b. tempering
  - c. weathering clay
  - d. burning bricks
73. The size of mould used for making bricks compared to size of brick is
- a. 10% more
  - b. 5% more
  - c. exactly equal
  - d. 5% less
74. Pallet board is used to
- a. make frog in the brick
  - b. to mount the mould
  - c. for table moulding of bricks
  - d. none of the above
75. In stiff mud process of machine moulding, water used for mixing is
- a. 8–12%
  - b. 12–18%

- c. 20–24%
  - d. 30%
76. Gradual drying of moulded bricks is necessary to
- a. prevent shrinkage
  - b. permit shrinkage without cracking
  - c. permit blending of alumina and silica
  - d. none of the above
77. The brick is considered dry when the moisture content is
- a. 8%
  - b. 5%
  - c. 2%
  - d. zero
78. Hand moulded bricks take \_\_\_\_\_ days for drying while stiff-mud machine made bricks \_\_\_\_\_ days.
- a. 30, 5
  - b. 15, 2
  - c. 10, 1
  - d. 8, 1/4
79. The indentation mark left on bricks during the process of moulding are
- a. pallets
  - b. fillets
  - c. marks
  - d. frog
80. Which one of the following statements is wrong about clamp burning
- a. it is cheap
  - b. does not need skilled labour
  - c. control on burning process is good
  - d. burning process is slow
81. Continuous kiln is
- a. bull's trench kiln
  - b. Hoffman's kiln
  - c. tunnel kiln
  - d. all of the above
82. The minimum strength of brick required for building wall is
- a.  $7.5 \text{ N/mm}^2$
  - b.  $5.0 \text{ N/mm}^2$
  - c.  $3.5 \text{ N/mm}^2$
  - d.  $2.5 \text{ N/mm}^2$
83. To check the size of brick number of bricks to be kept side by side is
- a. 30
  - b. 20
  - c. 10
  - d. 5
84. The bricks which may be used to build wall but to be provided with plaster are
- a. Ist Class

- b. IInd Class
  - c. IIIrd Class
  - d. IVth Class
85. The compressive strength of high duty bricks should be more than
- a.  $40 \text{ N/mm}^2$
  - b.  $20 \text{ N/mm}^2$
  - c.  $5 \text{ N/mm}^2$
  - d.  $3.5 \text{ N/mm}^2$
86. Thickness of web of hollow bricks should not be less than
- a. 20 mm
  - b. 16 mm
  - c. 12 mm
  - d. 8 mm
87. Compressive strength of paving bricks should not be less than
- a.  $40 \text{ N/mm}^2$
  - b.  $30 \text{ N/mm}^2$
  - c.  $20 \text{ N/mm}^2$
  - d.  $40 \text{ N/mm}^2$
88. Field test for strength of good bricks is to drop it from a height of \_\_\_\_\_ and they should not break
- a. 1.2 m
  - b. 1.0 m
  - c. 0.7 m
  - d. 0.75 m
89. For making stabilized soil brick the soil is stabilized with
- a. sand
  - b. coal
  - c. cement
  - d. salt
90. Refractory bricks resist
- a. high temperature
  - b. chemical action
  - c. action of frost
  - d. all of the above

### Clay Products

91. In case of round tiles, under-tiles are used with their narrow ends
- (a) towards eave
  - (b) towards ridge
  - (c) towards valley
  - (d) in any one fashion
92. Maximum water absorption permitted on class AA type Mangalore tiles is
- (a) 13%
  - (b) 15%
  - (c) 17%
  - (d) 19%
93. Which of the following statement is wrong?
- (a) Pan tiles are similar to half round tiles but less curved
  - (b) Pan tiles are weaker than half round tiles

- (c) Allahabad tiles are interlocking tiles
- (d) Mangalore tiles are also interlocking tiles

94. The word vitrified mean

a. glazed

- a. like glass
- b. given attractive colour
- c. all of the above

95. Terracotta means

- a. insulated
- b. fit for sanitary services
- c. good for ornamental work
- d. baked earth

96. Water absorption of vitrified tiles is not more than

- a. 0.5%
- b. 1.0%
- c. 2.0%
- d. 5.0%

97. To make terracotta porous, the following is mixed with clay before burning.

- a. lime
- b. silica
- c. sawdust
- d. none of the above

### Ferrous Materials

98. By calcining and smelting iron ores, a crude and impure form of iron obtained is known as

- a. cast iron
- b. wrought iron
- c. steel
- d. pig iron

99. The colour of cast iron is

- a. grey
- b. white
- c. both grey and white
- d. none of the above

100. The compressive and tensile strength of cast iron are

- a.  $700 \text{ N/mm}^2$  and  $150 \text{ N/mm}^2$
- b.  $600 \text{ N/mm}^2$  and  $400 \text{ N/mm}^2$
- c.  $415 \text{ N/mm}^2$  and  $415 \text{ N/mm}^2$
- d.  $400 \text{ N/mm}^2$  and  $600 \text{ N/mm}^2$ .

101. For making spiral staircases, ideal material is

- a. pig iron
- b. cast iron
- c. wrought iron
- d. steel

102. Purest form of iron is

- a. pig iron
- b. cast iron

- c. wrought iron
  - d. steel
103. Carbon content in wrought iron is
- a. 0.15%
  - b. 0.25 to 1.5%
  - c. 2 to 4%
  - d. more than 4%
104. The ratio of tensile strength to compressive strength of steel is
- a. less than 1
  - b. equal to 1
  - c. more than 1
  - d. nothing can be said definitely
105. Ribs are made on steel wires to increase
- a. strength in compression
  - b. strength in tension
  - c. bond strength
  - d. fatigue quality
106. The property of metal enabling it to be drawn into thin wire is known as
- a) malleability
  - b) ductility
  - c) toughness
  - d) plasticity
107. The property of the metal enabling it to be transformed into different shapes by heating is a, b, c, d as per Question No. 106
108. The property of metals due to which it can withstand shock is a, b, c, d as per Question No. 107
109. Non-ferrous Materials
- a) Market form of copper is/are
  - b) ingots
  - c) sheets
  - d) tubes
  - e) all of the above
110. The ore from which aluminium is extracted economically is
- a) kaolin
  - b) cryolite
  - c) corundum
  - d) bauxite

***Answers to Multiple-Choice Questions***

**I.**

- |           |            |           |            |           |            |           |            |            |            |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|------------|------------|
| <u>1.</u> | <u>(d)</u> | <u>2.</u> | <u>(d)</u> | <u>3.</u> | <u>(b)</u> | <u>4.</u> | <u>(c)</u> | <u>5.</u>  | <u>(b)</u> |
| <u>6.</u> | <u>(c)</u> | <u>7.</u> | <u>(d)</u> | <u>8.</u> | <u>(a)</u> | <u>9.</u> | <u>(c)</u> | <u>10.</u> | <u>(d)</u> |

11.	(c)	12.	(b)	13.	(d)	14.	(b)	15.	(d)
16.	(d)	17.	(c)	18.	(c)	19.	(a)	20.	(a)
21.	(d)	22.	(a)	23.	(a)	24.	(a)	25.	(b)
26.	(b)	27.	(c)	28.	(d)	29.	(a)	30.	(d)
31.	(d)	32.	(d)	33.	(a)	34.	(d)	35.	(b)
36.	(d)	37.	(c)	38.	(c)	39.	(c)	40.	(a)
41.	(b)	42.	(a)	43.	(b)	44.	(d)	45.	(c)
46.	(a)	47.	(d)	48.	(a)	49.	(d)	50.	(b)
51.	(a)	52.	(a)	53.	(b)	54.	(a)	55.	(c)
56.	(b)	57.	(b)	58.	(d)	59.	(c)	60.	(d)
61.	(d)	62.	(d)	63.	(d)	64.	(a)	65.	(c)
66.	(c)	67.	(d)	68.	(c)	69.	(b)	70.	(b)
71.	(b)	72.	(b)	73.	(a)	74.	(b)	75.	(c)
76.	(b)	77.	(c)	78.	(b)	79.	(d)	80.	(a)
81.	(d)	82.	(c)	83.	(b)	84.	(b)	85.	(a)
86.	(d)	87.	(a)	88.	(b)	89.	(c)	90.	(d)
91.	(a)	92.	(d)	93.	(b)	94.	(b)	95.	(a)
96.	(a)	97.	(c)	98.	(d)	99.	(c)	100.	(c)
101.	(b)	102.	(c)	103.	(a)	104.	(b)	105.	(d)
106.	(b)	107.	(a)	108.	(c)	109.	(d)	110.	(d)

## **TRANSPORTATION ENGINEERING**

### **SURVEYING:**

#### **Surveying:**

It is the art of determining the relative position of a point on or below the surface of the earth.

#### **Principles of surveying:**

- Location of a point from two point of reference.
- Working from whole to the part.

### **Plane surveying and geodetic surveying:**

- Plane surveying: It is the type of surveying in which the mean surface of the earth is considered as a plane and the spheroidal shape is neglected.
- Geodetic surveying: It is the type of surveying in which the shape of the earth is taken in to account.

### **Plan and map:**

Map is a small-scale representation of a large area. Plan is a large-scale representation of a small area.

### **Basic principle of Chain Surveying:**

Chain surveying is the type of surveying in which only linear measurements are made in the field. The main principle of chain surveying or chain triangulation is to provide a framework consist of number of well-conditioned triangles or nearly equilateral triangles. It is used to find the area of the field. Chain surveying is suitable for survey of small areas. The area is divided into well- conditioned triangles and triangulation is the principle used.

### **Types of chains used in chain surveying:**

There can be 5 types of chains used for chain surveying. They are metric chain, Gunter's chain, engineer's chain, revenue chain and steel band or band chain.

### **Gunter's chain:**

Gunter's chain is also called surveyor's chain and is 66ft long. It consists of 100 links, each being 0.6 ft. Eighty Gunter's chain corresponds to 1 mile.

**Cross staff:** It is used for measuring out right angles. There three types are open cross staff, French cross staff and adjustable cross staff. Open cross staff has two vertical, opposite slits. French cross staff consists of a hollow octagonal box. Adjustable cross staff consists of two cylinders of equal diameter, one placed on top of the other.

### **Ranging:**

The process of fixing or establishing intermediate points between two terminal points is known as Ranging. Ranging is of 2 types – direct and indirect. Direct ranging is done using a line ranger or naked eye. Indirect ranging is done when starting and ending points are not visible.

### **Well-conditioned triangle:**

Well-conditioned triangles are those triangles in which no angles should be less than  $30^\circ$  not greater than  $120^\circ$ .

### **Levelling:**

It is the art of determining the relative height of a point on or below the surface of the earth. The application of leveling is Contouring.

### **Automatic Level or Dumpy Level:**

- A dumpy level, builder's auto level, leveling instrument, or automatic level is an optical instrument used to establish or verify points in the same horizontal plane. It is used in surveying and building with a vertical staff to measure height differences and to transfer, measure and set heights.
- The temporary adjustment of dumpy level are Setting up, Levelling up, Elimination of parallax

### **Use of Dumpy Level:**

A dumpy level is a surveying tool that measures horizontal lines. It is used to determine relative height and distance among different locations. In modern times, it is most commonly used to obtain measurements for buildings rather than to gather information on large tracts of land.

### **Level Staff:**

A level staff, also called levelling rod, is a graduated wooden or aluminum rod, used with a levelling instrument to determine the difference in height between points or heights of points above a datum surface. The least count of leveling staff is 0.005m or 5mm.

### **Mean sea level (MSL):**

It is the average level of sea. The mean sea level for India is Mumbai.

### **Reduced level:**

Height or Elevation measured from mean sea level is called Reduced level.

### **Bench mark and its types:**

Bench mark is a point of known elevation or reduced level. The types of Bench mark are Great Trigonometrical Survey (GTS) bench mark, Permanent bench mark, Temporary bench mark, Arbitrary bench mark.

### **Back sight, Intermediate sight, Fore sight, Change point, Station:**

- Back sight: It is the first staff reading taken on a bench mark for a given instrument station.
- Intermediate sight: It is the reading taken between back sight and fore sight.
- Fore sight: It is the last staff reading taken on a unknown point for a given instrument station.
- Change point: It is a point where back sight and fore sight reading are taken.
- Station: It is a point where levelling staff is held.

### **Inverted levelling:**

It is used only when the station point is above the line of sight.

### **Methods of booking in levelling:**

- Height of instrument or Height of collimation method.
- Rise and fall method.



**Least count of theodolite:** The least count of theodolite is 20 seconds.

**Least count of Prismatic compass:** The least count of Prismatic compass is 30 minutes.

**Contours:**

These are imaginary lines, which passes through points of same or equal elevations. These are found in topographical maps to represent features like mountains, valleys, etc.

**Contour interval and horizontal equivalent:**

- Contour interval: The vertical distance between any two consecutive contour line is called Contour interval.
- Horizontal equivalent: The horizontal distance between any two consecutive contour line is called Horizontal equivalent.

**Bearing:**

Bearing of line gives its direction relative to a given meridian. It can be measured as an angle using any angular measuring instruments.

**Types of compass used in surveying:**

The two compass types used in surveying are Prismatic Compass and Surveyor's Compass. Prismatic Compass is most commonly used one for surveying. Prismatic Compass functions based on WCB – whole circle bearing and surveyor's compass functions based on the reduced bearing system.

**Types of meridians are used in surveying:**

True, magnetic and arbitrary meridians are used. True meridian passes through true North and South. Magnetic meridian passes through magnetic North and South. Arbitrary meridian is used for rough purposes.

**Local attraction:**

While reading a compass, sometimes needle might be slightly deviated from magnetic North. It can be due to any weather conditions, magnetic objects nearby. It has to be corrected to get accurate readings.

**Magnetic declination:**

The horizontal angle between true bearing and magnetic bearing is called Magnetic declination.

**Traverse and its types:**

Inter connected survey lines is called Traverse. Two types: They are Closed traverse and Open traverse.

**Isogonic line, Agonic line, Aclinic line, Isoclinic line:**

- Isogonic line: Line drawn to a points having same magnetic declination.

- Agonic line: Line drawn to a points having zero magnetic declination.
- Aclinic line: Line joining the points having zero magnetic dip.
- Isoclinic line: Line joining the points having same magnetic dip.

### **Tacheometer:**

Tacheometer or Tacheometry, from the Greek "quick measure", is a system of rapid surveying, by which the positions, both horizontal and vertical, of points on the earth's surface relatively to one another are determined without using a chain or tape or a separate leveling instrument.

**Swinging in theodolite surveying:** It is the process of turning the telescope in horizontal plane about its vertical axis.

**Transiting or Reversing or Plunging:** It is the process of turning the telescope in vertical plane about its horizontal axis.

### **Face left observation and Face right observation in theodolite surveying:**

- Face left observation: If the face of the vertical circle is to the left of the observer, it is known as Face left observation.
- Face right observation: If the face of the vertical circle is to the right of the observer, it is known as Face right observation.

### **Categories of levelling staff:**

There are 2 categories – self reading staff and target staff. Self-reading staff can be directly read from the instrument through telescope. Target staff consists of moving target against which reading is to be taken.

### **Types of levelling:**

There are 4 ways to perform levelling. They are direct levelling, trigonometric levelling, barometric levelling and stadia levelling.

### **Curvature correction, Refraction correction and Combined correction in levelling:**

Curvature correction,  $C_c$  is given by  $0.0785D^2$ .

Refraction correction,  $C_r$  is given by  $0.01121D^2$ .

Combined correction =  $0.0673D^2$ .

Where  $D$  = Distance between the instrument and leveling staff.

### **Methods of plane table surveying:**

There are four ways to perform plane table surveying. They are radiation, inter-section, traversing and resection. First two are employed for locating details and other two for locating plane table stations.

### **Total Station:**

A Total Station is a modern surveying instrument that integrates an electronic theodolite with an electronic distance meter. A theodolite uses a movable telescope to measure angles in both the horizontal and vertical planes.

### **EDM in Surveying:**

A total station or TST (total station theodolite) is an electronic/optical instrument used in modern surveying and building construction. The total station is an electronic theodolite (transit) integrated with an electronic distance meter (EDM) to read slope distances from the instrument to a particular point.

**Types of EDM instruments:** The 3 types are microwave (Tellurometer), infrared (Distomat) and visible range (Geodimeter).

## **Highway engineering:**

### **Classification of roads based on location and function:**

They are national highways (NH), state highways (SH), major district road (MDRs), other district road (ODRs) and village road (VRs).

### **Longest National highway in india:**

Previously it was NH7 but National Highway 44 (NH 44) is the longest-running National Highway in India. It is 3,745 km long and covers the North-South Corridor of NHDP. It starts from Srinagar in the north and ends in Kanyakumari in the south. NH-44 was laid and is maintained by Central Public Works Department(CPWD).

### **Highway alignment:**

The position or lay out of centre line of the highway on the ground is called the alignment. It includes straight path, horizontal deviation and curves.

### **Sight distance:**

Sight distance is the actual distance along the road surface, over which a driver from a specified height above the carriage way has visibility of stationary or moving objects.

### **Stopping sight distance (SSD):**

Stopping sight distance (SSD) is the minimum sight distance available on a highway at any spot having sufficient length to enable the driver to stop a vehicle traveling at design speed, safely without collision with any other obstruction.

**Intermediate sight distance (ISD):** Intermediate sight distance = 2 x SSD

### **Overtaking sight distance (OSD):**

The overtaking sight distance is the minimum distance open to the vision of the driver of a vehicle intending to overtake the slow vehicle ahead safely against the tra\_c in the opposite direction.

**Headlight sight distance (HLSD):**

Head light sight distance is the distance visible to a driver during night driving under the illumination of head lights

**Camber or cross slope and its types:**

- Camber or cant is the cross slope provided to raise middle of the road surface in the transverse direction to drain off rain water from road surface. The objectives of providing camber are: Surface protection especially for gravel and bituminous roads. Sub-grade protection by proper drainage.
- Types of camber are straight line camber, parabolic camber and combination of both straight line and parabolic camber.

**carriage way:** It is the width of the road used by vehicular traffic.

**Width of pavement or carriage way:**

Single lane	3.75m
Two lane, no kerbs	7.0m
Two lane, raised kerbs	7.5m
Intermediate carriage	5.5m
Multi-lane	3.5m

**Right of way:**

Right of way (ROW) or land width is the width of land acquired for the road, along its alignment. It should be adequate to accommodate all the cross-sectional elements of the highway and may reasonably provide for future development.

**Shoulders:**

Shoulders are provided along the road edge and is intended for accommodation of stopped vehicles, serve as an emergency lane for vehicles and provide lateral support for base and surface courses.

**Kerbs:**

Kerbs indicate the boundary between the carriage way and the shoulder or islands or footpaths.

**PIEV theory:**

The total reaction time of driver may be split up into four components based on PIEV theory. They are 1) Perception 2) Intellection 3) Emotion 4) Violation.

- 1) Perception time: is time required for the sensations received by the eyes or ears of the driver to be transmitted to the brain through the nervous system & spinal cord or it is the time required to perceive an object or situation.
- 2) Intellection time : is the time require for the driver to understand the situation it is also the time required for comparing the different thoughts.

- 3) Emotion time: is the time elapsed during emotional sensational and other mental disturbance such as fear, anger or any other emotional feeling superstition etc
- 4) Volition time: is the time taken by the driver for the final action such as brake application.

**Note:**

In SSD, as per IRC

- Driver eye level above the road surface = 1.2m
- Minimum height of obstruction above the road surface = 0.15m
- Total reaction time of driver = 2.5 seconds
- Coefficient of longitudinal friction = 0.35 to 0.40

In OSD, as per IRC

- Driver eye level above the road surface = 1.2m
- Minimum height of obstruction above the road surface = 1.2m
- Total reaction time of driver = 2 seconds

**Gradient and its types:**

Gradient is the rate of rise or fall along the length of the road with respect to the horizontal. The types of gradient are Ruling gradient, Limiting gradient, Exceptional gradient and Minimum gradient.

**Super elevation:**

Super-elevation or cant or banking is the transverse slope provided at horizontal curve to counteract the centrifugal force, by raising the outer edge of the pavement with respect to the inner edge, throughout the length of the horizontal curve.

**Transition curves:**

The horizontal curve having varying radius is known as transition curve. Transition curve is provided to change the horizontal alignment from straight to circular curve gradually and has a radius which decreases from infinity at the straight end (tangent point) to the desired radius of the circular curve at the other end (curve point).

**Objectives for providing transition curves:**

- To introduce gradually the centrifugal force between the tangent point and the beginning of the circular curve, avoiding sudden jerk on the vehicle. This increases the comfort of passengers.
- To enable the driver turn the steering gradually for his own comfort and security,
- To provide gradual introduction of super elevation, and
- To provide gradual introduction of extra widening.
- To enhance the aesthetic appearance of the road.

**Types of transition curves:**

Different types of transition curves are spiral or clothoid, cubic parabola, and Lemniscate. IRC recommends spiral as the ideal shape of transition curve.

**Summit curves:** Summit curves are vertical curves with gradient upwards. They are formed when two gradients meet in any of the following four ways:

- when a positive gradient meets another positive gradient
- when positive gradient meets a flat gradient
- when an ascending gradient meets a descending gradient
- when a descending gradient meets another descending gradient

The ideal shape of summit curve is parabola.

**Valley curves:** Valley curve or sag curves are vertical curves with convexity downwards. They are formed when two gradients meet in any of the following four ways:

- when a descending gradient meets another descending gradient.
- when a descending gradient meets a flat gradient.
- when a descending gradient meets an ascending gradient.
- when an ascending gradient meets another ascending gradient.

The ideal shape of valley curve is Cubic parabola.

**Components of flexible pavements:** The components of flexible pavements are Subgrade, Sub-base, Base course and wearing or surface course.

**Methods used to design flexible pavement:**

- Group index method.
- California Bearing Ratio (CBR) method.
- California resistance value method/ Stabilometer method.
- Mcleod method.
- Triaxial method.
- Burmister's layered system concept.

**Tests for subgrade soil:** The important tests for subgrade soil are Shear test, CBR test, plate bearing test.

**Tests for aggregate:** Crushing test, Abrasion/Attrition test, Impact test, Soundness test, Shape test, Bitumen immersion test, Water absorption test and Specific gravity test.

**Tests for Bitumen:** Penetration test, Ductility test, Viscosity test, Float test, Softening point test, Flash and fire point test, Solubility test, Specific gravity test, Spot test, Water content test, Loss on heating test.

**Code books used for the design of flexible and Rigid pavements:**

- For flexible pavement: IRC 37-2012
- For rigid pavement: IRC 58-2002

**Joints provided in rigid pavements & its necessity:**

The joints provided in rigid pavements are Longitudinal joint and Transverse joint. It is provided to release stresses due to temperature variation, subgrade moisture variation, shrinkage of concrete etc.

## Railway engineering:

### Guage in railways:

The gauge of a railway track is defined as the clear minimum perpendicular distance between the inner faces of the two rails.

### Types of gauges and its dimensions in indian railways:

Gauge	Dimension (mm)
Broad gauge(B.G)	1676
Metre gauge(M.G)	1000
Narrow gauge(N.G)	762
Light gauge	610

**Types of rails used in indian railways:** Double headed rail, Bull headed rail and Flat footed rail. Here Flat footed rail is mostly preferred.

**Permanent way:** The combination of rails, fitted on sleepers and resting on ballast and subgrade is called Permanent way.

**Creep of rails:** The longitudinal movement of rails of permanent track caused due to speedy rolling stock is known as Creep of rails.

**Coning of wheels:** To check the slipping and lateral movement of wheels, an outward slope of 1 in 20 is provided to treads of wheels which is known as Coning of wheels. It is mainly done to maintain the vehicle in the central position with respect to the track.

**Fish plates:** A pair of plates of designed section, which are used in rail joints to maintain the continuity of the rails and to provide expansion and contraction of the rails due to temperature variation are called Fish plates.

**Sleepers:** The members which are laid transverse to the rails, to support the rails and to transfer the loads from rails to the ballast are called Sleepers.

**Sleeper density:** It is the number of sleepers per rail length. The sleeper density is specified as  $(n+x)$  where  $n$  is the length of the rail in metres. For Broad gauge, length of the rail = 12.8m (42ft) and for metre gauge, length of the rail = 11.89m (39ft) and  $x$  is a number whose value depends on the axle load.

**Ballast:** The granular material i.e., broken stones, gravels, shingles etc., placed below and around the sleepers to transmit wheel load from sleepers to formation and also to provide proper drainage is called Ballast.

**Gradient:** The rate of rise and fall provided to the formation of a railway along its alignment is called Gradient. The types of gradient are Ruling gradient, Momentum gradient, Pusher gradient and Station yard gradient.

**Super elevation in railways:** The difference in the elevation of the top of the outer raised rail and the top of the inner rail at a horizontal curve of a railway track is called Super elevation or Cant.

Super elevation for different gauges in indian railways:

Gauge	Super elevation
Broad gauge	$1.315 V^2/R$ in cm
Metre gauge	$0.80 V^2/R$ in cm
Narrow gauge	$0.60 V^2/R$ in cm

Where  $V$ =speed of the vehicle in km per hour and  $R$ =radius of curve in meter.

**Points and crossings:** The arrangements which are made for directing the trains from the main lines to branch lines or to cross over from one track to another track without any obstruction are called points and crossings. The types of crossings are Acute crossing ( $<90$  degree), Obtuse crossing ( $>90$  degree) and square crossing ( $= 90$  degree).

**Track modulus:** Load/unit length of rail to produce unit depression/deflection in track.

**Types of stations in railways:**

- Way side stations
- Junctions
- Terminal stations

**Railway yards and its types:** The system of tracks laid usually on a fairly level ground for receiving, storing, sorting, making up trains and dispatch of vehicles is known as Railway yards. There are four types: Passenger yards, Goods yards, Marshalling yards, Locomotive yards.

**Signalling:** The device used for operating trains efficiently and for the maintenance of passenger's safety is called Signalling. The most important signal used in indian railways is Semaphore signal.

## **Airport engineering:**

**Runway:** It is defined as the long and narrow strip of land which is selected or prepared for the landing and takeoff of aircraft along its length.

**Taxiway:** Taxiway is relatively a narrow strip of pavements which connects the runway and the apron.



**Apron:** These are the open surfaces provided in front of a terminal building for loading and unloading and parking operations.

**Approach area or Approach zone:** It indicates the wide area on either side of a particular runway up to a certain distance which is kept clear of any obstruction.

**Calm period:** The absence of appreciable wind generally considered as 6 kmph or less is called Calm period.

**Hangers:** It is the place where repair work of aircraft is done.

**Clear zone:** The term clear zone is used to indicate the inner most portions of the approach zone and it is to be provided at the end of runways.

**Turning zone:** It is the area of the airport other than the approach area and it is intended for turning operations of the aircraft in case of emergencies like failure of engine or trouble in smooth working of aircraft experienced at the start of the takeoff.

**Wind rose diagram:** An average data of around 5-10 years of the various components of wind (intensity, duration and direction) of the area is compiled to make a Wind Rose diagram. The entire area of the airport is divided into 16 equal parts at angles of 22.5 degree. The wind coverage in each of the small quadrants is then studied for the orientation of the runway.

**Cases normally considered in the basic runway length:**

Normal landing, Normal take off, Stopping in emergency

**Corrections for basic runway length:**

- Correction for elevation
- Correction for temperature
- Correction for gradient

## **Port and harbour engineering:**

**Port and Harbour:** Harbour is an enclosed area where there is storage, refuelling, loading and unloading of cargo facilities. A port is a harbour which provides all facilities for the transfer of cargo as well as passengers. So, all the ports are harbours.

**Breakwaters & its types:** Breakwater is a protection barrier constructed to protect the harbour from the effect of sea waves. Its alignment should be straight with intersection angle within 60 degree & sometimes curved in open sea to reduce effect of waves. The types of break waters are Rubble mount breakwater, vertical wallbreak water, composite breakwater.

**Wharfs and Quays:** The solid parallel platform in a harbour with berthing facility on one side only is called Wharfs. A Quays provides berthing on one side and retains earth on other side.

**Pier and Jetty:** A pier is the platform parallel to the shore with berthing possible on both sides. A jetty is the platform that is perpendicular to shoreline.

**Dolphins:** The marine structure located alongside or at entrance of a pier or a wharf is called Dolphins. These structures provide mooring facilities for ships, absorb impact force and shorten the length of a pier or a wharf.

**Fenders:** A Fender in the form of cushion is provided on a jetty face for ships to come in contact. They absorb the impact of the ship and protect them from damage.

**Groins:** A low wall built out into the sea more or less perpendicular to the coast line, to resist the travel of sand and shingle along a beach, is called Groins.

**Docks:** Docks are the sheltered basin for berthing ships. They are so arranged that the water in the dock may be kept at more or less constant level to facilitate loading and unloading.

SAFEC-CIVIL

## Transportation engineering objective questions:

1. During chaining along a straight line, the leader of the party has 4 arrows in his hand while the follower has 6. Distance of the follower from the starting point is

- a) 4 chains
- b) 6 chains
- c) 120 m
- d) 180m

Ans: b

2. A metallic tape is made of

- a) steel
- b) invar
- c) linen
- d) cloth and wires

Ans: d

3. For a well-conditioned triangle, no angle should be less than

- a)  $20^\circ$
- b)  $30^\circ$
- c)  $45^\circ$
- d)  $60^\circ$

Ans: b

4. The angle of intersection of the two plane mirrors of an optical square is

- a)  $30^\circ$
- b)  $45^\circ$
- c)  $60^\circ$
- d)  $90^\circ$

Ans: b

5. The allowable length of an offset depends upon the

- a) degree of accuracy required
- b) method of setting out the perpendiculars and nature of ground
- c) scale of plotting
- d) all of the above

Ans: d

6. Which of the following angles can be set out with the help of French cross staff?

- a)  $45^\circ$  only
- b)  $90^\circ$  only
- c) either  $45^\circ$  or  $90^\circ$
- d) any angle

Ans: c

7. Which of the following methods of offsets involves less measurement on the ground?

- a) method of perpendicular offsets
- b) method of oblique offsets
- c) method of ties
- d) all involve equal measurement on the ground

Ans: a

8. The permissible error in chaining for measurement with chain on rough or hilly ground is

- a) 1 in 100
- b) 1 in 250
- c) 1 in 500
- d) 1 in 1000

Ans: b

9. The correction for sag is

- a) always additive
- b) always subtractive
- c) always zero
- d) sometimes additive and sometimes subtractive

Ans: b

10. Cross staff is an instrument used for

- a) measuring approximate horizontal angles
- b) setting out right angles
- c) measuring bearings of the lines
- d) none of the above

Ans: b

11. Normal tension is that pull which

- a) is used at the time of standardising the tape
- b) neutralizes the effect due to pull and sag
- c) makes the correction due to sag equal to zero
- d) makes the correction due to pull equal to zero

Ans: b

12. Which of the following is not used in measuring perpendicular offsets ?

- a) line ranger
- b) steel tape
- c) optical square
- d) cross staff

Ans: a

13. If the length of a chain is found to be short on testing, it can be adjusted by

- a) straightening the links
- b) removing one or more small circular rings
- c) closing the joints of the rings if opened out
- d) all of the above

Ans: a

14. The maximum tolerance in a 20 m chain is

- a)  $\pm 2$  mm

b)  $\pm 3$  mm

c)  $\pm 5$  mm

d)  $\pm 8$  mm

Ans: c

a) For accurate work, the steel band should always be used in preference to chain because the steel band

a) is lighter than chain

b) is easier to handle

c) is practically inextensible and is not liable to kinks when in use

d) can be easily repaired in the field

Ans: c

b) The length of a chain is measured from

a) centre of one handle to centre of other handle

b) outside of one handle to outside of other handle

c) outside of one handle to inside of other handle

d) inside of one handle to inside of other handle

Ans: b

17. Select the incorrect statement.

a) The true meridians at different places are parallel to each other.

b) The true meridian at any place is not variable.

c) The true meridians converge to a point in northern and southern hemispheres.

d) The maps prepared by national survey departments of any country are based on true meridians.

Ans: a

18. If the true bearing of a line AB is  $269^\circ 30'$ , then the azimuth of the line AB is

a)  $0^\circ 30'$

b)  $89^\circ 30'$

c)  $90^\circ 30'$

d)  $269^\circ 30'$

Ans: c

19. In the prismatic compass

a) the magnetic needle moves with the box

b) the line of the sight does not move with the box

c) the magnetic needle and graduated circle do not move with the box

d) the graduated circle is fixed to the box and the magnetic needle always remains in the N-S direction

Ans: c

20. For a line AB

a) the fore bearing of AB and back bearing of AB differ by  $180^\circ$

b) the fore bearing of AB and back bearing of BA differ by  $180^\circ$

c) both (a) and (b) are correct.

d) none is correct

Ans: a

21. Local attraction in compass surveying may exist due to

- a) incorrect levelling of the magnetic needle
- b) loss of magnetism of the needle
- c) friction of the needle at the pivot
- d) presence of magnetic substances near the instrument

Ans: d

22. In the quadrantal bearing system, a whole circle bearing of  $293^{\circ} 30'$  can be expressed as

- a)  $W23^{\circ}30'N$
- b)  $N66^{\circ}30'W$
- c)  $S113^{\circ}30'N$
- d)  $N23^{\circ}30'W$

Ans: b

23. The prismatic compass and surveyor's compass

- a) give whole circle bearing (WCB) of a line and quadrantal bearing (QB) of a line respectively
- b) both give QB of a line and WCB of a line
- c) both give QB of a line
- d) both give WCB of a line

Ans: a

24. The horizontal angle between the true meridian and magnetic meridian at a place is called

- a) azimuth
- b) declination
- c) local attraction
- d) magnetic bearing

Ans: b

25. A negative declination shows that the magnetic meridian is to the

- a) eastern side of the true meridian
- b) western side of the true meridian
- c) southern side of the true meridian
- d) none of the above

Ans: b

26. If the magnetic bearing of the sun at a place at noon in southern hemisphere is  $167^{\circ}$ , the magnetic declination at that place is

- a)  $77^{\circ} N$
- b)  $23^{\circ} S$
- c)  $13^{\circ} E$
- d)  $13^{\circ} W$

Ans: c

27. The graduations in prismatic compass

- i) are inverted
- ii) are upright
- iii) run clockwise having  $0^{\circ}$  at south
- iv) run clockwise having  $0^{\circ}$  at north

The correct answer is

- a) (i) and (iii)
- b) (i) and (iv)
- c) (ii) and (iii)

d) (ii) and (iv)

Ans: a

28. Agate cap is fitted with a

a) cross staff

b) level

c) chain

d) prismatic compass

Ans: d

29. The temporary adjustments of a prismatic compass are

i) Centering

ii) Levelling

iii) Focusing the prism

The correct order is

a) (0, (iii), 00

b) (i), (ii), (iii)

c) (ii), (iii), 0

d) (in), (i), (ii)

Ans: b

30. Theodolite is an instrument used for

a) tightening the capstan-headed nuts of level tube

b) measurement of horizontal angles only

c) measurement of vertical angles only

d) measurement of both horizontal and vertical angles

Ans: d

31. The process of turning the telescope about the vertical axis in horizontal plane is known as

a) transiting

b) reversing

c) plunging

d) swinging

Ans: d

32. Size of a theodolite is specified by

a) the length of telescope

b) the diameter of vertical circle

c) the diameter of lower plate

d) the diameter of upper plate

Ans: c

33. Which of the following is not the function of levelling head ?

a) to support the main part of the instrument

b) to attach the theodolite to the tripod

c) to provide a means for leveling the theodolite

d) none of the above

Ans: d

34. If the lower clamp screw is tightened and upper clamp screw is loosened, the theodolite may be rotated

- a) on its outer spindle with a relative motion between the vernier and graduated scale of lower plate
- b) on its outer spindle without a relative motion between the vernier and graduated scale of lower plate
- c) on its inner spindle with a relative motion between the vernier and the graduated scale of lower plate
- d) on its inner spindle without a relative motion between the vernier and the graduated scale of lower plate

Ans: c

35. A telescope is said to be inverted if its

- a) vertical circle is to its right and the bubble of the telescope is down
- b) vertical circle is to its right and the bubble of the telescope is up
- c) vertical circle is to its left and the bubble of the telescope is down
- d) vertical circle is to its left and the bubble of the telescope is up

Ans: a

36. The cross hairs in the surveying telescope are placed

- a) midway between eye piece and objective lens
- b) much closer to the eye-piece than to the objective lens
- c) much closer to the objective lens than to the eye piece
- d) anywhere between eye-piece and objective lens

Ans: b

37. For which of the following permanent adjustments of theodolite, the spire test is used ?

- a) adjustment of plate levels
- b) adjustment of line of sight
- c) adjustment of horizontal axis
- d) adjustment of altitude bubble and vertical index frame

Ans: c

38. The adjustment of horizontal cross hair is required particularly when the instrument is used for

- a) leveling
- b) prolonging a straight line
- c) measurement of horizontal angles
- d) all of the above

Ans: a

39. Which of the following errors is not eliminated by the method of repetition of horizontal angle measurement ?

- a) error due to eccentricity of verniers
- b) error due to displacement of station signals
- c) error due to wrong adjustment of line of collimation and trunnion axis
- d) error due to inaccurate graduation

Ans: b

40. The error due to eccentricity of inner and outer axes can be eliminated by

- a) reading both verniers and taking the mean of the two
- b) taking both face observations and taking the mean of the two
- c) double sighting



d) taking mean of several readings distributed over different portions of the graduated circle

Ans: a

41. In the double application of principle of reversion, the apparent error is

- a) equal to true error
- b) half the true error
- c) two times the true error
- d) four times the true error

Ans: d

42. Which of the following errors can be eliminated by taking mean of both face observations

- ? a) error due to imperfect graduations
- b) error due to eccentricity of verniers
- c) error due to imperfect adjustment of plate levels
- d) error due to line of collimation not being perpendicular to horizontal axis

Ans: d

43. Which of the following errors cannot be eliminated by taking both face observations ?

- a) error due to horizontal axis not being perpendicular to the vertical axis
- b) index error i.e. error due to imperfect adjustment of the vertical circle vernier
- c) error due to non-parallelism of the axis of telescope level and line of collimation
- d) none of the above

Ans: d

44. If a tripod settles in the interval that elapses between taking a back sight reading and the following foresight reading, then the elevation of turning point will

- a) increase
- b) decrease
- c) not change
- d) either „a“ or „b“

Ans: a

45. If altitude bubble is provided both on index frame as well as on telescope of a theodolite, then the instrument is levelled with reference to

- i) altitude bubble on index frame
  - ii) altitude bubble on index frame if it is to be used as a level
  - iii) altitude bubble on telescope
  - iv) altitude bubble on telescope if it is to be used as a level
- The correct answer is

- a) only (i)
- b) both (i) and (iv)
- c) only (iii)
- d) both (ii) and (iii)

Ans: b

46. A “level line” is

- a) horizontal line
- b) line parallel to the mean spheroidal surface of earth
- c) line passing through the center of cross hairs and the center of eye piece
- d) line passing through the objective lens and the eye-piece of a dumpy or tilting level

Ans: b

47. The following sights are taken on a “turning point”

- a) foresight only
- b) backsight only
- c) foresight and backsight
- d) foresight and intermediate sight

Ans: c

48. The rise and fall method of levelling provides a complete check on

- a) backsight
- b) intermediate sight
- c) foresight
- d) all of the above

Ans: d

49. If the R.L. of a B.M. is 100.00 m, the back-sight is 1.215 m and the foresight is 1.870 m, the R.L. of the forward station is

- a) 99.345 m
- b) 100.345 m
- c) 100.655m
- d) 101.870m

Ans: a

50. In an internal focussing type of telescope, the lens provided is

- a) concave
- b) convex
- c) plano-convex
- d) plano concave

Ans: a

51. Which of the following errors can be neutralised by setting the level midway between the two stations ?

- a) error due to curvature only
- b) error due to refraction only
- c) error due to both curvature and re-fraction
- d) none of the above

Ans: c

52. Height of instrument method of leveling is

- a) more accurate than rise and fall method
- b) less accurate than rise and fall method
- c) quicker and less tedious for large number of intermediate sights
- d) none of the above

Ans: c

53. The rise and fall method

- a) is less accurate than height of instrument method
- b) is not suitable for levelling with tilting levels
- c) provides a check on the reduction of intermediate point levels
- d) quicker and less tedious for large number of intermediate sights

Ans: c

54. If the staff is not held vertical at a levelling station, the reduced level calculated from the observation would be

- a) true R.L.
- b) more than true R.L.
- c) less than true R.L.
- d) none of the above

Ans: c

55. The difference between a level line and a horizontal line is that

- a) level line is a curved line while horizontal line is a straight line
- b) level line is normal to plumb line while horizontal line may not be normal to plumb line at the tangent point to level line
- c) horizontal line is normal to plumb line while level line may not be normal to the plumb line
- d) both are same

Ans: a

56. The sensitivity of a bubble tube can be increased by

- a) increasing the diameter of the tube
- b) decreasing the length of bubble
- c) increasing the viscosity of liquid
- d) decreasing the radius of curvature of tube

Ans: a

57. With the rise of temperature, the sensitivity of a bubble tube

- a) decreases
- b) increases
- c) remains unaffected
- d) none of the above

Ans: a

58. Refraction correction

- a) completely eliminates curvature correction
- b) partially eliminates curvature correction
- c) adds to the curvature correction
- d) has no effect on curvature correction

Ans: b

59. The R.L. of the point A which is on the floor is 100 m and back sight reading on A is 2.455 m. If the foresight reading on the point B which is on the ceiling is 2.745 m, the R.L. of point B will be

- a) 94.80 m
- b) 99.71 m
- c) 100.29 m
- d) 105.20 m

Ans: d

60. If the horizontal distance between the staff point and the point of observation is  $d$ , then the error due to curvature of earth is proportional to

- a)  $d$
- b)  $1/d$

- c)  $d^2$
  - d)  $1/d^2$
- Ans: c

61. Sensitiveness of a level tube is designated by

- a) radius of level tube
- b) length of level tube
- c) length of bubble of level tube
- d) none of the above

Ans: a

62. Which of the following statements is in-correct ?

- a) Error due to refraction may not be completely eliminated by reciprocal levelling.
- b) Tilting levels are commonly used for precision work.
- c) The last reading of levelling is always a foresight.
- d) All of the above statements are incorrect.

Ans: d

63. Dumpy level is most suitable when

- a) the instrument is to be shifted frequently
- b) fly levelling is being done over long distance
- c) many readings are to be taken from a single setting of the instrument
- d) all of the above

Ans: c

64. The difference of levels between two stations A and B is to be determined. For best results, the instrument station should be

- a) equidistant from A and B
- b) closer to the higher station
- c) closer to the lower station
- d) as far as possible from the line AB

Ans: a

65. Contour interval is

- a) inversely proportional to the scale of the map
- b) directly proportional to the flatness of ground
- c) larger for accurate works
- d) larger if the time available is more

Ans: a

66. An imaginary line lying throughout the surface of ground and preserving a constant inclination to the horizontal is known as

- a) contour line
- b) horizontal equivalent
- c) contour interval
- d) contour gradient

Ans: d

67. The suitable contour interval for a map with scale 1 : 10000 is

- a) 2 m
- b) 5m

c) 10 m

d) 20 m

Ans: a

68. Select the correct statement.

a) A contour is not necessarily a closed curve.

b) A contour represents a ridge line if the concave side of lower value contour lies towards the higher value contour.

c) Two contours of different elevations do not cross each other except in case of an overhanging cliff.

d) All of the above statements are correct.

Ans: c

69 A series of closely spaced contour lines represents a

a) steep slope

b) gentle slope

c) uniform slope

d) Plane surface

Ans: a

70. Direct method of contouring is

a) a quick method

b) adopted for large surveys only

c) most accurate method

d) suitable for hilly terrains

Ans: c

71. In direct method of contouring, the process of locating or identifying points lying on a contour is called

a) ranging

b) centering

c) horizontal control

d) vertical control

Ans: d

72. In the cross-section method of indirect contouring, the spacing of cross-sections depends upon i) contour interval

ii) scale of plan

iii) characteristics of ground

The correct answer is

a) only (i)

b) (i) and (ii)

c) (ii) and (iii)

d) (i), (ii) (iii)

Ans: d

73. Which of the following methods of contouring is most suitable for a hilly terrain ?

a) direct method

b) square method

c) cross-sections method

d) tacheometric method

Ans: d

74. Select the correct statement.

- a) Contour interval on any map is kept constant.
- b) Direct method of contouring is cheaper than indirect method.
- c) Inter-visibility of points on a contour map cannot be ascertained.
- d) Slope of a hill cannot be determined with the help of contours.

Ans: a

75 Closed contours, with higher value inwards, represent a

- a) depression
- b) hillock
- c) plain surface
- d) none of the above

Ans: b

76. Contour interval is

- a) the vertical distance between two consecutive contours
- b) the horizontal distance between two consecutive contours
- c) the vertical distance between two points on same contour
- d) the horizontal distance between two points on same contour

Ans: a

77 Benchmark is established by

- a) hypsometry
- b) barometric levelling
- c) spirit levelling
- d) trigonometrical levelling

Ans: c

78 The type of surveying which requires least office work is

- a) tachemetry
- b) trigonometrical levelling
- c) plane table surveying
- d) theodolite surveying

Ans: c

79 Intersection method of detailed plotting is most suitable for

- a) forests
- b) urban areas
- c) hilly areas
- d) plains

Ans: c

80 Detailed plotting is generally done by

- a) radiation
- b) traversing
- c) resection
- d) all of the above

Ans: a

81 Three point problem can be solved by

- a) Tracing paper method
- b) Bessels method
- c) Lehman's method
- d) all of the above

Ans: d

82 The size of a plane table is

- a) 750 mm x 900 mm
- b) 600 mm x 750 mm
- c) 450 mm x 600 mm
- d) 300 mm x 450 mm

Ans: b

83 The process of determining the locations of the instrument station by drawing resectors from the locations of the known stations is called

- a) radiation
- b) intersection
- c) resection
- d) traversing

Ans: c

84 The instrument used for accurate centering in plane table survey is

- a) spirit level
- b) alidade
- c) plumbing fork
- d) trough compass

Ans: c

85 Which of the following methods of plane table surveying is used to locate the position of an inaccessible point ?

- a) radiation
- b) intersection
- c) traversing
- d) resection

Ans: b

86 The two point problem and three point problem are methods of

- a) resection
- b) orientation
- c) traversing
- d) resection and orientation

Ans: d

87 The resection by two point problem as compared to three point problem

- a) gives more accurate problem
- b) takes less time
- c) requires more labour
- d) none of the above

Ans: c

88 The methods used for locating the plane table stations are

- i) radiation

- ii) traversing
- iii) intersection
- iv) resection

The correct answer is

- a) (i) and (ii)
- (iii) and (iv)
- (ii) and (iv)
- (i) and (iii)

Ans: c

89 After fixing the plane table to the tripod, the main operations which are needed at each plane table station are

- i) levelling
- ii) orientation
- iii) centering

The correct sequence of these operations is

- a) (i), (ii), (iii)
- b) (i), (iii), (ii)
- c) (iii), (i), (ii)
- d) (ii), (iii), (i)

Ans: b

90 Bowditch rule is applied to

- a) an open traverse for graphical adjustment
- b) a closed traverse for adjustment of closing error
- c) determine the effect of local attraction
- d) none of the above

Ans: b

91 If in a closed traverse, the sum of the north latitudes is more than the sum of the south latitudes and also the sum of west departures is more than the sum of the east departures, the bearing of the closing line is in the

- a) NE quadrant
- b) SE quadrant
- c) NW quadrant
- d) SW quadrant

Ans: b

92 If the reduced bearing of a line AB is  $N60^\circ W$  and length is 100 m, then the latitude and departure respectively of the line AB will be

- a) +50 m, +86.6m
- b) +86.6 m, -50 m
- c) +50m, -86.6 m
- d) +70.7 m, -50 m

Ans: b

93 The angle between the prolongation of the preceding line and the forward line of a traverse is called

- a) deflection angle
- b) included angle
- c) direct angle



d) none of the above

Ans: a

94 Transit rule of adjusting the consecutive coordinates of a traverse is used where

a) linear and angular measurements of the traverse are of equal accuracy

b) angular measurements are more accurate than linear measurements

c) linear measurements are more accurate than angular measurements

d) all of the above

Ans: b

95 Which of the following methods of theodolite traversing is suitable for locating the details which are far away from transit stations ?

a) measuring angle and distance from one transit station

b) measuring angles to the point from at least two stations

c) measuring angle at one station and distance from other

d) measuring distance from two points on traverse line

Ans: b

96 Subtense bar is an instrument used for

a) levelling

b) measurement of horizontal distances in plane areas

c) measurement of horizontal distances in undulated areas

d) measurement of angles

Ans: c

97 Horizontal distances obtained by thermometric observations

a) require slope correction

b) require tension correction

c) require slope and tension corrections

d) do not require slope and tension corrections

Ans: d

98 The number of horizontal cross wires in a stadia diaphragm is

a) one

b) two

c) three

d) four

Ans: c

99 If the intercept on a vertical staff is observed as 0.75 m from a tacheometer, the horizontal distance between tacheometer and staff station is

a) 7.5 m

b) 25 m

c) 50

d) 75 m

Ans: d

100 For a tacheometer the additive and multiplying constants are respectively

a) 0 and 100

b) 100 and 0

c) 0 and 0

d) 100 and 100

Ans: a

101 If the focal length of the object glass is 25 cm and the distance from object glass to the trunnion axis is 15 cm, the additive constant is

a) 0.1

b) 0.4

c) 0.6

d) 1.33

Ans: b

102. Different grades are joined together by a

a) compound curve

b) transition curve

c) reverse curve

d) vertical curve

Ans: d

## **HIGHWAY ENGINEERING**

1. Nagpur road plan formula were prepared by assuming

a) rectangular or block road pattern

b) radial or star and block road pattern

c) radial or star and circular road pattern

d) radial or star and grid road pattern

Ans: d

2. Select the correct statement.

a) Nagpur road plan formula take into account the towns with very large population.

b) Nagpur road plan has a target road length of 32 km per 100 square km.

c) Second 20-year plan has provided 1600 km of expressways out of the proposed National highway.

d) Second 20-year plan allowed deduction of length of railway track in the area while calculating the length of roads.

Ans: c

3. The sequence of four stages of survey in a highway alignment is

a) reconnaissance, map study, preliminary survey and detailed survey

b) map study, preliminary survey, reconnaissance and detailed survey

c) map study, reconnaissance, preliminary survey and detailed survey

d) preliminary survey, map study, reconnaissance and detailed survey

Ans: c

4. The shape of the camber, best suited for cement concrete pavements, is

a) straight line

b) parabolic

c) elliptical

d) combination of straight and parabolic

Ans: a

5. For water bound macadam roads in localities of heavy rainfall, the recommended value of camber is

- a) 1 in 30
- b) 1 in 36
- c) 1 in 48
- d) 1 in 60

Ans: b

6. The stopping sight distance depends upon

- a) total reaction time of driver
- b) speed of vehicle
- c) efficiency of brakes
- d) all of the above

Ans: d

20. When the path travelled along the road surface is more than the circumferential movement of the wheels due to rotation, then it results in

- a) slipping
- b) skidding
- c) turning
- d) revolving

Ans: b

21. Coefficient of friction is less when the pavement surface is

- a) rough
- b) dry
- c) smooth and dry
- d) smooth and wet

Ans: d

22. The shoulder provided along the road edge should be

- a) rougher than the traffic lanes
- b) smoother than the traffic lanes
- c) of same colour as that of the pavement
- d) of very low load bearing capacity

Ans: a

23 Camber in the road is provided for

- a) effective drainage
- b) counteracting the centrifugal force
- c) having proper sight distance
- d) none of the above

Ans: a

24 Compared to a level surface, on a descending gradient the stopping sight distance is

- a) less
- b) more
- c) same
- d) dependent on the speed

Ans: b

25 On a single lane road with two way traffic, the minimum stopping sight distance is equal to

- a) stopping distance
- b) two times the stopping distance
- c) half the stopping distance
- d) three times the stopping distance

Ans: b

26 The desirable length of overtaking zone as per IRC recommendation is equal to

- a) overtaking sight distance
- b) two times the overtaking sight distance
- c) three times the overtaking sight distance
- d) five times the overtaking sight distance

Ans: d

28. Stopping sight distance is always

- a) less than overtaking sight distance
- b) equal to overtaking sight distance
- c) more than overtaking sight distance
- d) none of the above

Ans: a

29. Reaction time of a driver

- a) increases with increase in speed
- b) decreases with increase in speed
- c) is same for all speeds
- d) none of the above

Ans: b

30. If the stopping distance is 60 meters, then the minimum stopping sight distance for two lane, two way traffic is

- a) 30m
- b) 60m
- c) 120m
- d) 180m

Ans: b

31. The effect of grade on safe overtaking sight distance is

- a) to increase it on descending grades and to decrease it on ascending grades
- b) to decrease it on descending grades and to increase it on ascending grades
- c) to increase it on both descending and ascending grades
- d) to decrease it on both descending and ascending grades

Ans: c

32 The ruling design speed on a National Highway in plain terrain as per IRC recommendations is

- a) 60 kmph
- b) 80 kmph
- c) 100 kmph
- d) 120 kmph

Ans: c

33. The terrain may be classified as rolling terrain if the cross slope of land is

- a) upto 10%
- b) between 10% and 25%
- c) between 25% and 60%
- d) more than 60%

Ans: b

34. If  $b$  is the wheel track of a vehicle and  $h$  is the height of centre of gravity above road surface, then to avoid overturning and lateral skidding on a horizontal curve, the centrifugal ratio should always be

- a) less than  $b/2h$  and greater than co-efficient of lateral friction
- b) less than  $b/2h$  and also less than co-efficient of lateral friction
- c) greater than  $b/2h$  and less than co-efficient of lateral friction
- d) greater than  $b/2h$  and also greater than coefficient of lateral friction

Ans: b

35. As per IRC recommendations, the maximum limit of super elevation for mixed traffic in plain terrain is

- a) 1 in 15
- b) 1 in 12.5
- c) 1 in 10
- d) equal to camber

Ans: a

36. For the design of super elevation for mixed traffic conditions, the speed is reduced by

- a) 15%
- b) 20%
- c) 25%
- d) 75%

Ans: c

37. On a horizontal curve if the pavement is kept horizontal across the alignment, then the pressure on the outer wheels will be

- a) more than the pressure on inner wheels
- b) less than the pressure on inner wheels
- c) equal to the pressure on inner wheels
- d) zero

Ans: a

38. For a constant value of coefficient of lateral friction, the value of required super-elevation increases with

- a) increase in both speed and radius of curve
- b) decrease in both speed and radius of curve
- c) increase in speed and with decrease in radius of curve
- d) decrease in speed and with increase in radius of curve

Ans: d

39. To calculate the minimum value of ruling radius of horizontal curves in plains, the design speed is given by

- a) 8 kmph

- b) 12kmph
  - c) 16kmph
  - d) 20 kmph
- Ans: c

40. The absolute minimum radius of curve for safe operation for a speed of 110 kmph is

- a) 110 m
- b) 220 m
- c) 440 m
- d) 577 m

Ans: c

41. The attainment of super elevation by rotation of pavement about the inner edge of the pavement

- a) is preferable in steep terrain
- b) results in balancing the earthwork
- c) avoids the drainage problem in flat terrain
- d) does not change the vertical alignment of road

Ans: c

42. Select the correct statement.

- a) Psychological extra widening depends on the number of traffic lanes.
- b) Mechanical extra widening depends on the speed of vehicle.
- c) Psychological extra widening depends on the length of wheel base.
- d) Psychological extra widening depends on the speed of vehicle.

Ans: d

43. In case of hill roads, the extra widening is generally provided

- a) equally on inner and outer sides of the curve
- b) fully on the inner side of the curve
- c) fully on the outer side of the curve
- d) one-fourth on inner side and three-fourth on outer side of the curve

Ans: b

44. The transition curve used in the horizontal alignment of highways as per IRC recommendations is

- a) spiral
- b) lemniscate
- c) cubic parabola
- d) any of the above

Ans: a

45. For design, that length of transition curve should be taken which is

- a) based on allowable rate of change of centrifugal acceleration
- b) based on rate of change of super elevation
- c) higher of (a) and (b)
- d) smaller of (a) and (b)

Ans: c

46. The maximum design gradient for vertical profile of a road is

- a) ruling gradient
- b) limiting gradient

- c) exceptional gradient
- d) minimum gradient

Ans: a

47. The percentage compensation in gradient for ruling gradient of 4% and horizontal curve of radius 760 m is

- a) 0.1 %
- b) 1 %
- c) 10%
- d) no compensation

Ans: d

48. If ruling gradient is 1 in 20 and there is also a horizontal curve of radius 76 m, then the compensated grade should be

- a) 3 %
- b) 4%
- c) 5 %
- d) 6%

Ans: b

49. The camber of road should be approximately equal to

- a) longitudinal gradient
- b) two times the longitudinal gradient
- c) three times the longitudinal gradient
- d) half the longitudinal gradient

Ans: d

50. Which of the following shapes is preferred in a valley curve ?

- a) simple parabola
- b) cubic parabola
- c) spiral
- d) lemniscate

Ans: b

51. The value of ruling gradient in plains as per IRC recommendation is

- a) 1 in 12
- b) 1 in 15
- c) 1 in 20
- d) 1 in 30

Ans: d

52. In case of summit curves, the deviation angle will be maximum when

- a) an ascending gradient meets with another ascending gradient
- b) an ascending gradient meets with a descending gradient
- c) a descending gradient meets with another descending gradient
- d) an ascending gradient meets with a level surface

Ans: b

48. If the design speed is  $V$  kmph and deviation angle is  $N$  radians, then the total length of a valley curve in meters is given by the expression

- a)  $0.38 N V^3/2$

- b)  $0.38 (NV^3)^{0.2}$
- c)  $3.8 NV^{0.2}$
- d)  $3.8 (NV^3)^{0.2}$

Ans: b

49. If an ascending gradient of 1 in 50 meets a descending gradient of 1 in 50, the length of summit curve for a stopping sight distance of 80 m will be

- a) zero
- b) 64m
- c) 80m
- d) 60m

Ans: d

50. Highway facilities are designed for

- a) annual average hourly volume
- b) annual average daily traffic
- c) thirtieth highest hourly volume
- d) peak hourly volume of the year

Ans: c

51. Enoscope is used to find

- a) average speed
- b) spot speed
- c) space-mean speed
- d) time-mean speed

Ans: b

52. For highway geometric design purposes the speed used is

- a) 15<sup>th</sup> percentile
- b) 50<sup>th</sup> percentile
- c) 85<sup>th</sup> percentile
- d) 98<sup>th</sup> percentile

Ans: d

53. Select the correct statement.

- a) Traffic volume should always be more than traffic capacity.
- b) Traffic capacity should always be more than traffic volume.
- c) Spot speed is the average speed of a vehicle at a specified section.
- d) 85th percentile speed is more than 98th percentile speed.

Ans: b

54. Length of a vehicle affects

- a) width of traffic lanes
- b) extra width of pavement and minimum turning radius
- c) width of shoulders and parking facilities
- d) clearance to be provided under structures such as overbridges, under-bridges etc.

Ans: b

55. The maximum width of a vehicle as recommended by IRC is

- a) 1.85 m



- b) 2.44 m
  - c) 3.81 m
  - d) 4.72 m
- Ans: b

56. Desire lines are plotted in

- a. traffic volume studies
- b. speed studies
- c. accident studies
- d. origin and destination studies

Ans: d

57. Which of the following methods is preferred for collecting origin and destination data for a small area like a mass business center or a large intersection ?

- a) road side interview method
- b) license plate method
- c) return postcard method
- d) home interview method

Ans: b

56. The diagram which shows the approximate path of vehicles and pedestrians involved in accidents is known as

- a) spot maps
- b) pie charts
- c) condition diagram
- d) collision diagram

Ans: d

57. With increase in speed of the traffic stream, the minimum spacing of vehicles

- a) increases
- b) decreases
- c) first decreases and then increases after reaching a minimum value at optimum speed
- d) first increases and then decreases after reaching a maximum value at optimum speed

Ans: a

58. Which of the following is known as design capacity ?

- a) basic capacity
- b) theoretical capacity
- c) possible capacity
- d) practical capacity

Ans: a

59. If the average center to center spacing of vehicles is 20 meters, then the basic capacity of a traffic lane at a speed of 50 kmph is

- a) 2500 vehicles per day
- b) 2000 vehicles per hour
- c) 2500 vehicles per hour
- d) 1000 vehicles per hour

Ans: c

60. With increase in speed of the traffic stream, the maximum capacity of the lane

- a) increases

- b) decreases
  - c) first increases and then decreases after reaching a maximum value at optimum speed
  - d) first decreases and then increases after reaching a minimum value at optimum speed
- Ans: c

61. Equivalent factor of passenger car unit (PCU) for a passenger car as per IRC is

- a) 1.0
- b) 2.0
- c) 0.5
- d) 10

Ans: a

62. If the stopping distance and average length of a vehicle are 18 m and 6 m respectively, then the theoretical maximum capacity of a traffic lane at a speed of 10 m/sec is

- a) 1500 vehicles per hour
- b) 2000 vehicles per hour
- c) 2500 vehicles per hour
- d) 3000 vehicles per hour

Ans: a

63. Scientific planning of transportation system and mass transit facilities in cities should be based on

- a) spot speed data
- b) origin and destination data
- c) traffic volume data
- d) accident data

Ans: b

64. The diagram which shows all important physical conditions of an accident location like roadway limits, bridges, trees and all details of roadway conditions is known as

- a) pie chart
- b) spot maps
- c) condition diagram
- d) collision diagram

Ans: c

65. When the speed of traffic flow becomes zero, then

- a) traffic density attains maximum value whereas traffic volume becomes zero
- b) traffic density and traffic volume both attain maximum value
- c) traffic density and traffic volume both become zero
- d) traffic density becomes zero whereas traffic volume attains maximum value

Ans: a

66. On a right angled road intersection with two way traffic, the total number of conflict points is

- a) 6
- b) 11
- c) 18
- d) 24

Ans: d

67. The background colour of the informatory sign board is

- a) red
- b) yellow
- c) green
- d) white

Ans: b

68. Which of the following is indicated by a warning sign ?

- a) level crossing
- b) no parking
- c) end of speed limit
- d) overtaking prohibited

Ans: a

69. "Dead Slow" is a

- a) regulatory sign
- b) warning sign
- c) informatory sign
- d) none of the above

Ans: a

70. The most efficient traffic signal system is

- a) simultaneous system
- b) alternate system
- c) flexible progressive system
- d) simple progressive system

Ans: c

71. The provision of traffic signals at intersections

- a) reduces right angled and rear end collisions
- b) increases right angled and rear end collisions
- c) reduces right angled collisions but may increase rear end collisions
- d) reduces rear end collisions but may increase right angled collisions

Ans: c

72. Select the incorrect statement.

- a) Stop or red time of a signal is the sum of go and clearance intervals for the cross flow.
- b) Go or green time of a signal is the sum of stop and clearance intervals for the cross flow.
- c) Clearance time is generally 3 to 5 seconds.
- d) The cycle length is normally 40 to 60 seconds for two phase signals.

Ans: b

73 Centre line markings are used

- a) to designate traffic lanes
- b) in roadways meant for two way traffic
- c) to indicate that overtaking is not permitted
- d) to designate proper lateral placement of vehicles before turning to different directions

Ans: b

74 The particular places where pedestrians are to cross the pavement are properly marked by the pavement marking known as

- a) stop lines
- b) turn markings
- c) crosswalk lines
- d) lane lines

Ans: c

75 The entrance and exit curves of a rotary have

- a) equal radii and equal widths of pavement
- b) equal radii but pavement width is more at entrance than at exit curve
- c) equal pavement widths but radius is more at entrance curve than at exit curve
- d) different radii and different widths of pavement

Ans: d

76 When two equally important roads cross roughly at right angles, the suitable shape of central island is

- a) circular
- b) elliptical
- c) tangent
- d) turbine

Ans: a

77 The maximum number of vehicles beyond which the rotary may not function efficiently is

- a) 500 vehicles per hour
- b) 500 vehicles per day
- c) 5000 vehicles per hour
- d) 5000 vehicles per day

Ans: c

78 A traffic rotary is justified where

- a) number of intersecting roads is between 4 and 7
- b) space is limited and costly
- c) when traffic volume is less than 500 vehicles per hour
- d) when traffic volume is more than 5000 vehicles per hour

Ans: a

79 When a number of roads are meeting at a point and only one of the roads is important, then the suitable shape of rotary is

- a) circular
- b) tangent
- c) elliptical
- d) turbine

Ans: b

80 Maximum number of vehicles can be parked with

- a) parallel parking
- b) 30° angle parking
- c) 45° angle parking
- d) 90° angle parking

Ans: d

81 When the width of kerb parking space and width of street are limited, generally preferred parking system is

- a) parallel parking
- b) 45° angle parking
- c) 65° angle parking
- d) 90° angle parking

Ans: a

82 As per IRC recommendations, the average level of illumination on important roads carrying fast traffic is

- a) 10 lux
- b) 15 lux
- c) 20 lux
- d) 30 lux

Ans: d

83 The most economical lighting layout which is suitable for narrow roads is

- a) single side lighting
- b) staggered system
- c) central lighting system
- d) none of the above

Ans: a

84. The direct interchange ramp involves

- a) diverging to the right side and merging from left
- b) diverging to the left side and merging from right
- c) diverging to the right side and merging from right
- d) diverging to the left side and merging from left

Ans: c

85 In soils having same values of plasticity index, if liquid limit is increased, then

- a) compressibility and permeability decrease and dry strength increases
- b) compressibility, permeability and dry strength decrease
- c) compressibility, permeability and dry strength increase
- d) compressibility and permeability increase and dry strength decreases

Ans: d

86 Which of the following tests measures the toughness of road aggregates ?

- a) crushing strength test
- b) abrasion test
- c) impact test
- d) shape test

Ans: c

87 Los Angeles testing machine is used to conduct

- a) abrasion test
- b) impact test
- c) attrition test
- d) crushing strength test

Ans: a

88 In CBR test the value of CBR is calculated at

- a) 2.5 mm penetration only
- b) 5.0 mm penetration only
- c) 7.5 mm penetration only
- d) both 2.5mm and 5.0 mm penetrations

Ans: d

89 If aggregate impact value is 20 to 30 percent, then it is classified as

- a) exceptionally strong
- b) strong
- c) satisfactory for road surfacing
- d) unsuitable for road surfacing

Ans: c

90 The maximum allowable Los Angeles abrasion value for high quality surface course is

- a) 10%
- b) 20 %
- c) 30%
- d) 45 %

Ans: c

91 Percentage of free carbon in bitumen is

- a) more than that in tar
- b) less than that in tar
- c) equal to that in tar
- d) none of the above

Ans: b

92 The ductility value of bitumen for suitability in road construction should not be less than

- a) 30 cm
- b) 40 cm
- c) 50 cm
- d) 60 cm

Ans: c

93 The maximum limit of water absorption for aggregate suitable for road construction is

- a) 0.4 %
- b) 0.6%
- c) 0.8 %
- d) 1.0 %

Ans: b

94 Which of the following represents hardest grade of bitumen ?

- a) 30/40
- b) 60/70
- c) 80/100
- d) 100/120

Ans: a

95 Penetration test on bitumen is used for determining its

- a) grade
- b) viscosity
- c) ductility
- d) temperature susceptibility

Ans: a

96 Bitumen of grade 80/100 means

- a) its penetration value is 8 mm
- b) its penetration value is 10 mm
- c) its penetration value is 8 to 10 mm
- d) its penetration value is 8 to 10 cm

Ans: c

97 RC-2, MC-2 and SC-2 correspond to

- a) same viscosity
- b) viscosity in increasing order from RC-2 to SC-2
- c) viscosity in decreasing order from RC-2 to SC-2
- d) none of the above

Ans: a

98 The recommended grade of tar for grouting purpose is

- a) RT-1
- b) RT-2
- c) RT.3
- d) RT-5

Ans: d

99 Softening point of bitumen to be used for road construction at a place where maximum temperature is  $40^{\circ}\text{C}$  should be

- a) less-than  $40^{\circ}\text{C}$
- b) greater than  $40^{\circ}\text{C}$
- c) equal to  $40^{\circ}\text{C}$
- d) none of the above

Ans: b

100 For rapid curing cutbacks, the oil used is

- a) gasoline
- b) kerosene oil
- c) light diesel
- d) heavy diesel

Ans: a

101 The method of design of flexible pavement as recommended by IRC is

- a) group index method
- b) CBR method
- c) Westergaard method
- d) Benkelman beam method

Ans: b

102 The group index for a soil, whose liquid limit is 40 percent, plasticity index is 10 percent and percentage passing 75 micron IS sieve is 35, is

- a) 0
- b) 3
- c) 5
- d) 7

Ans: a

103 Bottom most layer of pavement is known as

- a) wearing course
- b) base course
- c) sub-base course
- d) subgrade

Ans: d

104 Flexible pavement distribute the wheel load a) directly to subgrade

- b) through structural action
- c) through a set of layers to the subgrade
- d) none of the above

Ans: c

105 The number of repetitions, which the pavement thickness designed for a given wheel load should be able to support during the life of pavement is

- a) 1000
- b) 10000
- c) 100000
- d) 1000000

Ans: d

106 Group index method of design of flexible pavement is

- a) a theoretical method
- b) an empirical method based on physical properties of subgrade soil
- c) an empirical method based on strength characteristics of subgrade soil
- d) a semi empirical method

Ans: b

107 Select the correct statement.

- a) More the value of group index, less thickness of pavement will be required.
- b) More the value of CBR, greater thickness of pavement will be required.
- c) Minimum and maximum values of group index can be 0 and 20 respectively.
- d) all of the above

Ans: c

108 If the group index value of subgrade is between 5 and 9, then the subgrade is treated as

- a) good
- b) fair
- c) poor



d) very poor

Ans: c

109 Tyre pressure influences the

a) total depth of pavement

b) quality of surface course

c) both the above

d) none of the above

Ans: b

110 Rigidity factor for a tyre pressure greater than 7 kg/cm<sup>2</sup> is

a) equal to 1

b) less than 1

c) greater than 1

d) zero

Ans: b

111 The critical combination of stresses for corner region in cement concrete roads is

a) load stress + warping stress frictional stress

b) load stress + warping stress + frictional stress

c) load stress + warping stress

d) load stress + frictional stress

Ans: c

112 Tie bars in cement concrete pavements are at

a) expansion joints

b) contraction joints

c) warping joints

d) longitudinal joints

Ans: d

113 The maximum spacing of contraction joints in rigid pavements is

a) 2.5 m

b) 3.5 m

c) 4.5 m

d) 5.5m

Ans: c

114 The maximum thickness of expansion joint in rigid pavements is

a) 0

b) 25 mm

c) 50 mm

d) 100 mm

Ans: b

115 The function of an expansion joint in rigid pavements is to

a) relieve warping stresses

b) relieve shrinkage stresses

c) resist stresses due to expansion

d) allow free expansion

Ans: d

116 The fundamental factor in the selection of pavement type is

- a) climatic condition
- b) type and intensity of traffic
- c) subgrade soil and drainage conditions
- d) availability of funds for the construction project

Ans: b

117 Most suitable material for highway embankments is

- a) granular soil
- b) organic soil
- c) silts
- d) clays

Ans: a

118 Maximum daily traffic capacity of bituminous pavements is

- a) 500 tonnes per day
- b) 1000 tonnes per day
- c) 1500 tonnes per day
- d) 2000 tonnes per day

Ans: c

119 The most suitable equipment for compacting clayey soils is a

- a) smooth wheeled roller
- b) pneumatic tyred roller
- c) sheep foot roller
- d) vibrator

Ans: c

120 The aggregates required for one kilometer length of water bound macadam road per meter width and for 10 mm thickness is

- a) 8 cubic meter
- b) 10 cubic meter
- c) 12 cubic meter
- d) 15 cubic meter

Ans: c

121 The camber of shoulders in water bound macadam roads is

- a) equal to the cross slope of pavement
- b) less than the cross slope of pavement
- c) greater than the cross slope of pavement
- d) zero

Ans: a

122 The binder normally used in flexible pavement construction is

- a) cement
- b) lime
- c) bitumen
- d) none of the above

Ans: c

123 In highway construction, rolling starts from

- a) sides and proceed to centre
- b) centre and proceed to sides
- c) one side and proceed to other side
- d) any of the above

Ans: a

124 For the construction of water bound macadam roads, the correct sequence of operations after spreading coarse aggregates is

- a) dry rolling, wet rolling, application of screening and application of filler
- b) dry rolling, application of filler, wet rolling and application of screening
- c) dry rolling, application of screening, wet rolling and application of filler
- d) dry rolling, application of screening, application of filler and wet rolling

Ans: c

125 In the penetration macadam construction, the bitumen is

- a) sprayed after the aggregates are spread and compacted
- b) premixed with aggregates and then spread
- c) sprayed before the aggregates are spread and compacted
- d) none of the above

Ans: a

126 When the bituminous surfacing is done on already existing black top road or over existing cement concrete road, the type of treatment to be given is

- a) seal coat
- b) tack coat
- c) prime coat
- d) spray of emulsion

Ans: b

127 Which of the following premix methods is used for base course ?

- a) bituminous carpet
- b) mastic asphalt
- c) sheet asphalt
- d) bituminous bound macadam

Ans: d

128. Select the correct statement.

- a) Quantity of binder required for tack coat is less than that required for prime coat.
- b) Prime coat treatment is given for plugging the voids in water bound macadam during bituminous road construction.
- c) Seal coat is the final coat over certain previous bituminous pavements.
- d) A bitumen primer is a high viscosity cutback.

Ans: d

129 The suitable surfacing material for a bridge deck slab is

- a) sheet asphalt
- b) bituminous carpet
- c) mastic asphalt

d) rolled asphalt

Ans: c

130 Which of the following is considered to be the highest quality construction in the group of black top pavements ?

a) mastic asphalt

b) sheet asphalt

c) bituminous carpet

d) bituminous concrete

Ans: d

131 The thickness of bituminous carpet varies from

a) 20 to 25 mm

b) 50 to 75 mm

c) 75 to 100 mm

d) 100 to 120 mm

Ans: a

132 Which of the following represents a carpet of sand-bitumen mix without coarse aggregates ?

a) mastic asphalt

b) sheet asphalt

c) bituminous carpet

d) bituminous concrete

Ans: b

133 In highway construction on super elevated curves, the rolling shall proceed from

a) sides towards the centre

b) centre towards the sides

c) lower edge towards the upper edge

d) upper edge towards the lower edge

Ans: c

134 The camber for hill roads in case of bituminous surfacing is adopted as

a) 2%

b) 2.5%

c) 3%

d) 4%

Ans: b

135 The minimum design speed for hairpin bends in hill roads is taken as

a) 20 kmph

b) 30 kmph

c) 40 kmph

d) 50 kmph

Ans: a

136 The drain which is provided parallel to roadway to intercept and divert the water from hill slopes is known as

a) sloping drain

- b) catchwater drain
  - c) side drain
  - d) cross drain
- Ans: b

137 The walls which are necessary on the hill side of roadway where earth has to be retained from slipping is known as

- a) retaining wall
  - b) breast wall
  - c) parapet wall
  - d) none of the above
- Ans: b

138 In hill roads the side drains are provided

- a) only on the hill side of road
  - b) only on the opposite side of hill
  - c) on both sides of road
  - d) none of the above
- Ans: a

## **DOCKS AND HARBOUR ENGINEERING**

### Question No. 01

Which of the following conditions of loading imposes the greatest load on the foundation in case of dry docks?

- (A) When the dock is empty
- (B) When the dock is empty with the ship of maximum tonnage
- (C) When the dock is full of water
- (D) When the dock is dry and is under construction

Answer: Option C

### Question No. 02

Which of the following structures are constructed parallel to shore line to develop a demarcating line between land area and water area?

- (A) Sea walls, bulk heads and groynes
- (B) Sea walls, bulk heads and revetments
- (C) Sea walls, revetments and groynes
- (D) Bulk heads, revetments and groynes

Answer: Option B

### Question No. 03

In multiple point mooring system, vessel is secured to minimum of

- (A) Two points
- (B) Four points
- (C) Six points
- (D) Eight points

Answer: Option B

Question No. 04

As compared to wall type breakwater, mound type breakwater

- (A) Requires skilled labour
- (B) Requires low maintenance cost
- (C) Requires less material
- (D) Results in less damage due to gradual failure

Answer: Option D

Question No. 05

In a two lane channel, bottom width of channel is given by

- (A) Manoeuvring lane + (2 × Bank clearance lane)
- (B) (2 × Manoeuvring lane) + (2 × Bank clearance lane)
- (C) (2 × Manoeuvring lane) + (2 × Bank clearance lane + ship clearance lane)
- (D) Manoeuvring lane + (2 × Bank clearance lane) + ship clearance lane

Answer: Option C

Question No. 06

In basins subjected to strong winds and tide, the length of the berthing area should not be less than

- (A) The length of design vessel
- (B) The length of design vessel + 10% clearance between adjacent vessels
- (C) The length of design vessel + 20% clearance between adjacent vessels
- (D) Twice the length of design vessel

Answer: Option C

Question No. 07

A ship strikes the berth generally at an angle

- (A) 90° with the face of the dock
- (B) 45° with the face of the dock
- (C) 30° with the face of the dock
- (D) 10° with the face of the dock

Answer: Option D

Question No. 09

The difference in height between highest high water and lowest low water is called

- (A) Mean range
- (B) Maximum range

(C) Maximum rise

(D) Mean rise

Answer: Option B

Question No. 10

When a ship floats at its designed water line, the vertical distance from water line to the bottom of the ship is known as

(A) Beam

(B) Depth

(C) Freeboard

(D) Draft

Answer: Option D

Question No. 11

By increasing the rise of lock-gates,

(i) The length of the lock gate will increase

(ii) Transverse stress due to water pressure on the gate will increase (iii) Compressive force on the gate will increase

Of these statements

(A) (i) and (ii) are correct

(B) (i) and (iii) are correct

(C) Only (ii) is correct

(D) Only (iii) is correct

Answer: Option A

Question No. 12

For designing the dock, the proportion of ship load assumed to be borne by keel blocks is

(A) 5/8

(B) 3/8

(C) 3/16

(D) 5/16

Answer: Option A

Question No. 14

When a wave strikes a vertical breakwater in deep water, it is reflected back and on meeting another advancing wave of similar amplitude merges and rises vertically in a wall of water. This phenomenon is called

(A) Surf

(B) Clapotis

(C) Fetch

(D) Swell

Answer: Option B

Question No. 15

Select the incorrect statement.

- (A) The progress of work in low level method of mound construction is very slow
- (B) Barge method of mound construction is economical
- (C) In low level method of mound construction, the area of working is limited
- (D) In staging method of mound construction, the work is not interrupted even during stormy weather

Answer: Option B

Question No. 16

Pick up the correct statement from the following:

- (A) The regular periodic rise and fall of the surface of the sea, is called tide
- (B) The average difference in water level between high tide and low tide at a place, is called tidal range
- (C) The movement of water caused by the action of tide, is called a tidal current
- (D) all of the above

Answer: Option D

Question No. 17

The significant wave height is defined as the average height of the

- (A) One-third highest waves
- (B) One-fourth highest waves
- (C) One-fifth highest waves
- (D) One-tenth highest waves

Answer: Option A

Question No. 18

The fixed mooring does not require

- (A) Mooring post
- (B) Bollard
- (C) Anchors
- (D) Capstan

Answer: Option C

Question No. 19

A ship is berthed in a chamber and lifted by principles of buoyancy, such a chamber is called.

- (A) Dry dock
- (B) Wet dock
- (C) Floating dock



(D) Refuge dock

Answer: Option C

Question No. 20

Due to the impact of water wave on a sea shore structure

- (A) Hydrostatic pressure coupled with a strong momentary impact is caused
- (B) Vibrations are subjected
- (C) Internal pressure is developed
- (D) All of the above

Answer: Option D

Question No. 21

Assertion A: Intervention of undulations in the sea bed reduces the depth of wave at the section.

Reason R: No wave can have a height greater than the depth of water through which it passes

Select your answer based on the coding system given below:

- (A) Both A and R is true and R is correct explanation of A
- (B) Both A and R is true but R is not the correct explanation of A
- (C) A is true but R is false
- (D) A is false but R is true

Answer: Option A

Question No. 22

Surf zone is:

- (A) The fathom line of 10 m depth
- (B) The fathom line of 5 m depth
- (C) The swell of the sea breaking on the shore or reefs
- (D) The coast line attacked by the waves

Answer: Option C

Question No. 23

Assertion A: Basin walls have to be of much greater height than dock walls.

Reason R: Tidal basins are subject to fluctuations of levels due to tidal variations

Select your answer based on the coding system given below:

- (A) Both A and R is true and R is the correct explanation of A
- (B) Both A and R is true but R is not correct explanation of A
- (C) A is true but R is false
- (D) A is false but R is true

Answer: Option A

Question No. 24

Pick up the correct statement from the following:

- (A) A harbour without any port complex, is called a refuge harbour
- (B) A harbour used for fishery, is called fishery harbour
- (C) The terminal building of a commercial harbour consists of an administrative block, customs clearance and ware-houses
- (D) All the above

Answer: Option D

Question No. 25

Which of the following structures protects the shore by trapping of littoral drift?

- (A) Groynes
- (B) Sea walls
- (C) Revetments
- (D) Moles

Answer: Option A

Question No. 27

The minimum diameter of turning basin, where ships turn by going ahead and without tug assistance should be

- (A) L
- (B) 1.5 L
- (C) 2.0 L
- (D) 4.0 L

L is the length of the ship

Answer: Option D

Question No. 28

Pick up the correct statement from the following:

- (A) The maritime structures should be designed to withstand wave motion of air
- (B) The wind vortex results in conical depression in the air surface
- (C) A tube of air rotating at hundreds of kilometres per hour forms a tornado
- (D) all of the above

Answer: Option D

Question No. 29

At a given port, the fetch is 400 nautical miles, the maximum height of storm wave will be

- (A) 2.073 m
- (B) 8.169 m
- (C) 9.144 m
- (D) 6.8 m

Answer: Option C

Question No. 30

Pick up the correct statement from the following:

- (A) Spring tides are caused at new and full moon
- (B) Neap tides are caused when the moon is in her quarters
- (C) Spring tides are roughly twice the height of neap tides
- (D) All of the above

Answer: Option D

Question No. 31

Which of the following is a fixed type mooring accessory?

- (A) Bollard
- (B) Buoys
- (C) Cables
- (D) Anchors

Answer: Option A

Question No. 32

According to the recommendations of International Navigational Congress in 1912, the ratio of length to width at the entrance for cargo vessels is

- (A) 5.5 and 6.0 to 1
- (B) 6.2 and 6.8 to 1
- (C) 7.4 and 7.8 to 1
- (D) 8.2 and 8.5 to 1

Answer: Option C

Question No. 33

Consider the following statements.

- (i) Fender is the cushion provided on the face of the jetty for ships to come in contact,
  - (ii) Slip is the space of water area between two adjacent piers where ships are berthed,
  - (iii) Pier head is a structure constructed near the tip of break water near the harbour entrance.
- Of the statements

- (A) (i) and (ii) are correct
- (B) (ii) and (iii) are correct
- (C) (i) and (iii) are correct
- (D) (i), (ii) and (iii) are correct

Answer: Option D

Question No. 34

Pick up the correct statement from the following:

- (A) For nautical purposes, low water level is generally referred to by the navigators
- (B) The depth of the bed of the sea from the surface of water is called sounding
- (C) The contour lines on the bed of a water body are called fathoms
- (D) All the above

Answer: Option D

Question No. 35

The maximum harbour depth below lowest low water is generally equal to

- (i) Loaded draft +1.2 m when bottom is rock
- (ii) Loaded draft +1.8 m when bottom is soft
- (iii) Loaded draft +1.2 m when bottom is soft
- (iv) Loaded draft +1.8 m when bottom is rock

Of these statements

- (A) (i) and (ii) are correct
- (B) (i) and (iii) are correct
- (C) (ii) and (iv) are correct
- (D) (iii) and (iv) are correct

Answer: Option D

Question No. 38

Which one of the following statements is correct?

- (A) The soundings are made with respect to the mean low water
- (B) The soundings which are below the datum are written in black on the map
- (C) The spot heights of the features above datum are written in red on the map
- (D) All the above

Answer: Option D

Question No. 39

Which of the following are repair docks?

- (A) Marine railways, dry docks, floating docks, wet docks
- (B) Dry docks, wet docks, floating docks, lift docks
- (C) Wet docks, floating docks, lift docks, marine railways
- (D) Wet docks, lift docks, marine railways, dry docks

Answer: Option C

Question No. 40

The smoothed surface of the front face of the quay walls, is known as fending which is made of

- (A) Granite stone
- (B) Timber
- (C) Steel
- (D) All the above

Answer: Option D

Question No. 41

Assertion A: Depth and width required at the entrance to a harbour are more than those required in the channel.

Reason R: The entrance to a harbour is usually more exposed to waves as compared to the harbour itself.

Select your answer based on the coding system given below:

- (A) Both A and R is true and R is the correct explanation of A
- (B) Both A and R is true but R is not the correct explanation of A
- (C) A is true but R is false
- (D) A is false but R is true

Answer: Option A

Question No. 42

Pick up the incorrect statement from the following: In a dry dock block made of hard wood,

- (A) Spacing of the blocks is 1.35 m
- (B) The lowest block is 1.8 m long 40 cm × 40 cm in cross-section
- (C) The middle block is 1.6 m long 40 cm × 40 cm in cross-section
- (D) None of these

Answer: Option D

Question No. 43

Which one of the following lines is used for tying a ship with a dock?

- (A) Bow line
- (B) Stern line
- (C) Spring line
- (D) All of these

Answer: Option D

Question No. 44

In a wet dock system,

- (A) Minimum required depth of water for the vessels is maintained
- (B) Entrance locks are provided with massive gates

(C) The cost of construction is quite heavy

(D) All the above

Answer: Option D

Question No. 45

Assertion A: Marine structures are made specially bulky and strong.

Reason R: Sea insects result in undermining of the hardest and the soundest building material

Select your answer based on the coding system given below:

(A) Both A and R is true and R is the correct explanation of

A (B) Both A and R is true but R is not the correct

explanation of A (C) A is true but R is false

(D) A is false but R is true

Answer: Option A

Question No. 47

A dock:

(A) Is a marine structure for berthing of vessels for loading and unloading cargo and passengers

(B) Is provided with a dock gate

(C) Is provided with an arrangement to pump out water when required

(D) All the above

Answer: Option D

Question No. 48

Which of the following type of sea walls results in greatest protection of shore structures?

(A) Vertical sea wall

(B) Sea wall with batter

(C) Stepped sea wall

(D) Sea wall with concave face

Answer: Option D

Question No. 49

Pick up the correct statement from the following:

(A) An artificial barrier which makes the enclosed area safe for anchorage of ships, is known as break water

(B) The break water whose inside is used as a platform for loading and unloading is called a mole

(C) The length of the quay wall is governed by the length of the largest vessel likely to be berthed

(D) All the above

Answer: Option D

Question No. 50

If the maximum spring rise is 2 m and height of the waves expected is 4 m , then the breakwater height above the datum will be

- (A) 2.5 m
- (B) 4 m
- (C) 5 m
- (D) 7 m

Answer: Option D

Question No. 52

Pick up the correct statement function following:

- (A) The coarse material which has a smaller angle of repose, causes a steeper beach slope
- (B) The coarse material which has a greater angle of repose, causes a steeper beach slope
- (C) The flattening out of the beach is caused due to the movement of small and uniform particles leeward
- (D) Both (b) and (c)

Answer: Option D

Question No. 53

Consider the following statements in regard to Beaufort scale for wind speeds,

- (i) The Beaufort number ranges from 1 to 12.
  - (ii) Higher Beaufort number indicates higher speed of wind,
  - (iii) Beaufort number for calm is smallest and for hurricane is highest
- Of these statements

- (A) (i) and (ii) are correct
- (B) (ii) and (iii) are correct
- (C) (i) and (iii) are correct
- (D) (i), (ii) and (iii) are correct

Answer: Option B

Question No. 54

The shore line survey includes:

- (A) Depicting the shore line
- (B) Depicting the prominent details on shore line
- (C) Depicting the high water line
- (D) All the above

Answer: Option D

Question No. 55

A harbour is a place where

- (A) Ships get shelter and protection against destructive forces due to sea waves
- (B) Facilities are provided for receiving cargo and passengers
- (C) Port buildings are constructed for commercial purposes
- (D) All of the above

Answer: Option D

Question No. 57

Assertion A: Large size stones are required in stone revetment in shore protection.

Reason R: Resistance of stone to wave force is proportional to its volume and wave force is proportional to the exposed area of the stone.

Select your answer based on the coding system given below.

- (A) Both A and R is true and R is the correct explanation of A
- (B) Both A and R is true but R is not a correct explanation of A
- (C) A is true but R is false
- (D) A is false but R is true

Answer: Option A

Question No. 58

A roadstead:

- (A) Is a protected area of water where boats can move safely
- (B) Is the end of the road at the harbour
- (C) May be protected by break water walls
- (D) None of these

Answer: Option A

Question No. 59

In tropical regions,

- (A) The surface gets heated more effectively than the arctic areas
- (B) After heating, the air becomes lighter and is displaced by cool air from the polar regions
- (C) The rising tropical air flows towards the polar region in the upper strata
- (D) All of the above

Answer: Option D

Question No. 60

Buoys which support the cables to which vessels are attached are of

- (A) Cylindrical shape
- (B) Pear shaped
- (C) Spherical shape
- (D) All of these

Answer: Option D



Question No. 65

Dead weight tonnage of a ship

- (i) Varies with latitude and season
- (ii) Is more than displacement tonnage
- (iii) Is the difference between displacement load and displacement light

Of these statements

- (A) i) and ii) are correct
- (B) ii) and iii) are correct
- (C) i) and iii) are correct
- (D) Only iii) is correct

Answer: Option C

Question No. 67

The width of the entrances of the harbours is restricted to

- (A) 100 m
- (B) 125 m
- (C) 150 m
- (D) 180 m

Answer: Option D

Question No. 69

If  $H$  is the height of the wave expected, then the height of the breakwater is generally taken as

- (A)  $1.2 H$  to  $1.25 H$  above the datum
- (B)  $1.2 H$  to  $1.25 H$  above the low water level
- (C)  $1.2 H$  to  $1.25 H$  above the high water level
- (D)  $1.2 H$  to  $1.25 H$  above the mean sea level

Answer: Option C

Question No. 70

Littoral drift

- (A) Is the raised line of sand, parallel to the sea coast
- (B) Is the slow movement of surface water at sea caused by the wind
- (C) Is a current parallel to the shore, caused due to tangential component of the wind
- (D) Is a current perpendicular to the shore line caused due to wind

Answer: Option C

Question No. 71

Which one of the following statements is not relevant to hydrographic survey?

- (A) Establishment of a chain of bench marks near the shore line
- (B) Establishment of horizontal control points on the shore

(C) Determination of the sea bed profile

(D) None of these

Answer: Option D

Question No. 72

Pick up the correct statement from the following:

(A) The breakwater which can be used as a platform for loading and unloading of cargo is called a mole

(B) The brick masonry retaining wall which is used for loading and unloading of cargo is called quay wall

(C) Three types of break waters are generally provided in harbours

(D) All of the above

Answer: Option D

Question No. 73

Pick up the correct statement from the following:

(A) The Mediterranean Sea is considered to be a huge harbour

(B) The Caspian Sea is considered to be a big harbour

(C) The Red sea is considered to be harbour

(D) None of the above

Answer: Option A

Question No. 74

For large vessels, the buoys are strengthened by connecting it to a number of anchors having

(A) One legged mooring

(B) Two legged mooring

(C) Three legged mooring

(D) All the types as above

Answer: Option D

Question No. 75

Flow of air from one place to the other is caused due to

(A) The sum of elevation

(B) Pressure head

(C) Velocity head

(D) All of the above

Answer: Option D

Question No. 76

A lead line or sounding line

(A) Is stretched thoroughly when wet before it is graduated

(B) Should be soaked in water for about one hour prior to taking soundings

(C) Is adjusted at regular interval

(D) All the above

Answer: Option D

## **STRUCTURAL ENGINEERING**

### **DESIGN OF STEEL STRUCTURES**

1. The heaviest I-section for same depth is

- a) ISMB
- b) ISLB
- c) ISHB
- d) ISWB

Ans: c

2. Bending compressive and tensile stresses respectively are calculated based on

- a) net area and gross area
- b) gross area and net area
- c) net area in both cases
- d) gross area in both cases

Ans: b

3. If the thickness of thinnest outside plate is 10 mm, then the maximum pitch of rivets in tension will be taken as

- a) 120 mm
- b) 160 mm
- c) 200 mm
- d) 300 mm

Ans: b

4. In a gusseted base, when the end of the column is machined for complete bearing on the base plate, then the axial load is assumed to be transferred to base plate

- a) fully by direct bearing
- b) fully through fastenings
- c) 50% by direct bearing and 50% through fastenings
- d) 75% by direct bearing and 25% through fastenings

Ans: c

5. When the axis of load lies in the plane of rivet group, then the rivets are subjected to

- a) only shear stresses
- b) only tensile stresses
- c) both (a) and (b)
- d) none of the above

Ans: a

6. When the axis of load lies in the plane of rivet group, then the most heavily loaded rivet will be the one which

- a) is at the maximum distance from CG of the rivet group
- b) is at the minimum distance from CG of the rivet group
- c) gives the maximum angle between the two forces  $F_a$  and  $F_m$
- d) gives the minimum angle between the two forces  $F_a$  and  $F_m$

where,  $F_a$  is the load shared by each rivet due to axial load and  $F_m$  is the shearing load due to moment in any rivet.

Ans: d

7. Which of the following types of riveted joint is free from bending stresses ?

- a) lap joint
- b) butt joint with single cover plate
- c) butt joint with double cover plates
- d) none of the above

Ans: c

8. The difference between gross diameter and nominal diameter for the rivets up to 25 mm

diameter is

- a) 1.0 mm
- b) 1.5 mm
- c) 2.0 mm
- d) 2.5 mm

Ans: b

9. As compared to field rivets, the shop rivets are

- a) stronger
- b) weaker
- c) equally strong
- d) any of the above

Ans: a

10. If the thickness of plate to be connected by a rivet is 16 mm, then suitable size of rivet as per Unwin's formula will be

- a) 16 mm
- b) 20 mm
- c) 24 mm
- d) 27 mm

Ans: c

11. By providing sufficient edge distance, which of the following failures of riveted joint can be avoided ?

- a) tension failure of the plate
- b) shear failure of the rivet
- c) shear failure of the plate
- d) crushing failure of the rivet

Ans: c

12. Minimum pitch of the rivets shall not be less than

- a) 1.5 d
- b) 2.0 d
- c) 2.5 d
- d) 3.0 d

where d is gross diameter of rivet

Ans: c

13. Efficiency of a riveted joint, having the minimum pitch as per IS : 800, is

- a) 40%
- b) 50%
- c) 60%
- d) 70%

Ans: c

14. Select the correct statement

- a) Material cost of a rivet is higher than that of a bolt.
- b) Tensile strength of a bolt is lesser than that of a rivet.
- c) Bolts are used as a temporary fastenings whereas rivets are used as permanent fastenings.
- d) Riveting is less noisy than bolting.

Ans: c

15. Bolts are most suitable to carry

- a) shear
- b) bending
- c) axial tension
- d) shear and bending

Ans: c

16. Diameter of a bolt hole is usually taken as

- a) gross diameter of bolt
- b) nominal diameter + 1.5 mm
- c) nominal diameter + 2.0 mm
- d) nominal diameter of bolt

Ans: b

17. When the bolts are subjected to reversal of stresses, the most suitable type of bolt is

- a) black bolt
  - b) ordinary unfinished bolt
  - c) turned and fitted bolt
  - d) high strength bolt
- Ans: d

18. In the cross-section of a weld, throat is the

- a) minimum dimension
- b) average dimension
- c) maximum dimension
- d) none of the above

Ans: a

19. The effective length of a fillet weld should not be less than

- a) two times the weld size
- b) four times the weld size
- c) six times the weld size
- d) weld size

Ans: b

20. For a standard  $45^\circ$  fillet, the ratio of size of fillet to throat thickness is

- a) 1:1
- b) 1 :  $\sqrt{2}$
- c)  $\sqrt{2}$  : 1
- d) 2: 1

Ans: c

21. A butt weld is specified by

- a) effective throat thickness
- b) plate thickness
- c) size of weld
- d) penetration thickness

Ans: a

22. The actual thickness of butt weld as compared to the thickness of plate is usually

- a) more
- b) less
- c) equal
- d) none of the above

Ans: a

23. According to IS Specifications, the maximum pitch of rivets in compression is

- a) lesser of 200 mm and  $12t$
  - b) lesser of 200 mm and  $16t$
  - c) lesser of 300 mm and  $32t$
  - d) lesser of 300 mm and  $24t$
- where  $t$  is thickness of thinnest outside plate or angle

Ans: a

24. A circular column section is generally not used in actual practice because

- a) it is uneconomical
- b) it cannot carry the load safely
- c) it is difficult to connect beams to the round sections
- d) all of the above

Ans: c

25. The slenderness ratio of a column supported throughout its length by a masonry wall is

- a) zero
- b) 10
- c) 100
- d) infinity

Ans: a

26. According to IS Specifications, the effective length of a column effectively held in position at both ends and restrained in direction at one end is taken as

- a)  $0.67L$
- b)  $0.8L$
- c)  $L$

d) 1.5 L  
Ans: b

27. The effective length of a battened strut effectively held in position at both ends but not restrained in direction is taken as

- a) 1.8 L
  - b) L
  - c) 1.1 L
  - d) 1.5 L
- Ans: c

28. The maximum slenderness ratio of a compression member carrying both dead and superimposed load is

- a) 180
  - b) 200
  - c) 250
  - d) 350
- Ans: a

29. The maximum slenderness ratio of a steel column, the design of which is governed by wind or seismic forces is

- a) 150
  - b) 180
  - c) 250
  - d) 350
- Ans: c

30. According to IS:800, in the Merchant Rankine formula the value of imperfection index (n) is

- a) 1.0
  - b) 1.4
  - c) 1.8
  - d) 2.0
- Ans: b

31. The best arrangement to provide unified behaviour in built up steel columns is by

- a) lacing
  - b) battening
  - c) tie plates
  - d) perforated cover plates
- Ans: a

32. If the 20 mm rivets are used in lacing bars, then the minimum width of lacing bar should be

- a) 40mm
  - b) 60mm
  - c) 80mm
  - d) 100mm
- Ans: b

33. The use of tie plates in laced columns is

- a) prohibited
  - b) not prohibited
  - c) permitted at start and end of lacing system only
  - d) permitted between two parts of the lacing
- Ans: c

34. Lacing bars in a steel column should be designed to resist

- a) bending moment due to 2.5% of the column load
  - b) shear force due to 2.5% of the column load
  - c) 2.5% of the column load
  - d) both (a) and (b)
- Ans: b

35. Angle of inclination of the lacing bar with the longitudinal axis of the column should preferably be between

- a) 10° to 30°
- b) 30° to 40°

- c)  $40^\circ$  to  $70^\circ$
- d)  $90^\circ$

Ans: c

36. Battening is preferable when the

- i) column carries axial load only
- ii) space between the two main components is not very large
- iii) column is eccentrically loaded

The correct answer is

- a) only (i)
- b) only (iii)
- c) (i) and (ii)
- d) (ii) and (iii)

Ans: c

37. The effective length of a battened column is increased by

- a) 5%
- b) 10%
- c) 15%
- d) 20%

Ans: b

38. The overlap of batten plates with the main members in welded connections should be more than

- a)  $3t$
- b)  $4t$
- c)  $6t$
- d)  $8t$

where  $t$  = thickness of the batten plate

Ans: b

39. The slenderness ratio of lacing bars should not exceed

- a) 100
- b) 120
- c) 145
- d) 180

Ans: c

40. Economical depth of a plate girder corresponds to

- a) minimum weight
- b) minimum depth
- c) maximum weight
- d) minimum thickness of web

Ans: a

41. Shear buckling of web in a plate girder is prevented by using

- a) vertical intermediate stiffener
- b) horizontal stiffener at neutral axis
- c) bearing stiffener
- d) none of the above

Ans: a

42. Horizontal stiffener in a plate girder is provided to safeguard against

- a) shear buckling of web plate
- b) compression buckling of web plate
- c) yielding
- d) all of the above

Ans: b

43. Minimum thickness of web in a plate girder, when the plate is accessible and also exposed to weather, is

- a) 5 mm
- b) 6 mm
- c) 8 mm
- d) 10 mm

Ans: b

44. The web crippling due to excessive bearing stress can be avoided by

- a) increasing the web thickness
- b) providing suitable stiffeners
- c) increasing the length of the bearing plates
- d) none of the above

Ans: c

45. As per IS : 800, for compression flange, the outstand of flange plates should not exceed

- a) 12t
- b) 16t
- c) 20t
- d) 25t

where t = thickness of thinnest flange plate

Ans: b

46. Intermediate vertical stiffeners in a plate girder need be provided if the depth of web exceeds

- a) 50t
- b) 85t
- c) 200t
- d) 250t

where t is thickness of web

Ans: b

47. Bearing stiffener in a plate girder is used to

- a) transfer the load from the top flange to the bottom one
- b) prevent buckling of web
- c) decrease the effective depth of web
- d) prevent excessive deflection

Ans: b

48. The forces acting on the web splice of a plate girder are

- a) axial forces
- b) shear and axial forces
- c) shear and bending forces
- d) axial and bending forces

Ans: c

49. Gantry girders are designed to resist

- a) lateral loads
- b) longitudinal loads and vertical loads
- c) lateral, longitudinal and vertical loads
- d) lateral and longitudinal loads

Ans: c

50. Minimum spacing of vertical stiffeners is limited to

- a)  $d/4$
- b)  $d/3$
- c)  $d/2$
- d)  $2d/3$

where d is the distance between flange angles

Ans: b

51. Bearing stiffeners are provided at

- i) the supports
  - ii) the mid span
  - iii) the point of application of concentrated loads
- The correct answer is
- a) only (i)
  - b) both (i) and (ii)
  - c) both (i) and (iii)
  - d) (i), (ii) and (iii)

Ans: c

52. Rivets connecting flange angles to cover plates in a plate girder are subjected to

- a) horizontal shear only
- b) vertical load only
- c) both (a) and (b)
- d) none of the above

Ans: a



53. The maximum spacing of vertical stiffeners is

- a) 1.33 d
- b) 1.25 d
- c) 1.5 d
- d) 1.75 d

where d is the distance between flange angles

Ans: c

54. The range of economical spacing of trusses varies from

- a)  $L/3$  to  $L/5$
- b)  $L/4$  to  $2L/5$
- c)  $L/3$  to  $L/2$
- d)  $2L/5$  to  $3L/5$  where L is span

Ans: a

55. The maximum permissible span of asbestos cement sheets is

- a) 650 mm
- b) 810 mm
- c) 1250 mm
- d) 1680 mm

Ans: d

56. Normally, the angle of roof truss with asbestos sheets should not be less than

- a)  $26\frac{1}{2}^\circ$
- b)  $30^\circ$
- c)  $35^\circ$
- d)  $40^\circ$

Ans: b

57. To minimize the total cost of a roof truss, the ratio of the cost of truss to the cost of purlins shall be

- a) 1
- b) 2
- c) 3
- d) 4

Ans: b

58. Generally the purlins are placed at the panel points so as to avoid

- a) axial force in rafter
- b) shear force in rafter
- c) deflection of rafter
- d) bending moment in rafter

Ans: d

59. For the buildings having a low permeability, the internal wind pressure acting normal to the wall and roof surfaces is taken as

- a) zero
- b)  $\pm 0.2p$
- c)  $\pm 0.5 p$
- d)  $\pm 0.7p$

where p is basic wind pressure

Ans: b

60. The relation between intensity of wind pressure p and velocity of wind V is taken as

- a)  $p \propto V$
- b)  $p \propto V^2$
- c)  $p \propto (1/V)$
- d)  $p \propto V^2$

Ans: b

61. The live load for a sloping roof with slope  $15^\circ$ , where access is not provided to roof, is taken as

- a) 0.65 kN/m<sup>2</sup>
- b) 0.75 kN/m<sup>2</sup>
- c) 1.35 kN/m<sup>2</sup>

d) 1.50 kN/m<sup>2</sup>

Ans: a

62. The internal pressure coefficient on walls for buildings with large permeability is taken as

a)  $\pm 0.2$

b)  $\pm 0.5$

c)  $\pm 0.7$

d) 0

Ans: c

63. The basic wind speed is specified at a height 'h' above mean ground level in an open terrain. The value of 'h' is

a) 10 m

b) 20 m

c) 25 m

d) 50 m

Ans: a

64. The risk coefficient k, depends on

a) mean probable design life of structures

b) basic wind speed

c) both (a) and (b)

d) none of the above

Ans: c

65. The external wind pressure acting on a roof depends on

a) degree of permeability of roof

b) slope of roof

c) both (a) and (b)

d) none of the above

Ans: b

66. Area of openings for buildings of large permeability is more than

a) 10% of wall area

b) 20% of wall area

c) 30% of wall area

d) 50% of wall area

Ans: b

67. As per IS : 875, for the purposes of specifying basic wind velocity, the country has been divided into

a) 4 zones

b) 5 zones

c) 6 zones

d) 7 zones

Ans: c

68. The number of seismic zones in which the country has been divided are

a) 3

b) 5

c) 6

d) 7

Ans: b

69. Minimum pitch provided in riveted steel tanks is

a) 1.5 d

b) 2.0 d

c) 2.5 d

d) 3.0 d

where d is diameter of rivets

Ans: d

70. The allowable tensile stress in structural mild steel plates for steel tank is assumed as

a) 95.0 MPa on net area

b) 105.5 MPa on net area

c) 105.5 MPa on gross area

d) 150.0 MPa on gross area

Ans: b

71. Steel tanks are mainly designed for

- a) weight of tank
- b) wind pressure
- c) water pressure
- d) earthquake forces

Ans: c

72. Which of the following sections should preferably be used at places where torsion occurs ?

- a) angle section
- b) channel section
- c) box type section
- d) any of the above

Ans: c

73. The capacity of the smallest pressed steel tank is

- a) 1000 litre
- b) 1650 litre
- c) 1950 litre
- d) 2450 litre

Ans: c

74. The bracing between two columns of a steel tank will be designed to resist

- a) horizontal shear due to wind or earthquake only
- b) horizontal, shear due to wind or earthquake + 2.5% of column loads
- c) column loads + 2.5% of horizontal shear due to wind or earthquake
- d) column loads + full horizontal shear due to wind or earthquake

Ans: b

75. The minimum thickness of plates in a steel stack should be

- a) 4 mm
- b) 5 mm
- c) 6 mm
- d) 8 mm

Ans: c

76. Maximum pitch of rivets, used in steel stacks, is limited to

- a)  $6t$
- b) 10t
- c) 12t
- d) 16t

where  $t$  is thickness of thinner plate being connected

Ans: b

77. The diameter of base of conical flare of a steel stack is

- a) less than  $d$
- b) equal to  $d$
- c) more than  $d$
- d) any of the above

where  $d$  is the diameter of the cylindrical part

Ans: c

78. Hudson's formula gives the dead weight of a truss bridge as a function of

- a) bottom chord area
- b) top chord area
- c) effective span of bridge
- d) heaviest axle load of engine

Ans: a

79. If the loaded length of span in meters of a railway steel bridge carrying a single track is 6 m, then impact factor is taken as

- a) 0
- b) 0.5
- c) between 0.5 and 1.0
- d) 1.0

Ans: c

80. If the floor is supported at or near the bottom but top chords of a bridge are not braced, then the bridge is called

- a) deck type
- b) through type
- c) half through type
- d) double deck type

Ans: c

81. The centrifugal force due to curvature of track is assumed to act on the bridge at a height of

- a) 1.23 m above the rail level
- b) 1.50 m above the rail level
- c) 1.83 m above the rail level
- d) 2.13 m above the rail level

Ans: c

82. The effect of racking forces is considered in the design of

- i) lateral braces
- ii) chord members

The correct answer is

- a) only (i)
- b) only (ii)
- c) both (i) and (ii)
- d) none of the above

Ans: a

83. The portal bracing in a truss bridge is used to

- a) transfer load from top of end posts to bearings
- b) keep the rectangular shape of the bridge cross-section
- c) stiffen the structure laterally
- d) prevent the sidesway buckling of top chord

Ans: a

84. The sway bracing is designed to transfer

- a) 2V<sub>i</sub> % of the top panel wind load to bottom bracing
- b) 10% of the top panel wind load to bottom bracing
- c) 25% of the top panel wind load to bottom bracing
- d) 50% of the top panel wind load to bottom bracing

Ans: d

85. Study the following statements.

- i) Top lateral bracing prevents the sidesway buckling of the chord.
- ii) Sway bracing keeps the rectangular shape of the bridge cross-section.
- iii) Sway bracing transfers the load from top of end posts to bearings.

The correct answer is

- a) only (i)
- b) both (i) and (ii)
- c) both (i) and (iii)
- d) all (i), (ii) and (iii)

Ans: b

86. The bracing provided in the plane of end posts is called

- a) sway bracing
- b) portal bracing
- c) top lateral bracing
- d) bottom lateral bracing

Ans: b

87. compression force in two end posts The pin of a rocker bearing in a bridge is designed for

- a) bearing and shear
- b) bending and shear
- c) bearing and bending
- d) bearing, shear and bending

Ans: d

88. The least dimension in case of a circular column of diameter D is taken as

- a) 0.5 D
- b) 0.68 D

- c) 0.88 D
  - d) D
- Ans: c

89. In case of timber structures, the form factor for solid circular cross-section is taken as

- a) 1.18
- b) 1.414
- c) 1.67
- d) 1.81

Ans: a

90. In case of timber structures, the simple bending formula  $M = fz$  may be applied for

- a) rectangular beams up to 300 mm depth
- b) all rectangular beams
- c) solid circular beams only
- d) all square cross-section beams

Ans: a

91. The elastic strain for steel is about

- a) 1/12 of strain at the initiation of strain hardening and about 1/120 of maximum strain
- b) 1/2 of strain at the initiation of strain hardening and about 1/12 of maximum strain
- c) 1/12 of strain at the initiation of strain hardening and 1/200 of maximum strain
- d) 1/24 of strain at the initiation of strain hardening and about 1/200 of maximum strain

Ans: c

92. The mechanism method and the statical method give

- a) lower and upper bounds respectively on the strength of structure
- b) upper and lower bounds respectively on the strength of structure
- c) lower bound on the strength of structure
- d) upper bound on the strength of structure

Ans: b

93. The moment-curvature relation at a plastic hinge is

- a) linear
- b) parabolic
- c) constant moment for all curvatures
- d) constant curvature for all moments

Ans: c

94. Shape factor is a property which depends

- a) only on the ultimate stress of the material
- b) only on the yield stress of the material
- c) only on the geometry of the section
- d) both on the yield stress and ultimate stress of material

Ans: c

95. The statical method of plastic analysis satisfies

- a) equilibrium and mechanism conditions
- b) equilibrium and plastic moment conditions
- c) mechanism and plastic moment conditions
- d) equilibrium condition only

Ans: b

96. The mechanism method of plastic analysis satisfies

- a) equilibrium and mechanism conditions
- b) equilibrium and plastic moment conditions
- c) mechanism and plastic moment conditions
- d) equilibrium condition only

Ans: a

97. Load factor is

- a) always equal to factor of safety
- b) always less than factor of safety
- c) always greater than factor of safety
- d) sometimes greater than factor of safety

Ans: c

98. The ratio of plastic section modulus to elastic section modulus

- a) is equal to 1
- b) is always less than 1
- c) is always greater than 1
- d) can be less than 1

Ans: c

99. Other conditions being same, the load factor in indeterminate structures is

- a) equal to load factor in determinate structures
- b) more than the load factor in determinate structures
- c) less than the load factor in determinate structures
- d) unpredictable

Ans: b

100. Which of the following conditions is to be satisfied both in elastic and plastic analysis ?

- a) equilibrium condition
- b) yield condition
- c) plastic moment condition
- d) mechanism condition

Ans: a

101. In the virtual work method, the virtual quantity is

- a) displacement
- b) load
- c) slope
- d) moment

Ans: a

102. As per IS:800, in the plastic design, which of the following pairs are correctly matched?

Working Loads Load factor

- (i) Dead load 1.7
- (ii) Dead Load + imposed load 1.7
- (iii) Dead load + load due to wind or 1.3 seismic forces
- (iv) Dead load + imposed load + load 1.7 due to wind or seismic forces

Of these statements

- a) (i) and (ii) are correct
- b) (i), (ii) and (iii) are correct
- c) (ii) and (iii) are correct
- d) only (i) is correct

Ans: a

103. The shape factor of an isosceles triangle for bending about the axis parallel to the base is:

- a) 1.5
- b) 1.7
- c) 2.0
- d) 2.34

Ans: d

104. In case of plastic design, the calculated maximum shear capacity of a beam as per IS:800 shall be

- a)  $0.55 A_w f_y$
- b)  $0.65 A_w f_y$
- c)  $0.75 A_w f_y$
- d)  $0.85 A_w f_y$

where,  $A_w$  = effective cross-sectional area resisting shear  $f_y$  = yield stress of the steel

Ans: a

105. The minimum thickness of a steel plate, which is directly exposed to weather and is not accessible for cleaning and repainting, should be:

- a) 4.5 mm
- b) 6 mm
- c) 8 mm
- d) 10 mm

Ans: c

106. The moment of inertia of the pair of vertical stiffeners about the center line of the web should not be less than.

- a)  $1.5dV/C$
- b)  $1.5d\cancel{V}/C$
- c)  $1.5d\cancel{V}/C^2$
- d)  $1.5dY/C^3$

where, 't' is the minimum required thick-ness of the web and 'C' is the maximum permitted clear distance between vertical stiffener for thickness 't'.

Ans: c

107. The connection of intermediate vertical stiffeners to the web, not subjected to external loads, shall be designed for a minimum shear force (kN/m) of

- a)  $75 t^2/h$
- b)  $125 t^3/h^2$
- c)  $125 t^2/h$
- d)  $175 t^2/h$

where, t = the web thickness in mm

h = the outstand of stiffener in mm

Ans: c

108. For a compression member with double angle section, which of the following section will give larger value of minimum radius of gyration?

- a) equal angles back to back
- b) unqual legged angles with long legs back to back
- c) unequal legged angles with short legs back to back
- d) both (b) or (c)

Ans: b

109. Lug angles

- a) are used to reduce the length of connection.
- b) are unequal angles.
- c) increases shear lag.
- d) all the above

Ans: a

110. For rivets in tension with counter-sunk heads, the tensile value shall be

- a) reduced by 25 %
- b) reduced by 33.3%
- c) increased by 25 %
- d) increased by 33.3 %

Ans: b

111. A steel beam supporting loads from the floor slab as well as from wall is termed as

- a) stringer beam
- b) lintel beam
- c) spandrel beam
- d) header beam

Ans: c

112. Pitch of tacking rivets, when double angles connected back to back and acting as tension members should not be more than

- a) 500 mm
- b) 600 mm
- c) 1000 mm
- d) 300 mm

Ans: c

113. In moment resistant connections, the moment resistance of riveted connection depends upon

- a) shear in rivets
- b) compression in rivets
- c) tension in rivets
- d) strength of rivets in bearing

Ans: c

114. The allowable shear stress in the web of mild steel beams decreases with

- a) decrease in h/t ratio
- b) increase in h/t ratio
- c) decrease in thickness
- d) increase in height

where 'h' is height and t is thickness

Ans: b

### Notes:

1. What is structural steel design?

Structural steel design, is an area of knowledge of structural engineering used to design steel structures. The structures can range from schools to homes to bridges. ... The second is the Load and Resistance Factor Design (LRFD) method.

2. What are the mechanical properties of structural steel?

Resistance to deformation based upon:

Material.

Length.

X-section.

3. Explain the design process of structural steel?

Design process :

Preliminary member sizing of beams

Structural analysis - modeling, analysis

Design review - member modifications

Cost of estimation

Preparation of structural drawings and specifications

Loads for structural analysis and design

Dead load

Live load

Mean return period OR

Recurrence interval OR

Live loads for various occupancies

Reduction in basic design live load

Impact Load

Wind load

4. Describe the steps used for erection of structural steel?

Material received at site.

Concrete bases and anchor bolts.

Shims.

Pre assembly at ground level.

Main construction steel erection (dimension bolt)

Tightening for anchor bolt.

Alignment for structural steel.

Tightening for steel.

Tightening for anchor bolts.

Grouting.

Complete structural steel erection (secondary beams, bracing).

Calibration of wrench and device.

Modification during and after erection includes cutting, welding, NDT,....etc).

Painting inspection.

5. What are the defects you can expect during inspection of material receiving at the site?

Lamination.

distortion.

pitting.

6. Mention the steps to check material received at the site?

Visual inspection.

Dimension inspection.

Verification of heat no and mill certificate information's.

7. How can you check the support foundation ?

Location.

Orientation.

Elevation.

8. What is the minimum top elevation of leveling shims?

Minimum 25mm.



9. What is the acceptable variation in dimensions between the centres of two anchor bolts (within an anchor bolt group)?

Maximum 3 mm.

10. Which code you can use for check bolts used for primary structural connection?

ASTM A325 N.

11. What is the minimum size of bolt used at Astm A32 N ?

Minimum size 20mm.

12. How much variation in elevation of the top of anchor rods?

Max 13 mm.

13. How many days minimum required to archive 70% concrete strength (curing time)?

7 days minimum.

14. How many bolts minimum required per connection?

2 bolt minimum required.

15. How much variation in dimension from centre of any anchor bolts group to be establish column line through the group?

Equal to or less than 6mm

16. What are the types of joints you can use for erection of structural steel?

Snugtightened joint. Pretension join or slip critical joint.

17. What is minimum thickness of any part of structural steel shape?

Minimum 5 mm.

18. What is the vertical tolerance (alignment) for straight compression structural member?

1 mm per 1m accepted.

19. What are the types of methods of bolt tightening?

Snug tightening, turn of nut pretensioning calibrated wrench pretensioning or direct tension indicator pretensioning

20. All gusset and stiffener plates shall be .....mm minimum thickness

10 mm minimum.

21. What are the properties of a steel?

The important characteristics of steel for design purposes are:

yield stress ( $F_y$ ).

ultimate stress ( $F_u$ ).

modulus of elasticity ( $E$ ).

percent elongation ( $e$ ).

coefficient of thermal expansion ( $a$ ).

22. What are the types of structural steel?

Types of structural steel : Various types of structural steel sections and their technical specifications are as follows:

Beams.

Channels.

Angles.

Flats

23. What are steel beams?

Steel Beams : Steel Beams is considered to be a structural element which mainly carries load in flexure meaning bending. Usually beams carry vertical gravitational force but are also capable of carrying horizontal loads generally in the case of an earthquake.

The mechanism of carrying load in a beam is very unique, like; the load carried by a beam is transferred to walls, columns or girders which in turn transfer the force to the adjacent structural compression members. The joists rest on the beam in light frame constructions.

24. Explain about steel channels?

Steel channels : Steel channels are used ideally as supports and guide rails. These are roll-formed products. The main metal used for making channels is steel along with aluminum. There are certain variations that are available in the channels category, the categorization is mainly on the

shape of the channel, the varieties are mentioned below:

**J channels:** This kind of channel has two legs and a web. One leg is longer. This channel resembles the letter-J.

**Hat channels:** This channel has legs that are folded in the outward direction resembling an old fashioned man's hat.

**U channels:** This most common and basic channel variety. It has a base known as a web and two equal length legs.

**C channels:** In this channel the legs are folded back in the channel and resemble the letter-C. C channels are known as rests.

**Hemmed channels:** In this kind of channel the top of the leg is folded hence forming double thickness.

25. What are the applications of steel channels?

Application : Steel channels are subjected to a wide array of applications. The application fields are:

Construction.

Appliances.

Transportation.

Used in making Sign posts.

Used in wood flooring for athletic purposes.

Used in installing and making windows and doors.

## **STRUCTURAL ANALYSIS**

1. The number of independent equations to be satisfied for static equilibrium of a plane structure is

- a) 1
- b) 2
- c) 3
- d) 6

Ans: c

2. If there are  $m$  unknown member forces,  $r$  unknown reaction components and  $j$  number of joints, then the degree of static indeterminacy of a pin-jointed plane frame is given by

- a)  $m + r + 2j$
- b)  $m - r + 2j$
- c)  $m + r - 2j$
- d)  $m + r - 3j$

Ans: c

3. Number of unknown internal forces in each member of a rigid jointed plane frame is

- a) 1
- b) 2
- c) 3
- d) 6

Ans: c

4. Degree of static indeterminacy of a rigid-jointed plane frame having 15 members, 3 reaction components and 14 joints is

- a) 2
- b) 3
- c) 6
- d) 8

Ans: c

5. Degree of kinematic indeterminacy of a pin-jointed plane frame is given by

- a)  $2j - r$
- b)  $j - 2r$
- c)  $3j - r$
- d)  $2j + r$

Ans: a

6. Independent displacement components at each joint of a rigid-jointed plane frame are

- a) three linear movements

- b) two linear movements and one rotation
  - c) one linear movement and two rotations
  - d) three rotations
- Ans: b

7. If in a pin-jointed plane frame  $(m + r) > 2j$ , then the frame is

- a) stable and statically determinate
- b) stable and statically indeterminate
- c) unstable
- d) none of the above

where  $m$  is number of members,  $r$  is reaction components and  $j$  is number of joints

Ans: b

8. A pin-jointed plane frame is unstable if

- a)  $(m + r) < 2j$
- b)  $m + r = 2j$
- c)  $(m + r) > 2j$
- d) none of the above

where  $m$  is number of members,  $r$  is reaction components and  $j$  is number of joints

Ans: a

9. A rigid-jointed plane frame is stable and statically determinate if

- a)  $(m + r) = 2j$
- b)  $(m + r) = 3j$
- c)  $(3m + r) = 3j$
- d)  $(m + 3r) = 3j$

where  $m$  is number of members,  $r$  is reaction components and  $j$  is number of joints

Ans: c

10. The number of independent equations to be satisfied for static equilibrium in a space structure is

- a) 2
- b) 3
- c) 4
- d) 6

Ans: d

11. The degree of static indeterminacy of a pin-jointed space frame is given by

- a)  $m + r - 2j$
- b)  $m + r - 3j$
- c)  $3m + r - 3j$
- d)  $m + r + 3j$

where  $m$  is number of unknown member forces,  $r$  is unknown reaction components and  $j$  is number of joints

Ans: b

12. The degree of static indeterminacy of a rigid-jointed space frame is

- a)  $m + r - 2j$
- b)  $m + r - 3j$
- c)  $3m + r - 3j$
- d)  $6m + r - 6j$

where  $m$ ,  $r$  and  $j$  have their usual meanings

Ans: d

13. The degree of kinematic indeterminacy of a pin-jointed space frame is

- a)  $2j - r$
- b)  $3j - r$
- c)  $j - 2r$
- d)  $j - 3r$

where  $j$  is number of joints and  $r$  is reaction components

Ans: b

14. The number of independent displacement components at each joint of a rigid-jointed space frame is

- a) 1
- b) 2
- c) 3
- d) 6

Ans: d

15. If in a rigid-jointed space frame,  $(6m + r) < 6j$ , then the frame is

- a) unstable
- b) stable and statically determinate
- c) stable and statically indeterminate
- d) none of the above

Ans: a

16. The principle of virtual work can be applied to elastic system by considering the virtual work of

- a) internal forces only
- b) external forces only
- c) internal as well as external forces
- d) none of the above

Ans: c

17. Castigliano's first theorem is applicable

- a) for statically determinate structures only
- b) when the system behaves elastically
- c) only when principle of superposition is valid
- d) none of the above

Ans: c

18. Principle of superposition is applicable when

- a) deflections are linear functions of applied forces
- b) material obeys Hooke's law
- c) the action of applied forces will be affected by small deformations of the structure
- d) none of the above

Ans: a

19. In moment distribution method, the sum of distribution factors of all the members meeting at any joint is always

- a) zero
- b) less than 1
- c) 1
- d) greater than 1

Ans: c

20. The carryover factor in a prismatic member whose far end is fixed is

- a) 0
- b)  $1/2$
- c)  $3/4$
- d) 1

Ans: b

21. In column analogy method, the area of an analogous column for a fixed beam of span  $L$  and flexural rigidity  $EI$  is taken as

- a)  $L/EI$
- b)  $L/2EI$
- c)  $L/3EI$
- d)  $L/4EI$

Ans: a

22. The degree of static indeterminacy up to which column analogy method can be used is

- a) 2
- b) 3
- c) 4
- d) unrestricted

Ans: b

23. The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in

- a) vertical direction
- b) horizontal direction
- c) inclined direction
- d) the direction in which the deflection is required

Ans: d

24. In the slope deflection equations, the deformations are considered to be caused by

- i) bending moment
- ii) shear force
- iii) axial force

The correct answer is

- a) only (i)
- b) (i) and (ii)
- c) (ii) and (iii)
- d) (i), (ii) and (iii)

Ans: a

25. The three moments equation is applicable only when

- a) the beam is prismatic
- b) there is no settlement of supports
- c) there is no discontinuity such as hinges within the span
- d) the spans are equal

Ans: c

26. While using three moments equation, a fixed end of a continuous beam is replaced by an additional span of

- a) zero length
- b) infinite length
- c) zero moment of inertia
- d) none of the above

Ans: a

27. The Castigliano's second theorem can be used to compute deflections

- a) in statically determinate structures only
- b) for any type of structure
- c) at the point under the load only
- d) for beams and frames only

Ans: b

28. Bending moment at any section in a conjugate beam gives in the actual beam

- a) slope
- b) curvature
- c) deflection
- d) bending moment

Ans: c

29. For a two-hinged arch, if one of the supports settles down vertically, then the horizontal thrust

- a) is increased
- b) is decreased
- c) remains unchanged
- d) becomes zero

Ans: c

30. For a symmetrical two hinged parabolic arch, if one of the supports settles horizontally, then the horizontal thrust

- a) is increased
- b) is decreased
- c) remains unchanged
- d) becomes zero

Ans: b

31. A single rolling load of 8 kN rolls along a girder of 15 m span. The absolute maximum bending moment will be

- a) 8 kN.m
- b) 15 kN.m
- c) 30 kN.m
- d) 60 kN.m

Ans: c

32. The maximum bending moment due to a train of wheel loads on a simply supported girder

- a) always occurs at centre of span
- b) always occurs under a wheel load

- c) never occurs under a wheel load
- d) none of the above

Ans: b

33. When a uniformly distributed load, longer than the span of the girder, moves from left to right, then the maximum bending moment at mid section of span occurs when the uniformly distributed load occupies

- a) less than the left half span
- b) whole of left half span
- c) more than the left half span
- d) whole span

Ans: d

34. When a uniformly distributed load, shorter than the span of the girder, moves from left to right, then the conditions for maximum bending moment at a section is that

- a) the head of the load reaches the section
- b) the tail of the load reaches the section
- c) the load position should be such that the section divides it equally on both sides
- d) the load position should be such that the section divides the load in the same ratio as it divides the span

Ans: d

35. When a series of wheel loads crosses a simply supported girder, the maximum bending moment under any given wheel load occurs when

- a) the centre of gravity of the load system is midway between the centre of span and wheel load under consideration
- b) the centre of span is midway between the centre of gravity of the load system and the wheel load under consideration
- c) the wheel load under consideration is midway between the centre of span and the centre of gravity of the load system
- d) none of the above

Ans: b

36. Which of the following is not the displacement method ?

- a) Equilibrium method
- b) Column analogy method
- c) Moment distribution method
- d) Kani's method

Ans: b

37. Study the following statements.

- i) The displacement method is more useful when degree of kinematic indeterminacy is greater than the degree of static indeterminacy.
- ii) The displacement method is more useful when degree of kinematic indeterminacy is less than the degree of static indeterminacy.
- iii) The force method is more useful when degree of static indeterminacy is greater than the degree of kinematic indeterminacy.
- iv) The force method is more useful when degree of static indeterminacy is less than the degree of kinematic indeterminacy.

The correct answer is

- a) (i) and (iii)
- b) (ii) and (iii)
- c) (i) and (iv)
- d) (ii) and (iv)

Ans: d

38. Select the correct statement

- a) Flexibility matrix is a square symmetrical matrix
- b) Stiffness matrix is a square symmetrical matrix
- c) both (a) and (b)
- d) none of the above

Ans: c

39. To generate the j th column of the flexibility matrix

- a) a unit force is applied at coordinate j and the displacements are calculated at all coordinates
- b) a unit displacement is applied at co-ordinate j and the forces are calculated at all coordinates
- c) a unit force is applied at coordinate j and the forces are calculated at all coordinates

d) a unit displacement is applied at co-ordinate  $j$  and the displacements are calculated at all co-ordinates

Ans: a

40. For stable structures, one of the important properties of flexibility and stiffness matrices is that the elements on the main diagonal

- i) of a stiffness matrix must be positive
- ii) of a stiffness matrix must be negative
- iii) of a flexibility matrix must be positive
- iv) of a flexibility matrix must be negative

The correct answer is

- a) (i) and (iii)
- b) (ii) and (iii)
- c) (i) and (iv)
- d) (ii) and (iv)

Ans: a

41. Effects of shear force and axial force on plastic moment capacity of a structure are respectively to

- a) increase and decrease
- b) increase and increase
- c) decrease and increase
- d) decrease and decrease

Ans: d

42. Which of the following methods of structural analysis is a force method ?

- a) slope deflection method
- b) column analogy method
- c) moment distribution method
- d) none of the above

Ans: b

43. Which of the following methods of structural analysis is a displacement method ?

- a) moment distribution method
- b) column analogy method
- c) three moment equation
- d) none of the above

Ans: a

44. In the displacement method of structural analysis, the basic unknowns are

- a) displacements
- b) force
- c) displacements and forces
- d) none of the above

Ans: a

45. The fixed support in a real beam becomes in the conjugate beam a

- a) roller support
- b) hinged support
- c) fixed support
- d) free end

Ans: d

46. The width of the analogous column in the method of column analogy is

- a)  $2/EI$
- b)  $1/EI$
- c)  $1/2 EI$
- d)  $1/4 EI$

Ans: b

47. A simply supported beam deflects by 5 mm when it is subjected to a concentrated load of 10 kN at its centre. What will be deflection in a 1/10 model of the beam if the model is subjected to a 1 kN load at its centre ?

- a) 5 mm
- b) 0.5 mm
- c) 0.05 mm
- d) 0.005 mm

Ans: a

48. The deformation of a spring produced by a unit load is called

- a) stiffness
- b) flexibility
- c) influence coefficient
- d) unit strain

Ans: b

49. For a single point load  $W$  moving on a symmetrical three hinged parabolic arch of span  $L$ , the maximum sagging moment occurs at a distance  $x$  from ends. The value of  $x$  is

- a)  $0.211 L$
- b)  $0.25 L$
- c)  $0.234 L$
- d)  $0.5 L$

Ans: a

50. Muller Breslau's principle for obtaining influence lines is applicable to

- i) trusses
- ii) statically determinate beams and frames
- iii) statically indeterminate structures, the material of which is elastic and follows Hooke's law
- iv) any statically indeterminate structure

The correct answer is

- a) (i), (ii) and (iii)
- b) (i), (ii) and (iv)
- c) (i) and (ii)
- d) only (i)

Ans: a

51. Consider the following statements:

Sinking of an intermediate support of a continuous beam

- 1. reduces the negative moment at support.
- 2. increases the negative moment at support.
- 3. reduces the positive moment at support.
- 4. increases the positive moment at the centre of span.

Of these statements

- a) i and 4 are correct
- b) 1 and 3 are correct
- c) 2 and 3 are correct
- d) 2 and 4 are correct

Ans: a

52. A load  $W$  is moving from left to right support on a simply supported beam of span  $T$ . The maximum bending moment

at  $0.4 l$  from the left support is

- a)  $0.16 Wl$
- b)  $0.20 Wl$
- c)  $0.24 Wl$
- d)  $0.25 Wl$

Ans: c

53. When a load crosses a through type Pratt truss in the direction left to right, the nature of force in any diagonal member in the left half of the span would

- a) change from compression to tension
- b) change from tension to compression
- c) always be compression
- d) always be tension

Ans: a

## **GEOTECHNICAL ENGINEERING:**

### Question No. 01

Rise of water table above the ground surface causes

- (A) Equal increase in pore water pressure and total stress



- (B) Equal decrease in pore water pressure and total stress
- (C) Increase in pore water pressure but decrease in total stress
- (D) Decrease in pore water pressure but increase in total

Answer: Option A

Question No. 04

If the material of the base of the Casagrande liquid limit device on which the cup containing soil paste drops is softer than the standard hard rubber, then

- (A) The liquid limit of soil always increases
- (B) The liquid limit of soil always decreases
- (C) The liquid limit of soil may increase
- (D) The liquid limit of soil may decrease

Answer: Option A

Question No. 05

A triaxial shear test is preferred to direct shear test, because

- (A) It can be performed under all three drainage conditions with complete control
- (B) Precise measurement of pore pressure and change in volume during test, is not possible
- (C) Stress distribution on the failure plane, is non uniform
- (D) None of these

Answer: Option A

Question No. 06

The average coefficient of permeability of natural deposits

- (A) Parallel to stratification is always greater than that perpendicular to stratification
- (B) Parallel to stratification is always less than that perpendicular to stratification
- (C) Is always same in both directions
- (D) Parallel to stratification may or may not be greater than that perpendicular to stratification

Answer: Option A

Question No. 07

Pick up the correct statement from the following:

- (A) The dry density reduces by addition of water after attaining optimum moisture content
- (B) The line joining the peak of three moisture content graphs obtained by using three compactive energies, is called line of optimum
- (C) Well graded coarse grained soils can be compacted to a very high density as compared to fine grained soils
- (D) All the above

Answer: Option D

Question No. 08

The shear strength of a soil

- (A) Is directly proportional to the angle of internal friction of the soil
- (B) Is inversely proportional to the angle of internal friction of the soil
- (C) Decreases with increase in normal stress
- (D) Decreases with decrease in normal stress

Answer: Option D

Question No. 09

Pick up the correct statement from the following:

- (A) The object of classifying soils is to arrange them into groups according to their properties and behaviour
  - (B) A soil classification system is meant to provide an accepted and systematic method of describing the various types of soils eliminating personal factors
  - (C) The first category of soil classification is based on grain size of the soil
  - (D) All the above
- Answer: Option D

Question No. 10

The major principal stress in an element of cohesion-less soil within the backfill of a retaining wall is

- (A) Vertical if the soil is in an active state of plastic equilibrium
  - (B) Vertical if the soil is in a passive state of plastic equilibrium
  - (C) Inclined at  $45^\circ$  to the vertical plane
  - (D) None of the above
- Answer: Option A

Question No. 11

A grillage foundation

- (A) Is provided for heavily loaded isolated columns
  - (B) Is treated as spread foundation
  - (C) Consists of two sets of perpendicularly placed steel beams
  - (D) All the above
- Answer: Option D

Question No. 12

Effective stress on soil

- (A) Increases voids ratio and decreases permeability
  - (B) Increases both voids ratio and permeability
  - (C) Decreases both voids ratio and permeability
  - (D) Decreases voids ratio and increases permeability
- Answer: Option C

Question No. 13

Hydrometer readings are corrected for:

- (A) Temperature correction
  - (B) Meniscus correction
  - (C) Dispersing agent correction
  - (D) Temperature, meniscus and dispersing agent corrections
- Answer: Option D

Question No. 14

The ultimate consolidation settlement of a structure resting on a soil

- (A) Decreases with the increase in the initial voids ratio
  - (B) Decreases with the decrease in the plastic limit
  - (C) Increases with the increase in the initial voids ratio
  - (D) Increases with the decrease in the porosity of the soil
- Answer: Option A

Question No. 15

Select the incorrect statement.

- (A) In a direct shear box test, the plane of shear failure is predetermined

- (B) Better control is achieved on the drainage of the soil in a triaxial compression test
- (C) Stress distribution on the failure plane in the case of triaxial compression test is uniform
- (D) Unconfined compression test can be carried out on all types of soils

Answer: Option D

Question No. 17

The angle of internal friction, is least for

- (A) Angular-grained loose sand
- (B) Angular -grained dense sand
- (C) Round-grained loose sand
- (D) Clays

Answer: Option D

Question No. 18

Dispersed type of soil structure is an arrangement comprising particles having

- (A) Face to face or parallel orientation
- (B) Edge to edge orientation
- (C) Edge to face orientation
- (D) All of the above

Answer: Option A

Question No. 19

The neutral stress in a soil mass is

- (A) Force per neutral area
- (B) Force per effective area
- (C) Stress taken up by the pore water
- (D) Stress taken up by solid particles

Answer: Option C

Question No. 20

The coefficient of compressibility of soil, is the ratio of

- (A) Stress to strain
- (B) Strain to stress
- (C) Stress to settlement
- (D) Rate of loading to that of settlement

Answer: Option B

Question No. 21

A clay subjected to pressure in excess to its present over-burden, is said to be

- (A) Pre-compressed
- (B) Pre-consolidated
- (C) Over-consolidated
- (D) All the above

Answer: Option D

Question No. 22

Physical properties of a permeant which influence permeability are

- (A) Viscosity only
- (B) Unit weight only
- (C) Both viscosity and unit weight
- (D) None of the above

Answer: Option C

Question No. 23

Pick up the correct statement from the following:

- (A) The range of water content between the liquid limit and plastic limit is called plasticity index
- (B) The ratio of the liquid limit minus the natural water content to the plasticity index of soils, is called consistency index
- (C) The ratio of natural water content minus its plastic limit to its plasticity index is called liquidity index
- (D) All the above

Answer: Option D

Question No. 24

Rankine's theory of active earth pressure assumes

- (A) Soil mass is homogeneous, dry and cohesionless
- (B) Ground surface is a plane which may be horizontal or inclined
- (C) Back of the wall is vertical and smooth
- (D) All the above

Answer: Option D

Question No. 25

For testing a saturated clay for shear strength, the test recommended, is

- (A) Direct shear test
- (B) Triaxial compression test
- (C) Unconfined compression test
- (D) All the above

Answer: Option C

Question No. 26

Coefficient of permeability of soil

- (A) Does not depend upon temperature
- (B) Increases with the increase in temperature
- (C) Increases with the decrease in temperature
- (D) None of the above

Answer: Option B

Question No. 27

The ratio of volume of air voids to the volume of total voids, is known as

- (A) Air content
- (B) Percentage air voids
- (C) Percentage voids
- (D) Porosity

Answer: Option A

Question No. 28

Pick up the correct statement from the following:

- (A) In soils, the flow index indicates variation in shear strength with water content
- (B) Liquid limit minus plastic limit, is known as plasticity index of the soil
- (C) Plastic limit minus shrinkage limit, is known as shrinkage index of the soil
- (D) All the above

Answer: Option D

Question No. 29

The triaxial apparatus is usually used for

- (A) Unconsolidated-undrained test

- (B) Consolidated-undrained test
  - (C) Drained test
  - (D) All the above tests
- Answer: Option D

Question No. 30

- Which one of the following clays behaves like a dense sand?
- (A) Over-consolidated clay with a high over-consolidation ratio
  - (B) Over-consolidated clay with a low over-consolidation ratio
  - (C) Normally consolidated clay
  - (D) Under-consolidated clay
- Answer: Option A

Question No. 31

- During seepage through a soil, direction of seepage is always
- (A) Parallel to equipotential lines
  - (B) Perpendicular to stream lines
  - (C) Perpendicular to equipotential lines
  - (D) None of these
- Answer: Option C

Question No. 32

- The seepage force in a soil, is
- (A) Perpendicular to the equipotential lines
  - (B) Proportional to the exit gradient
  - (C) Proportional to the head loss
  - (D) All the above
- Answer: Option D

Question No. 33

- Pick up the correct statement from the following:
- (A) Coefficient of compressibility is the decrease in void ratio per unit increase of pressure
  - (B) The percent settlement at any time is called degree of consolidation
  - (C) Time factor is a dimensionless quantity
  - (D) All the above
- Answer: Option D

Question No. 34

- Direct measurement of permeability of the specimen at any stage of loading can be made
- (A) Only in fixed ring type consolidometer
  - (B) Only in floating ring type consolidometer
  - (C) Both (A) and (B)
  - (D) None of the above
- Answer: Option A

Question No. 35

- The property of a soil which allows it to be deformed rapidly without rupture, elastic rebound and also a volume change, is known
- (A) Porosity
  - (B) Plasticity
  - (C) Permeability
  - (D) Ductility

Answer: Option B

Question No. 36

Failure of the stability of slopes, generally occurs along

- (A) Slip plane
- (B) A horizontal surface
- (C) A curved surface
- (D) All the surfaces

Answer: Option C

Question No. 37

The shearing force acting along the slice of a curved surface of slippage, causes the soil to slide

- (A) Down at the centre
- (B) Down at the toe
- (C) Upward at the centre
- (D) None of these

Answer: Option A

Question No. 38

With the increase in the amount of compaction energy

- (A) Optimum water content increases but maximum dry density decreases
- (B) Optimum water content decreases but maximum dry density increases
- (C) Both optimum water content and maximum dry density increase
- (D) Both optimum water content and maximum dry density decrease

Answer: Option B

Question No. 39

Soils containing organic matters

- (A) Are of spongy nature
- (B) Swell with decrease of moisture
- (C) Shrink with increase of moisture content
- (D) None of these

Answer: Option A

Question No. 40

Buoyant unit weight equals the saturated density

- (A) Multiplied by unit weight of water
- (B) Divided by unit weight of water
- (C) Plus unit weight of water
- (D) Minus unit weight of water

Answer: Option D

Question No. 41

The change of moisture content of soils, changes the

- (A) Value of the angle of repose
- (B) Amount of compaction required
- (C) Cohesive strength of soil
- (D) All the above

Answer: Option D

Question No. 42

Skempton's pore pressure coefficient B for saturated soil is

- (A) 1
  - (B) Zero
  - (C) Between 0 and 1
  - (D) Greater than 1
- Answer: Option A

Question No. 43

The density of soil can be increased

- (A) By reducing the space occupied by air
- (B) By elastic compression of soil grains
- (C) By expelling water from pores
- (D) All the above

Answer: Option D

Question No. 44

Pick up the correct statement from the following:

- (A) Kaolinite is most stable clay
- (B) Kaolinite shows a very little sign of swelling on wetting
- (C) Kaolinite is also called China clay
- (D) All the above

Answer: Option D

Question No. 45

Pick up the correct definition from the following:

- (A) The lateral pressure exerted by the soil when the retaining wall moves away from the back fill, is generally known as active earth pressure of the soil
- (B) The lateral pressure exerted by the soil when the retaining wall moves towards the soil, is generally known as 'Passive earth pressure of the soil
- (C) The lateral pressure exerted by the soil when the retaining wall has no movement relative to the back fill, is known as 'earth pressure at rest of the soil
- (D) All the above

Answer: Option D

Question No. 46

Shear strength of a soil is a unique function of

- (A) Effective stress only
- (B) Total stress only
- (C) Both effective stress and total stress
- (D) None of the above

Answer: Option A

Question No. 48

260 g of wet soil was taken in a pycnometer jar of weight 400 g in order to find the moisture content in the soil, with specific gravity of soil particles 2.75. The weight of soil and remaining water filled in pycnometer without air bubbles was 1415 g and the weight of pycnometer filled with water alone was 1275 g. The moisture content in the soil is

- (A) 24.2 %
- (B) 18.2 %
- (C) 53.8 %
- (D) None of these

Answer: Option B

Question No. 49

The method of the slices is applicable to

- (A) Homogenous soils
  - (B) Stratified soils
  - (C) Saturated soils
  - (D) Non-uniform slopes
- Answer: Option A

Question No. 50

The angle that Coulomb's failure envelope makes with the horizontal is called

- (A) Cohesion
- (B) Angle of internal friction
- (C) Angle of repose
- (D) None of the above

Answer: Option A

Question No. 51

A flow net may be utilised for the determination of

- (A) Exit gradient
- (B) Seepage
- (C) Hydrostatic pressure
- (D) All the above

Answer: Option D

Question No. 52

The compression index of a soil

- (A) Decreases with an increase in the liquid limit
- (B) Increases with an increase in the liquid limit
- (C) Decreases with an increase in the plastic limit
- (D) Is not related with plastic limit

Answer: Option B

Question No. 53

If the coefficient of the active pressure  $K_a$  is  $1/3$ , the coefficient of passive pressure  $K_p$ , is

- (A)  $1/3$
- (B)  $2/3$
- (C) 1
- (D) 3

Answer: Option D

Question No. 54

Sensitivity of a soil can be defined as

- (A) Percentage of volume change of soil under saturated condition
- (B) Ratio of compressive strength of unconfined undisturbed soil to that of soil in a remoulded state
- (C) Ratio of volume of voids to volume of solids
- (D) None of the above

Answer: Option B

Question No. 55

The intensity of active earth pressure at a depth of 10 metres in dry cohesionless sand with an angle of internal friction of  $30^\circ$  and with a weight of  $1.8 \text{ t/m}^3$ , is

- (A)  $4 \text{ t/m}^2$
- (B)  $5 \text{ t/m}^2$
- (C)  $6 \text{ t/m}^2$
- (D)  $7 \text{ t/m}^2$



Answer: Option C

Question No. 56

The soil moisture driven off by heat, is called

- (A) Free water
- (B) Hygroscopic water
- (C) Gravity water
- (D) None of these

Answer: Option B

Question No. 57

Plasticity index is defined as the range of water content between

- (A) Liquid and plastic limit
- (B) Plastic limit and semi solid limit
- (C) Semi-solid limit and liquid limit
- (D) Liquid limit and solid limit

Answer: Option A

Question No. 58

Bishop's method of stability analysis

- (A) Is more conservative
- (B) Neglects the effect of forces acting on the sides of the slices
- (C) Assumes the slip surface as an arc of a circle
- (D) All of the above

Answer: Option C

Question No. 60

You are given a sample of soil containing coarse grains to determine its water content, you will use

- (A) Pycnometer
- (B) Oven-drying method
- (C) Calcium carbide method
- (D) Alcohol method

Answer: Option A

Question No. 61

Pick up the incorrect definition from the following:

- (A) Ratio of the compressive strength of unconfined undisturbed soil to that of remoulded soil, is known as the sensitivity of the soil sample
- (B) The rotation of soil particles into stable state while remoulding, is known as the thiotropy of soil
- (C) The water content at which a soil flows, is known plastic limit of the soil
- (D) None of these

Answer: Option D

Question No. 62

A 600 mm square bearing plate settles by 15 mm in plate load test on a cohesion-less soil under an intensity of loading of 0.2 N/ram<sup>2</sup>. The settlement of a prototype shallow footing 1 m square under the same intensity of loading is

- (A) 15 mm
- (B) Between 15 mm and 25 mm
- (C) 25 mm
- (D) Greater than 25 mm

Answer: Option B

Question No. 64

The angle between the directions of the failure and the major principal plane, is equal to

- (A)  $90^\circ +$  effective angle of shearing resistance
- (B)  $90^\circ +$  half of the angle of shearing resistance
- (C)  $45^\circ -$  half of the angle of shearing resistance
- (D)  $45^\circ +$  half of the angle of shearing resistance

Answer: Option D

Question No. 65

In active state of plastic equilibrium in a non cohesive soil with horizontal ground surface

- (A) Major principal stress is horizontal
- (B) Minor principal stress is vertical
- (C) Major principal stress is vertical
- (D) Minor and major principal stresses are equally inclined to horizontal

Answer: Option C

Question No. 66

Residual soils are formed by

- (A) Glaciers
- (B) Wind
- (C) Water
- (D) None of the above

Answer: Option D

Question No. 67

A soil not fully consolidated under the existing over-burden pressure, is called

- (A) Pre-consolidated
- (B) Normally consolidated
- (C) Over-consolidated
- (D) None of these

Answer: Option C

Question No. 68

Pick up the correct statement from the following:

- (A) Illite bond is weaker than Kaolinite bond
- (B) Illite bond is stronger than montmorillonite bond
- (C) Illite does not swell when wet
- (D) All the above

Answer: Option D

Question No. 69

If  $C_v$  is the coefficient of consolidation,  $t$  is the time and  $d$  is drainage path of one dimensional consolidation of soil, the time factor  $T_v$ , is given by

- (A)  $T_v = d^2/C_v t$
- (B)  $T_v = t^2/d^2 C_v$
- (C)  $T_v = C_v^3/d^2 t$
- (D)  $T_v = C_v^4/d t^2$

Answer: Option D

Question No. 70

Select the correct statement.

- (A) Unit weight of dry soil is greater than unit weight of wet soil
- (B) For dry soils, dry unit weight is less than total unit weight

(C) Unit weight of soil increases due to submergence in water

(D) Unit weight of soil decreases due to submergence in water

Answer: Option D

Question No. 71

The bearing capacity of a soil depends upon

(A) Size of the particles

(B) Shape of the particles

(C) Cohesive properties of particles

(D) All the above

Answer: Option D

Question No. 73

Pick up the correct statement from the following:

(A) The void ratio in soils is defined as the ratio of the volume of voids to the volume of solids

(B) The bulk density of a soil is defined as the unit weight of the soil

(C) The dry density of a soil is defined as weight of solids to the total volume of the soil

(D) All the above

Answer: Option D

Question No. 74

If the water content of a fully saturated soil mass is 100%, then the voids ratio of the sample is

(A) Less than specific gravity of soil

(B) Equal to specific gravity of soil

(C) Greater than specific gravity of soil

(D) Independent of specific gravity of soil

Answer: Option B

Question No. 75

If water content of a soil is 40%,  $G$  is 2.70 and void ratio is 1.35, the degree of saturation is

(A) 70 %

(B) 75 %

(C) 80 %

(D) 85 %

Answer: Option C

Question No. 73

Pick up the correct statement from the following:

(A) The void ratio in soils is defined as the ratio of the volume of voids to the volume of solids

(B) The bulk density of a soil is defined as the unit weight of the soil

(C) The dry density of a soil is defined as weight of solids to the total volume of the soil

(D) All the above

Answer: Option D

Question No. 74

If the water content of a fully saturated soil mass is 100%, then the voids ratio of the sample is

(A) Less than specific gravity of soil

(B) Equal to specific gravity of soil

(C) Greater than specific gravity of soil

(D) Independent of specific gravity of soil

Answer: Option B

Question No. 75

If water content of a soil is 40%,  $G$  is 2.70 and void ratio is 1.35, the degree of saturation is

(A) 70 %

(B) 75 %

(C) 80 %

(D) 85 %

Answer: Option C

Question No. 78

Stoke's law is valid only if the size of particle is

(A) Less than 0.0002 mm

(B) Greater than 0.2 mm

(C) Between 0.2 mm and 0.0002 mm

(D) All of the above

Answer: Option C

Question No. 79

Pick up the correct statement from the following:

(A) When stress decreases, void, ratio decreases

(B) When stress decreases, coefficient of permeability decreases

(C) When stress decreases, coefficient of volume change decreases

(D) When stress decreases void ratio, coefficients of permeability and volume change decrease

Answer: Option D

Question No. 80

Pick up the correct statement applicable to plate load test

(A) Width of the test pit for plate load test is made five times the width of the plate

(B) At the centre of the test pit, a hole is dug out whose size is kept equal to the size of the test plate

(C) Bottom level of the hole dug at the centre of the test pit, is kept at the level of the actual formation

(D) All the above

Answer: Option D

Question No. 81

Failure of a slope occurs only when total shear force is

(A) Equal to total shearing strength

(B) Greater than total shearing strength

(C) Less than total shearing strength

(D) None of these

Answer: Option B

Question No. 82

If the natural water content of soil mass lies between its liquid limit and plastic limit, the soil mass is said to be in

- (A) Liquid state
- (B) Plastic state
- (C) Semisolid state
- (D) Solid state

Answer: Option B

Question No. 83

Pick up the correct statement from the following:

- (A) The permeability of the coarse-grained soils may be reduced by grouting
- (B) The process of injecting fluids (i.e. grouts) into the pores space of the soil is called grouting
- (C) The grouting increases the soil strength
- (D) All the above

Answer: Option D

Question No. 84

Negative skin friction on piles

- (A) Is caused due to relative settlement of the soil
- (B) Is caused in soft clays
- (C) Decreases the pile capacity
- (D) All of the above

Answer: Option D

Question No. 85

Select the correct statement.

- (A) A uniform soil has more strength and stability than a nonuniform soil
- (B) A uniform soil has less strength and stability than a nonuniform soil
- (C) Uniformity coefficient does not affect strength and stability
- (D) Uniformity coefficient of a poorly graded soil is more than that of a well graded soil

Answer: Option B

Question No. 87

If a soil undergoes a change in shape and volume by application of external loads over it, but recovers its shape and volume immediately after removal of the load, the property of the soil is said to be

- (A) Resilience of soils
- (B) Elasticity of soils
- (C) Compressibility of soils
- (D) None of these

Answer: Option B

Question No. 88

The water content in a soil sample when it continues to lose weight without losing the volume, is called

- (A) Shrinkage limit
- (B) Plastic limit
- (C) Liquid limit
- (D) Semi-solid limit

Answer: Option A

Question No. 89

Effective stress is

- (A) The stress at particles contact
- (B) A physical parameter that can be measured
- (C) Important because it is a function of engineering properties of soil
- (D) All of the above

Answer: Option C

Question No. 90

The angle of internal friction is maximum for

- (A) angular-grained loose sand
- (B) angular-grained dense sand
- (C) round-grained dense sand
- (D) round-grained loose sand

Answer: Option B

Question No. 91

If the coefficients of volume change and compressibility of a soil sample are  $6.75 \times 10^{-2}$  and  $3 \times 10^{-2}$  respectively, the void ratio of the soil sample, is

- (A) 1.10
- (B) 1.15
- (C) 1.20
- (D) 1.30

Answer: Option D

Question No. 92

When a cohesionless soil attains quick condition, it loses

- (A) Shear strength
- (B) Bearing capacity
- (C) Both (a) and (b)
- (D) Neither (a) nor (b)

Answer: Option C

Question No. 93

Select the correct statement.

- (A) The greater the viscosity, the greater is permeability
- (B) The greater the unit weight, the greater is permeability
- (C) The greater the unit weight, the smaller is permeability

(D) Unit weight does not affect permeability

Answer: Option B

Question No. 94

A direct shear test possesses the following disadvantage:

(A) A relatively thin thickness of sample permits quick drainage

(B) A relatively thin thickness of sample permits quick dissipation of pore pressure developed during the test

(C) As the test progresses the area under shear, gradually changes

(D) None of these

Answer: Option C

Question No. 95

A stratum of clay 2 m thick will get consolidated 80% in 10 years. For the 80% consolidation of 8 m thick stratum of the same clay, the time required is

(A) 100 years

(B) 120 years

(C) 140 years

(D) 160 years

Answer: Option D

Question No. 96

When the seepage pressure becomes equal to the pressure due to submerged weight of a soil, the effective pressure is reduced to zero and the soil particles have a tendency to move up in the direction of flow. This phenomenon is generally known

(A) Quick condition

(B) Boiling condition

(C) Quick sand

(D) All the above

Answer: Option D

Question No. 100

If drainage is permitted throughout the test, during the application of both normal, and shear stresses so that full consolidation occurs and no excess pore pressure is set up at any stage of the test, is known as

(A) Quick test

(B) Drained test

(C) Consolidated undrained test

(D) None of these

Answer: Option B

Question No. 101

Degree of consolidation is

- (A) Directly proportional to time and inversely proportional to drainage path
- (B) Directly proportional to time and inversely proportional to square of drainage path
- (C) Directly proportional to drainage path and inversely proportional to time
- (D) Directly proportional to square of drainage path and inversely proportional to time

Answer: Option B

Question No. 102

Terzaghi's theory of one dimensional consolidation assumes

- (A) Load is applied in one direction
- (B) Coefficient of permeability is constant
- (C) Excess pore water drains out only in the vertical direction
- (D) All the above

Answer: Option D

Question No. 103

The shear resistance of a soil is constituted basically of the following component.

- (A) The frictional resistance to translocation between the individual soil particles at their contact point
- (B) To the structural relation to displacement of the soil because of the interlocking of the particles
- (C) Cohesion and adhesion between the surfaces of the soil particles
- (D) All the above

Answer: Option D

Question No. 104

The consolidation time for soils

- (A) Increases with increasing compressibility
- (B) Decreases with increasing permeability
- (C) Increases rapidly with increasing size of soil mass
- (D) All the above

Answer: Option D

Question No. 105

Coefficient of compressibility is

- (A) Constant for any type of soil
- (B) Different for different types of soils and also different for a soil under different states of consolidation
- (C) Different for different types of soils but same for a soil under different states of consolidation
- (D) Independent of type of soil but depends on the stress history of soil

Answer: Option B

Question No. 106

The ratio of the weight of water to the weight of solids in a given mass of soil, is known



- (A) Porosity
  - (B) Specific gravity
  - (C) Void ratio
  - (D) Water content
- Answer: Option D

Question No. 107

In a liquid limit test, the moisture content at 10 blows was 70% and that at 100 blows was 20%. The liquid limit of the soil, is

- (A) 35 %
- (B) 50 %
- (C) 65 %
- (D) None of these

Answer: Option C

Question No. 116

A cylindrical specimen of saturated soil failed under an axial vertical stress of  $100\text{kN/m}^2$  when it was laterally unconfined. The failure plane was inclined to the horizontal plane at an angle of  $45^\circ$ . The values of cohesion and angle of internal friction for the soil are respectively

- (A)  $0.5\text{ N/mm}^2$  and  $30^\circ$
- (B)  $0.05\text{ N/mm}^2$  and  $0^\circ$
- (C)  $0.2\text{ N/mm}^2$  and  $0^\circ$
- (D)  $0.05\text{ N/mm}^2$  and  $45^\circ$

Answer: Option B

Question No. 116

The critical exist gradient of seepage water in soils, increases with

- (A) An increase in specific gravity
- (B) A decrease in specific gravity
- (C) A decrease in void ratio
- (D) Both (a) and (c)

Answer: Option D

Question No. 117

Rankine's theory of earth pressure assumes that the back of the wall is

- (A) Plane and smooth
- (B) Plane and rough
- (C) Vertical and smooth
- (D) Vertical and rough

Answer: Option C

Question No. 118

The Mohr's straight theory is based on the following fact:

- (A) Material fails essentially by shear
- (B) Ultimate strength of the material is determined by the stress in the plane of slip
- (C) Failure criterion is independent of the intermediate principal stress
- (D) All the above

Answer: Option D

Question No. 119

According to Coulomb's wedge theory, the active earth pressure slides the wedge

- (A) Down and outwards on a slip surface
- (B) Up and inwards on a slip surface
- (C) Horizontal upward and parallel to base
- (D) Horizontal inward and parallel to base

Answer: Option A

Question No. 120

Pile foundations are generally preferred to for

- (A) Bridge foundations
- (B) Sky scrapper buildings
- (C) Residential buildings
- (D) Runways

Answer: Option B

Question No. 121

The rise of water table below the foundation influences the bearing capacity of soil mainly by reducing

- (A) Cohesion and effective angle of shearing resistance
- (B) Cohesion and effective unit weight of soil
- (C) Effective unit weight of soil and effective angle of shearing resistance
- (D) Effective angle of shearing resistance

Answer: Option B

Question No. 122

A soil mass is said to be in plastic equilibrium if

- (A) It is stressed to maximum
- (B) It is on the verge of failure
- (C) It is in plastic stage
- (D) It starts flowing

Answer: Option B

Question No. 123

Stoke's law states that the velocity at which a grain settles out of suspension, the other factors remaining constant, is dependent upon

- (A) Shape of grain
- (B) Weight of grain
- (C) Size of grain
- (D) Shape, size and weight of grain

Answer: Option D

Question No. 124

Pick up the correct statement from the following:

- (A) A soil having pH value more than 7 is an acidic soil
- (B) A soil having pH value less than 7 is an acidic soil
- (C) A soil having pH value more than 7 is an alkaline soil
- (D) A soil containing chemicals for the manufacture of Portland cement is preferred

Answer: Option B

Question No. 125

Contact pressure beneath a rigid footing resting on cohesive soil is

- (A) Less at edges compared to middle
- (B) More at edges compared to middle
- (C) Uniform throughout
- (D) None of the above

Answer: Option B

Question No. 126

The plasticity of fine soils may be assessed by means of

- (A) Dry strength test
- (B) Toughness test
- (C) Dilatancy test
- (D) All of these

Answer: Option D

Question No. 127

Pick up the correct statement from the following:

- (A) Sandy clayloam contains highest percentage of sand
- (B) Silty clayloam contains highest percentage of silt
- (C) Stiff boulder clay offers maximum shear strength
- (D) Soft chalk carries least safe load

Answer: Option B

Question No. 128

For general engineering purposes, soils are classified by

- (A) Particle size classification system
- (B) Textural classification system
- (C) High Way Research Board (HRB), classification system
- (D) Unified soil classification system

Answer: Option D

Question No. 129

Water content of soil can

- (A) Never be greater than 100 %
- (B) Take values only from 0 % to 100 %
- (C) Be less than 0 %
- (D) Be greater than 100 %

Answer: Option D

Question No. 131

Pick up the correct statement from the following:

- (A) Failure plane carries maximum shear stress
- (B) Failure plane does not carry maximum shear stress
- (C) Failure plane carries shear stress equal to maximum shear stress
- (D) None of these

Answer: Option B

Question No. 132

The phreatic line in an earth dam may be

- (A) Circular
- (B) Elliptical
- (C) Parabolic
- (D) A straight line

Answer: Option C

Question No. 133

If the voids of a soil mass are full of air only, the soil is termed as

- (A) Air entrained soil
- (B) Partially saturated soil
- (C) Dry soil
- (D) Dehydrated soil

Answer: Option C

Question No. 134

On wetting, cohesive soils,

- (A) Loose permeability
- (B) Gain shear strength
- (C) Loose elasticity
- (D) Decrease their shear strength

Answer: Option D

Question No. 135

Pick up the correct statement from the following:

- (A) An unconfined compression test is a special case of triaxial compression test
- (B) An unconfined compression test is a special case of direct shear test
- (C) The confining pressure is maximum during an unconfined compression test
- (D) The cylindrical specimen of a soil is subjected to major principal stress till it fails due to shearing along the plane of the failure

Answer: Option A

Question No. 136

A soil sample of mass specific gravity 1.92 has moisture content 30%. If the specific gravity of solids is 2.75, the degree of saturation, is

- (A) 95.4 %
- (B) 95.5 %
- (C) 95.6 %
- (D) 95.7 %

Answer: Option D

Question No. 137

Select the correct range of density index, ID

- (A)  $ID > 0$
- (B)  $ID < 0$
- (C)  $0 < ID < 1$
- (D)  $0 < ID < 1$

Answer: Option D

Question No. 138

A soil sample of mass specific gravity 1.92 has moisture content 30%. If the specific gravity of solids is 2.75, the void ratio, is

- (A) 0.858
- (B) 0.860
- (C) 0.862
- (D) 0.864

Answer: Option C

Question No. 139

If the specific gravity and voids in soil sample are  $G$  and  $e$  respectively, the hydraulic gradient  $i$ , is

- (A)  $(G - 1)/(1 + e)$
- (B)  $(G + 1)/(1 - e)$
- (C)  $(1 - G)/(1 + e)$
- (D)  $(1 + G)/(1 + e)$

Answer: Option A

Question No. 140

In a flow net

- (A) Flow lines and equipotential lines cross each other at right angles
- (B) Fields are rectangles whose length is twice the breadth
- (C) Smaller the dimensions of the field, smaller will be the hydraulic gradient and velocity of flow through it
- (D) For homogeneous soil, the curves are smooth and circular

Answer: Option A

Question No. 141

Which of the following methods is most accurate for the determination of the water content of soil?

- (A) Oven drying method
- (B) Sand bath method
- (C) Calcium carbide method
- (D) Pycnometer method

Answer: Option A

Question No. 143

The reduction in volume of soil due to squeezing out of water from the voids, is termed

- (A) Primary consolidation
- (B) Primary compression
- (C) Primary time effect
- (D) All the above

Answer: Option D

Question No. 144

Which of the following statements is correct?

- (A) Uniformity coefficient represents the shape of the particle size distribution curve.
- (B) For a well graded soil, both uniformity coefficient and coefficient of curvature are nearly unity.
- (C) A soil is said to be well graded if it has most of the particles of about the same size
- (D) None of the above

Answer: Option D

Question No. 145

'Talus' is the soil transported by

- (A) Wind
- (B) Water
- (C) Glacier
- (D) Gravitational force

Question No. 148

The water content of soil, which represents the boundary between plastic state and liquid state, is known as

- (A) Liquid limit
- (B) Plastic limit
- (C) Shrinkage limit
- (D) Plasticity index

Answer: Option A

Question No. 149

The specific gravity of Calcite is

- (A) 2.65
- (B) 2.72
- (C) 2.85
- (D) 2.90

Answer: Option B

Question No. 150

The direct shear test suffers from the following disadvantage:

- (A) Drain condition cannot be controlled
- (B) Pore water pressure cannot be measured
- (C) Shear stress on the failure plane is not uniform
- (D) The area under the shear and vertical loads does not remain constant throughout the test

Answer: Option C

Question No. 152

The clay mineral with the largest swelling and shrinkage characteristics is

- (A) Kaolinite
- (B) Illite
- (C) Montmorillonite
- (D) None of the above

Answer: Option C

Question No. 153

The length/diameter ratio of cylindrical specimens used in triaxial test, is generally

- (A) 1
- (B) 1.5
- (C) 2
- (D) 2.5

Answer: Option C

Question No. 154

The maximum load carried by a pile, when it continues to sink without further increase of load, is known as

- (A) Ultimate load carrying capacity
- (B) Ultimate bearing capacity
- (C) Ultimate bearing resistant
- (D) All the above

Answer: Option D

Question No. 155

The seepage exit gradient in a soil is the ratio of

- (A) Total head to the length of seepage
- (B) Flow line to slope
- (C) Head upstream to that at downstream
- (D) Head loss to the length of the seepage

Answer: Option D

Question No. 156

Which of the following methods is more suitable for the determination of permeability of clayey soil?

- (A) Constant head method
- (B) Falling head method
- (C) Horizontal permeability test
- (D) None of the above

Answer: Option B

Question No. 157

A structure is erected on an impervious clay whose thickness is 12 m. Drainage is possible both at upper and lower surfaces. Coefficient of consolidation is  $0.015 \text{ cm}^2$  per minute. For attaining 50% consolidation with a time factor 0.20, the number of days required

- (A) 3233
- (B) 3123
- (C) 33331
- (D) 3313

Answer: Option C

Question No. 158

The ratio of the difference between the void ratio of the soil in its loosest state and its natural void ratio ( $e$ ) to the difference between the void ratios in the loosest and fully dense state, is generally termed as

- (A) Degree of density
- (B) Relativity
- (C) Density index
- (D) All the above

Answer: Option D

Question No. 159

For determining the ultimate bearing capacity of soil, the recommended size of a square bearing plate to be used in load plate test should be 30 to 75 cm square with a minimum thickness of

- (A) 5 mm
- (B) 10 mm
- (C) 15 mm
- (D) 25 mm

Answer: Option D

Question No. 160

Within the consolidation process of a saturated clay

- (A) A gradual increase in neutral pressure and a gradual decrease in effective pressure take place and sum of the two is constant
- (B) A gradual decrease in neutral pressure and a gradual increase in effective pressure take place and sum of the two is constant
- (C) Both neutral pressure and effective pressure decrease



(D) Both neutral pressure and effective pressure increase

Answer: Option B

Question No. 161

An unsaturated 100 cm<sup>3</sup> sample of soil weighs 190 g. If its dried weight is 160 g, water content of the soil, is

(A) 0.188

(B) 0.288

(C) 0.388

(D) 0.588

Answer: Option A

Question No. 162

Pick up the correct statement from the following:

(A) If the ratio of depth to width is less than 2, it is shallow foundation

(B) If the ratio of depth to width is more than 2, it is deep foundation

(C) If the ratio of the length to width is between 1 and 2, it is spread foundation

(D) All the above

Answer: Option D

Question No. 163

Pick up the correct statement from the following:

(A) A maximum value of dry density is obtained at optimum water content

(B) At low value of water content most soils tend to be stiff

(C) At high water content, the dry density decreases with an increase of water content

(D) All the above

Answer: Option D

Question No. 164

Select the correct statement.

(A) Coefficient of compressibility of an over-consolidated clay is less than that of a normally consolidated clay

(B) Coefficient of compressibility of an over-consolidated clay is greater than that of a normally consolidated clay

(C) Coefficient of compressibility is constant for any clay

(D) None of the above

Answer: Option A

Question No. 165

Pick up the correct statement from the following:

(A) Isotropic consolidation of clay can be obtained in the triaxial apparatus under equal all-round pressure

(B) If the present effective stress is the maximum to which the clay has ever been subjected, it is called normally consolidated clay

(C) If the present effective stress in the past was more than present effective stress, it is called over-consolidated clay

(D) All the above

Answer: Option D

Question No. 166

Compression of soil occurs rapidly if voids are filled with

- (A) Air
- (B) Water
- (C) Partly with air and partly with water
- (D) None of these

Answer: Option A

Question No. 167

For better strength and stability, the fine grained soils and coarse grained soils are compacted respectively as

- (A) Dry of OMC and wet of OMC
- (B) Wet of OMC and dry of OMC
- (C) Wet of OMC and wet of OMC
- (D) Dry of OMC and dry of OMC where OMC is optimum moisture content

Answer: Option B

Question No. 168

Chemical weathering of soil is caused due to

- (A) Oxidation
- (B) Carbonation
- (C) Hydration
- (D) All the above

Answer: Option D

Question No. 170

According to IS : 2720 - 1965, the composition of a dispersing solution used in pipette analysis for determining the size of particles, is

- (A) sodium-hexametaphosphate 33 g, sodium carbonate 7 g and distilled water one litre
- (B) sodium-hexametaphosphate 7 g, sodium carbonate 33 g and distilled water one litre
- (C) sodium-hexametaphosphate 23 g, sodium carbonate 17 g and distilled water one litre
- (D) None of these

Answer: Option A

Question No. 174

The minimum depth of building foundations on

- (A) Sandy soils is 80 cm to 100 cm
- (B) Clay soils is 90 cm to 160 cm
- (C) Rocky soils is 5 cm to 50 cm
- (D) All the above

Answer: Option D

Question No. 175

The effect of cohesion on a soil is to

- (A) Reduce both the active earth pressure intensity and passive earth pressure intensity
- (B) Increase both the active earth pressure intensity and passive earth pressure intensity
- (C) Reduce the active earth pressure intensity but to increase the passive earth pressure intensity
- (D) Increase the active earth pressure intensity but to reduce the passive earth pressure intensity

Answer: Option C

Question No. 176

If voids ratio is 0.67, water content is 0.188 and specific gravity is 2.68, the degree of saturation of the soil, is

- (A) 25 %
- (B) 40 %
- (C) 60 %
- (D) 75 %

Answer: Option D

Question No. 177

Pick up the incorrect statement from the following:

- (A) The smaller the size of the pores, the higher the water can rise above the water table
- (B) Below the water table, the pore water may be static
- (C) The hydrostatic pressure depends on the depth below the water level
- (D) None of these

Answer: Option D

Question No. 178

A soil mass coated with a thin layer of paraffin weighs 460 g. When immersed, it displaces 299 cc of water. The weight of paraffin is 10 g. If specific gravity of solids is 2.5 and that of paraffin 0.9, the void ratio of soil, is

- (A) 0.55
- (B) 0.60
- (C) 0.65
- (D) 0.70

Answer: Option B

Question No. 179

Select the incorrect statement.

- (A) Bearing capacity of a soil depends upon the amount and direction of load
- (B) Bearing capacity of a soil depends on the type of soil
- (C) Bearing capacity of a soil depends upon shape and size of footing

(D) Bearing capacity of a soil is independent of rate of loading

Answer: Option A

Question No. 181

Over-consolidation of soils is caused due to

- (A) Erosion of over burden
- (B) Melting of ice sheets after glaciations
- (C) Permanent rise of water table
- (D) All the above

Answer: Option D

Question No. 182

The consistency index of a soil is defined as the ratio of

- (A) Liquid limit plus the natural water content to the plasticity index of the soil
- (B) Liquid limit minus the natural water content to the plasticity index of the soil
- (C) Natural water content of a soil minus plastic limit to the plasticity index of the soil
- (D) Natural water content of a soil plus its plastic limit to the plasticity index of the soil

Answer: Option B

Question No. 183

Which of the following types of soil is transported by gravitational forces?

- (A) Loess
- (B) Talus
- (C) Drift
- (D) Dune sand

Answer: Option B

Question No. 184

Soil classification of composite soils, exclusively based on the particle size distribution, is known

- (A) Particle classification
- (B) Textural classification
- (C) High Way Research Board classification
- (D) Unified soil classification

Answer: Option B

Question No. 186

When the degree of saturation is zero, the soil mass under consideration represents

- (A) One phase system
- (B) Two phase system with soil and air
- (C) Two phase system with soil and water
- (D) Three phase system

Answer: Option B

Question No. 188

Pick up the cohesive soil from the following:

- (A) Red earth

- (B) Clay
  - (C) Black cotton soil
  - (D) Compacted ground
- Answer: Option C

Question No. 189

For proper field control, which of the following methods is best suited for quick determination of water content of a soil mass?

- (A) Oven drying method
- (B) Sand bath method
- (C) Alcohol method
- (D) Calcium carbide method

Answer: Option D

Question No. 190

The internal molecular attraction of a soil, the cohesion

- (A) Decreases as the moisture content increases
- (B) Increases as the moisture content decreases
- (C) Is more in well compacted clays
- (D) Depends upon the external applied load

Answer: Option C

Question No. 191

Which of the following is a measure of particle size range?

- (A) Effective size
- (B) Uniformity coefficient
- (C) Coefficient of curvature
- (D) None of the above

Answer: Option B

Question No. 192

If  $N_f$ ,  $N_d$  and  $H$  are total number flow channels, total number of potential drops and total hydraulic head differences respectively, the discharge  $q$  through the complete flow is given by (where  $K$  is a constant)

- (A)  $q = (N_f/N_d)$
- (B)  $q = KH (N_d/(N_f))$
- (C)  $q = KH (N_f/N_d)$
- (D)  $q = KH N_f/N_d$

Answer: Option C

Question No. 193

A failure wedge develops if a retaining wall

- (A) Moves away from the backfill
- (B) Moves towards the backfill
- (C) Sinks downwards
- (D) Stresses equally by vertical and horizontal forces

Answer: Option A

Question No. 194

The admixture of coarser particles like sand or silt to clay causes

- (A) Decrease in liquid limit and increase in plasticity index
- (B) Decrease in liquid limit and no change in plasticity index
- (C) Decrease in both liquid limit and plasticity index
- (D) Increase in both liquid limit and plasticity index

Answer: Option C

Question No. 195

A partially saturated sample of soil has a unit weight of  $2.0 \text{ g/cm}^3$  and specific gravity of soil particles is 2.6. If the moisture content in the soil is 20%, the degree of saturation is

- (A) 20 %
- (B) 77 %
- (C) 92 %
- (D) None of these

Answer: Option C

Question No. 196

The shearing strength of a cohesion-less soil depends upon

- (A) Dry density
- (B) Rate of loading
- (C) Confining pressure
- (D) Nature of loading

Answer: Option C

Question No. 197

Sand particles are made of

- (A) Rock minerals
- (B) Kaolinite
- (C) Illite
- (D) Montmorillonite

Answer: Option A

Question No. 198

The water content of soil is defined as the ratio of

- (A) Volume of water to volume of given soil
- (B) Volume of water to volume of voids in soil
- (C) Weight of water to weight of air in voids
- (D) Weight of water to weight of solids of given mass of soil

Answer: Option D

Question No. 199

A critical hydraulic gradient may occur when

- (A) Flow is in upward direction
- (B) Seepage pressure is in upward direction

(C) Effective pressure is zero

(D) All the above

Answer: Option D

Question No. 200

Which of the following methods is best suited for determination of permeability of coarse-grained soils?

(A) Constant head method

(B) Falling head method

(C) Both the above

(D) None of the above

Answer: Option A

Question No. 201

Back fill with a sloping surface exerts a total active pressure  $P_a$  on the wall of height  $H$  and acts at

(A)  $H/4$  above the base parallel to base

(B)  $H/2$  above the base parallel to base

(C)  $H/3$  above the base parallel to base

(D)  $H/5$  above the base parallel to base

Answer: Option C

Question No. 202

The slope of isochrone at any point at a given time indicates the rate of change of

(A) Effective stress with time

(B) Effective stress with depth

(C) Pore water pressure with depth

(D) Pore water pressure with time

Answer: Option C

Question No. 203

The ratio of the volume of water present in a given soil mass to the total volume of its voids, is known

(A) Porosity

(B) Void ratio

(C) Percentage voids

(D) Degree of saturation

Answer: Option D

Question No. 204

A soil has bulk density  $2.30 \text{ g/cm}^3$  and water content 15 per cent, the dry density of the sample, is

(A)  $1.0 \text{ g/cm}^2$

(B)  $1.5 \text{ g/cm}^3$

(C)  $2.0 \text{ g/cm}^3$

(D)  $2.5 \text{ g/cm}^3$

Answer: Option C

Question No. 205

The total active earth pressure due to dry back fill with no surcharge, acts at  $H/3$  above the base of the wall and is directly proportional to

- (A)  $H$
- (B)  $H$
- (C)  $H^2$
- (D)  $H^3$

Answer: Option C

Question No. 206

Coefficient of consolidation for clays normally

- (A) Decreases with increase in liquid limit
- (B) Increases with increase in liquid limit
- (C) First increases and then decreases with increase in liquid limit
- (D) Remains constant at all liquid limits

Answer: Option A

Question No. 209

The maximum dry density upto which any soil can be compacted depends upon

- (A) Moisture content only
- (B) Amount of compaction energy only
- (C) Both moisture content and amount of compaction energy
- (D) None of the above

Answer: Option C

Question No. 210

For determine the specific gravity of soil solids, using a pycnometer of 500 cc., the following data is available : Weight of dry empty pycnometer = 125 g Weight of dried soil and pycnometer = 500 g Weight of dried soil and distilled = 850 g water filled in pycnometer up to top The specific gravity of soil solids, is

- (A) 2.0
- (B) 2.25
- (C) 2.50
- (D) 2.75

Answer: Option C

Question No. 211

If there is no impervious boundary at the bottom of a hydraulic structure, stream lines tend to follow:

- (A) A straight line
- (B) A parabola
- (C) A semi-ellipse
- (D) A semi-circle

Answer: Option C



Question No. 212

If a cohesive soil specimen is subjected to a vertical compressive load, the inclination of the cracks to the horizontal is

- (A) 90°
- (B) 45°
- (C) 22.5°
- (D) 0°

Answer: Option B

Question No. 213

The Westergaard analysis is used for

- (A) Sandy soils
- (B) Cohesive soils
- (C) Stratified soils
- (D) Clayey soils

Answer: Option C

Question No. 214

Cohesive soils are generally

- (A) Plastic and also compressible
- (B) Elastic and also compressible
- (C) Plastic but incompressible
- (D) None of these

Answer: Option A

Question No. 215

Coefficient of earth pressure at rest is

- (A) Less than active earth pressure but greater than passive earth pressure
- (B) Greater than active earth pressure but less than passive earth pressure
- (C) Greater than both the active earth pressure and passive earth pressure
- (D) Less than both the active and passive earth

pressures Answer: Option B

Question No. 216

The ratio of the volume of voids to the total volume of the given soil mass, is known

- (A) Porosity
- (B) Specific gravity
- (C) Void ratio
- (D) Water content

Answer: Option A

Question No. 217

The total weight of a pycnometer with water and oven dried soil 20 ( g) is 1600 g. The pycnometer filled with water alone weighs 1500 g. The specific gravity of the soil, is

- (A) 1.0

(B) 1.5

(C) 2.0

(D) 2.5

Answer: Option C

Question No. 218

In the plate loading test for determining the bearing capacity of soil, the size of square bearing plate should be

(A) Less than 300 mm

(B) Between 300 mm and 750 mm

(C) Between 750 mm and 1 m

(D) Greater than 1 m

Answer: Option B

Question No. 219

If the specific gravity of a soil particle of 0.05 cm diameter is 2.67, its terminal velocity while settling in distilled water of viscosity, 0.01 poise, is

(A) 0.2200 cm/sec

(B) 0.2225 cm/sec

(C) 0.2250 cm/sec

(D) 0.2275 cm/sec

Answer: Option D

Question No. 220

The shear strength in plastic undrained clay, is due to

(A) Inter-granular friction

(B) Internal friction

(C) Cohesion

(D) None of these

Answer: Option C

Question No. 221

A fully saturated soil is said to be

(A) One phase system

(B) Two phase system with soil and air

(C) Two phase system with soil and water

(D) Three phase system

Answer: Option C

Question No. 222

Pick up the incorrect statement from the following:

(A) Compaction has no effect on the structure of a soil

(B) Permeability decreases with increase in the dry density of a compacted soil

(C) A wet side compacted soil is more compressible than a dry side compacted soil

(D) Dry side compaction soils swell more when given access to moisture

Answer: Option A

Question No. 223

A pycnometer is used to determine

- (A) Voids ratio
- b) Dry density
- c) Water content
- d) Density index

Answer: Option C

Question No. 224

If the volume of voids is equal to the volume of solids in a soil mass, then the values of porosity and voids ratio respectively are

- (A) 1.0 and 0.0
- (B) 0.0 and 1.0
- (C) 0.5 and 1.0
- (D) 1.0 and 0.5

Answer: Option C

Question No. 225

The compressibility of clays is caused due to:

- (A) Expulsion of double layer water from in between the grains
- (B) Slipping of particles to new positions of greater density
- (C) Bending of particles as elastic sheets
- (D) All the above

Answer: Option D

Question No. 226

Sedimentation analysis is based on the assumption:

- (A) Soil particles are spherical
- (B) Particles settle independent of other particles
- (C) Walls of the jar do not affect the settlement
- (D) All the above

Answer: Option D

Question No. 227

A pycnometer is used to determine

- (A) Water content and voids ratio
- (B) Specific gravity and dry density
- (C) Water content and specific gravity
- (D) Voids ratio and dry density

Answer: Option C

Question No. 228

The vane shear test is used for the in-situ determination of the undrained strength of the intact fully saturated

- (A) Sands
- (B) Clays
- (C) Gravels
- (D) Highly organic soil

Answer: Option B

Question No. 230

When the plastic limit of a soil is greater than the liquid limit, then the plasticity index is reported

- (A) Negative
- (B) Zero
- (C) Non-plastic (NP)
- (D) 1

Answer: Option B

Question No. 231

Flow net is used for the determination of

- (A) Quantity of seepage
- (B) Hydrostatic pressure
- (C) Seepage pressure
- (D) All the above

Answer: Option D

Question No. 232

The inventor of the term soil mechanics, was

- (A) Kray
- (B) Dr. Karl Terzaghi
- (C) Leygue
- (D) Fellenius

Answer: Option B

Question No. 233

Highway Research Board (HRB) classification of soils is based on

- (A) Particle size composition
- (B) Plasticity characteristics
- (C) Both particle size composition and plasticity characteristics
- (D) None of the above

Answer: Option C

Question No. 234

The fundamental equation of air content ( $a_c$ ), degree of saturation ( $S_r$ ) and void ratio ( $e$ ), is

- (A)  $a_c = e (1 - S_r)/(1 - e)$
- (B)  $a_c = e (1 + S_r)/(1 + e)$
- (C)  $a_c = e (1 - S_r)/(1 + e)$
- (D)  $a = e (1 + S)/(1 - e)$

Answer: c Option C

Question No. 235

Stoke's law does not hold good if the size of particle is smaller than

- (A) 0.0002 mm
- (B) 0.002 mm
- (C) 0.02 mm
- (D) 0.2 mm

Answer: Option A

Question No. 236

Quick sand is a

- (A) Type of sand
- (B) Flow condition occurring in cohesive soils
- (C) Flow condition occurring in cohesion-less soils
- (D) Flow condition occurring in both cohesive and cohesion-less soils

Answer: Option A

Question No. 237

Pick up the correct statement from the following:

- (A) O.M.C. refers to the moisture corresponding to the maximum point on the moisture content dry density curve
- (B) The line which shows moisture content dry density relation for soil containing a constant percentage of air voids, is known as air void line
- (C) The free fall of hammer for compaction is 30.5 cm
- (D) All the above

Answer: Option D

Question No. 238

A saturated soil sample has water content of 40% and specific gravity of soil particles 2.7. The void ratio of the soil, is

- (A) 0.4
- (B) 0.52
- (C) 1.08
- (D) None of these

Answer: Option C

Question No. 239

The total discharge from two wells situated near to each other is

- (A) Sum of the discharges from individual wells
- (B) Less than the sum of the discharges from individual wells

(C) Greater than the sum of the discharges from individual wells

(D) Equal to larger of the two discharges from individual wells

Answer: Option B

Question No. 240

A sample of saturated soil has 30% water content and the specific gravity of soil grains is 2.6.

The dry density of the soil mass in  $\text{g/cm}^3$ , is

(A) 1.47

(B) 1.82

(C) 1.91

(D) None of these

Answer: Option D

Question No. 241

Compressibility of sandy soils is

(A) Almost equal to that of clayey soils

(B) Much greater than that of clayey soils

(C) Much less than that of clayey soils

(D) None of the above

Answer: Option C

Question No. 242

Depending upon the properties of a material, the failure envelope may

(A) Be either straight or curved

(B) Pass through the origin of stress

(C) Intersect the shear stress axis

(D) All the above

Answer: Option D

Question No. 243

The maximum pressure which a soil can carry without shear failure, is called

(A) Safe bearing capacity

(B) Net safe bearing capacity

(C) Net ultimate bearing capacity

(D) Ultimate bearing capacity

Answer: Option A

Question No. 244

In a deposit of normally consolidated clay

(A) Effective stress increases with depth but water content of soil and undrained strength decrease with depth

(B) Effective stress and water content increase with depth but undrained strength decreases with depth

(C) Effective stress and undrained strength increase with depth but water content decreases with depth

(D) Effective stress, water content and undrained strength decrease with depth

Answer: Option C

Question No. 245

A moist soil sample weighing 108 g has a volume of 60 cc. If water content is 25% and value of  $G = 2.52$ , the void ratio is

- (A) 0.55
- (B) 0.65
- (C) 0.75
- (D) 0.80

Answer: Option C

Question No. 246

For slopes of limited extent the surface of slippage, is usually along

- (A) A parabolic arc
- (B) An elliptical arc
- (C) A straight line
- (D) A circular arc

Answer: Option D

Question No. 247

A retaining wall 6m high supports a backfill with a surcharge angle of  $10^\circ$ . The back of the wall is inclined to the vertical at a positive batter angle of  $5^\circ$ . If the angle of wall friction is  $7^\circ$ , then the resultant active earth pressure will act at a distance of 2 m above the base and inclined to the horizontal at an angle of

- (A)  $7^\circ$
- (B)  $10^\circ$
- (C)  $12^\circ$
- (D)  $17^\circ$

Answer: Option C

Question No. 248

The minimum water content at which the soil just begins to crumble when rolled into threads 3 mm in diameter, is known

- (A) Liquid limit
- (B) Plastic limit
- (C) Shrinkage limit
- (D) Permeability limit

Answer: Option B

Question No. 249

Valid range for  $S$ , the degree of saturation of soil in percentage is

- (A)  $S > 0$
- 3.  $S < 0$
- 4.  $0 < S < 100$
- 5.  $0 < S < 100$

Answer: Option D

Question No. 250

The minimum water content at which the soil retains its liquid state and also possesses a small shearing strength against flowing, is known

- (A) Liquid limit
- (B) Plastic limit
- (C) Shrinkage limit
- (D) Permeability limit

Answer: Option A

Question No. 251

'Drift' is the material picked up, mixed, disintegrated, transported and redeposited by

- (A) Wind
- (B) Gravitational force
- (C) Glaciated water
- (D) All the above

Answer: Option C

Question No. 252

The ratio of volume of voids to the total volume of soil mass is called

- (A) Air content
- (B) Porosity
- (C) Percentage air voids
- (D) Voids ratio

Answer: Option B

Question No. 253

The ratio of the volume of voids to the volume of soil solids in a given soil mass, is known

- (A) Porosity
- (B) Specific gravity
- (C) Void ratio
- (D) Water content

Answer: Option C

Question No. 254

The specific yield of soil depends upon

- (A) Compaction of stratum
- (B) Distribution of pores
- (C) Shape and size of particles
- (D) All the above

Answer: Option D

Question No. 255

The hydrometer method of sedimentation analysis differs from the pipette analysis mainly in

- (A) The principle of test



- (B) The method of taking observations
- (C) The method of preparation of soil suspension
- (D) All of the above

Answer: Option B

Question No. 256

Degree of saturation of a natural soil deposit having water content 15%, specific gravity 2.50 and void ratio 0.5, is

- (A) 50 %
- (B) 60 %
- (C) 75 %
- (D) 80 %

Answer: Option C

Question No. 257

Cohesionless soil is

- (A) Sand
- (B) Silt
- (C) Clay
- (D) Clay and silt

Answer: Option A

Question No. 258

At liquid limit, all soils possess

- (A) Same shear strength of small magnitude
- (B) Same shear strength of large magnitude
- (C) Different shear strengths of small magnitude
- (D) Different shear strengths of large magnitude

Answer: Option A

Question No. 259

The ratio of the weight of given volume of soil solids to the weight of an equal volume of distilled water at the given temperature, is known

- (A) Porosity
- (B) Specific gravity
- (C) Void ratio
- (D) Water content

Answer: Option B

Question No. 260

For a base failure of a slope, depth factor

- (A)  $D_f = 1$
- (C)  $D_f < 1$
- (D)  $D_f > 1$
- (E) None of these

Answer: Option C

Question No. 261

If the water table rises upto ground surface, then the

- (A) Effective stress is reduced due to decrease in total stress only but pore water pressure does not change
- (B) Effective stress is reduced due to increase in pore water pressure only but total stress does not change
- (C) Total stress is reduced due to increase in pore water pressure only but effective stress does not change
- (D) Total stress is increased due to decrease in pore water pressure but effective stress does not change

Answer: Option B

Question No. 262

A coarse-grained soil has a voids ratio 0.75, and specific gravity as 2.75. The critical gradient at which quick sand condition occurs, is

- (A) 0.25
- (B) 0.50
- (C) 0.75
- (D) 1.00

Answer: Option D

Question No. 263

The shear strength of a soil

- (A) Increases with an increase in the normal stress
- (B) Is proportional to the cohesion of the soil
- (C) Is generally known as the strength of the soil
- (D) All the above

Answer: Option D

Question No. 264

Total number of stress components at a point within a soil mass loaded at its boundary is

- (A) 3
- (B) 6
- (C) 9
- (D) 16

Answer: Option C

Question No. 265

A partially saturated soil is classified as

- (A) One phase soil
- 4. Two phase soil
- 5. Three phase soil
- 6. Four phase soil

Answer: Option C

Question No. 266

The ratio of the undrained strength in the undrained state to the undrained strength, at the same water content, in the remoulded state, is called the sensitivity of the clay. Its value for quick clays is

- (A) 4
- (B) 8
- (C) 12
- (D) 20

Answer: Option D

Question No. 267

The ultimate consolidation settlement of a soil is

- (A) Directly proportional to the voids ratio
- (B) Directly proportional to the compression index
- (C) Inversely proportional to the compression index
- (D) None of the above

Answer: Option B

Question No. 268

The ratio of settlement at any time 't' to the final settlement, is known as

- (A) Co-efficient of consolidation
- (B) Degree of consolidation
- (C) Consolidation index
- (D) Consolidation of undisturbed soil

Answer: Option B

Question No. 269

Pick up the correct statement from the following:

- (A) In hydrometer method, weight  $W_d$  per ml of suspension is found directly
- (B) In pipette analysis, weight  $W_d$  per ml of suspension is found indirectly
- (C) In pipette analysis, weight  $W_d$  per ml of suspension is found directly
- (D) None of these

Answer: Option C

Question No. 270

Unconfined compressive strength test is

- (A) Undrained test
- (B) Drained test
- (C) Consolidated undrained test
- (D) Consolidated drained test

Answer: Option A

Question No. 271

For shear strength, triaxial shear test is suitable because

- (A) It can be performed under all three drainage conditions
  - (B) Precise measurement of the pore pressure and volume change during the test is possible
  - (C) Stress distribution on the failure plane, is uniform
  - (D) All the above
- Answer: Option D

Question No. 272

The zero atmospheric pressure is at

- (A) Sea level
- (B) Water table
- (C) Phreatic surface
- (D) Both (B) and (C) of the above

Answer: Option D

Question No. 273

Terzaghi's bearing capacity factors  $N_c$ ,  $N_q$  and  $N_r$  are functions of

- (A) Cohesion only
- (B) Angle of internal friction only
- (C) Both cohesion and angle of internal friction
- (D) None of the above

Answer: Option B

Question No. 275

'Loess' is silty clay formed by the action of

- (A) Water
- (B) Glacier
- (C) Wind
- (D) Gravitational force

Answer: Option C

Question No. 276

Rise of water table in cohesion-less soils upto ground surface reduces the net ultimate bearing capacity approximately by

- (A) 25 %
- (B) 50 %
- (C) 75 %
- (D) 90 %

Answer: Option B

Question No. 277

A decrease in water content results in a reduction of the volume of a soil in

- (A) Liquid state
- (B) Plastic state
- (C) Semi solid state
- (D) All of these

Answer: Option D

Question No. 278

In non-cohesive soil in passive state of plastic equilibrium

- (A) Major principal stress is horizontal
- (B) Minor principal stress is vertical
- (C) Major principal stress is vertical
- (D) Minor and major principal stresses are equally inclined to the horizontal

Answer: Option B

Question No. 279

A soil has a bulk density of 22 kN/m<sup>3</sup> and water content 10 %. The dry density of soil is

- (A) 18.6 kN/m<sup>3</sup>
- (B) 20.0 kN/m<sup>3</sup>
- (C) 22.0 kN/m<sup>3</sup>
- (D) 23.2 kN/m<sup>3</sup>

Answer: Option B

Question No. 282

If the sand in-situ is in its densest state, then the relative density of sand is

- (A) Zero
- (B) 1
- (C) Between 0 and 1
- (D) Greater than 1

Answer: Option B

Question No. 283

If dry density, water density and specific gravity of solids of a given soil sample are 1.6 g/cc, 1.84 g/cc and 2.56 respectively, the porosity of the soil sample, is

- (A) 0.375
- (B) 0.370
- (C) 0.380
- (D) 0.390

Answer: Option A

Question No. 284

The property of a soil which permits water to percolate through it, is called

- (A) Moisture content
- (B) Permeability
- (C) Capillarity
- (D) None of these

Answer: Option B

Question No. 285

Toughness index is defined as the ratio of

- (A) Plasticity index to consistency index

- (B) Plasticity index to flow index
- (C) Liquidity index to flow index
- (D) Consistency index to liquidity index

Answer: Option B

Question No. 286

A moist soil sample of volume 60 cc. weighs 108 g and its dried weight is 86.4 g. If its absolute density is 2.52, the degree of saturation is

- (A) 54 %
- (B) 64 %
- (C) 74 %
- (D) 84 %

Answer: Option D

Question No. 287

The hydraulic head that would produce a quick condition in a sand stratum of thickness 1.5 m, specific gravity 2.67 and voids ratio 0.67 is equal to

- (A) 1.0 m
- (B) 1.5 m
- (C) 2.0 m
- (D) 3 m

Answer: Option B

Question No. 290

The factor which affects the compaction, is

- (A) Moisture content
- (B) Compacting content
- (C) Method of compaction
- (D) All the above

Answer: Option D

Question No. 291

In a consolidated drained test on a normally consolidated clay, the volume of the soil sample during shear

- (A) Decreases
- (B) Increases
- (C) Remains unchanged
- (D) First increases and then decreases

Answer: Option A

Question No. 292

Pick up the correct statement from the following:

- (A) The rise of the ground surface due to frost action is called frost heave
- (B) The freezing of water is accompanied by a volume increase of 9%
- (C) Below freezing point, higher soil suction develops
- (D) All the above

Answer: Option D

Question No. 294

The maximum value of effective stress in the past divided by the present value is defined as over consolidation ratio (OCR). The O.C.R. of an over consolidated clay is

- (A) Less than 1
- (B) 1
- (C) More than 1
- (D) None of these

Answer: Option C

Question No. 295

A 300 mm square bearing plate settles by 15 mm in a plate load test on a cohesive soil when the intensity of loading is  $0.2 \text{ N/mm}^2$ . The settlement of a prototype shallow footing 1 m square under the same intensity of loading is

- (A) 15 mm
- (B) 30 mm
- (C) 50 mm
- (D) 167 mm

Answer: Option C

Question No. 296

The effective size of particles of soil is denoted by

- (A) D10
- (B) D20
- (C) D30
- (D) D60

Answer: Option A

Question No. 297

Valid range for  $n$ , the percentage voids, is

- (A)  $0 < n < 100$
- (Q)  $0 < n < 100$
- (R)  $n > 0$
- (S)  $n < 0$

Answer:  
Option A

Question No. 298

If  $S$ ,  $L$  and  $R$  are the arc length, long chord and radius of the sliding circle then the perpendicular distance of the line of the resultant cohesive force, is given by

- (A)  $a = S.R / L$
- (B)  $a = L.S / R$
- (C)  $a = L.R / S$

(D) None of these

Answer: Option A

Question No. 299

Uniformity coefficient of a soil is

(A) Always less than 1

(B) Always equal to 1

(C) Equal to or less than 1

(D) Equal to or greater than 1

Answer: Option D

Question No. 300

The fluid generally used for grouting is

(A) Cement and water mix

(B) Clay suspension

(C) Sodium silicate

(D) All the above

Answer: Option D

Question No. 301

The total and effective stresses at a depth of 5 m below the top level of water in a swimming pool are respectively

(A) Zero and zero

(B)  $0.5 \text{ kg/cm}^2$  and zero

(C)  $0.5 \text{ kg/cm}^2$  and  $0.5 \text{ kg/cm}^2$

(D)  $1.0 \text{ kg/cm}^2$  and  $0.5 \text{ kg/cm}^2$

Answer: Option B

Question No. 302

Pick up the in-correct statement from the following: The soils which contain montmorillonite minerals

(A) Swell more when wet

(B) Shrink more when dry

(C) Possess high plasticity

(E) Possess high coefficient of internal coefficient

Answer: Option D

Question No. 303

Time factor for a clay layer is

(A) A dimensional parameter

(B) Directly proportional to permeability of soil

(C) Inversely proportional to drainage path

(D) Independent of thickness of clay layer

Answer: Option B

Question No. 304



The critical exist gradient of seepage water in soils, is

- (A) Directly proportional to the voids ratio
- (B) Inversely proportional to the specific gravity
- (C) Directly proportional to the specific gravity
- (D) None of these

Answer: Option D

Question No. 305

In the triaxial compression test, the application of additional axial stress (i.e. deviator stress) on the soil specimen produces shear stress on

- (A) Horizontal plane only
- (B) Vertical plane only
- (C) Both horizontal and vertical planes
- (D) All planes except horizontal and vertical planes

Answer: Option D

Question No. 306

For a clay slope of height of 10 m, the stability number is 0.05,  $\gamma = 2.0 \text{ t/m}^3$ ,  $C = 2.5 \text{ t/m}^2$ , the critical height of the slope of the soil, is

- (A) 4.0 m
- (B) 12.5 m
- (C) 25.0 m
- (D) 15.0 m

Answer: Option C

Question No. 307

Allowable bearing pressure for a foundation depends upon

- (A) Allowable settlement only
- (B) Ultimate bearing capacity of soil only
- (C) Both allowable settlement and ultimate bearing capacity
- (D) None of above

Answer: Option C

Question No. 308

Pick up the correct statement from the following:

- (A) The property of a soil that enables it to become stiff in a relatively short time on standing is called thixotropy
- (B) The ratio of shear strength in natural state to the remoulded shear strength under undrained conditions is called degree of sensitivity
- (C) The difference between the undisturbed shear strength and remoulded shear strength is known remoulding loss
- (D) All the above

Answer: Option D

Question No. 309

Voids ratio of a soil mass can

- (A) Never be greater than unity
- (B) Be zero
- (C) Take any value greater than zero
- (D) Take values between 0 and 1 only

Answer: Option C

Question No. 310

If the cohesive force ( $c$ ), is  $1.5 \text{ t/m}^2$ , the density ( $\gamma$ ) of the soil is  $2.0 \text{ t/m}^3$ , factor of safety ( $F$ ) is 1.5 and stability factor ( $S_n$ ) is 0.05, the safe height  $h$  of a slope is

- (A) 5 metres
- (B) 8 metres
- (C) 10 metres
- (D) 12 metres

Answer: Option C

Question No. 311

If the plasticity index of a soil mass is zero, the soil is

- (A) Sand
- (B) Silt
- (C) Clay
- (D) Clayey silt

Answer: Option A

Question No. 312

Coulomb's wedge theory assumes that

- (A) Back fill is dry, cohesionless, homogeneous and isotropic
- (B) Slip surface is the plane which passes through the heel of the wall
- (C) Position and direction of the resultant earth pressure are known
- (D) All the above

Answer: Option D

Question No. 313

Due to a rise in temperature, the viscosity and the unit weight of the percolating fluid are reduced to 60% and 90% respectively. If other things remain constant, the coefficient of permeability

- (A) Increases by 25 %
- (B) Increases by 50 %
- (C) Increases by 33.3 %
- (D) Decreases by 33.3 %

Answer: Option B

Question No. 314

Transporting and re-depositing soils, is done by

- (A) Water

- (B) Glacier
  - (C) Gravity
  - (D) All the above
- Answer: Option D

Question No. 315

For a loose sand sample and a dense sand sample consolidated to the same effective stress

- (A) Ultimate strength is same and also peak strength is same
- (B) Ultimate strength is different but peak strength is same
- (C) Ultimate strength is same but peak strength of dense sand is greater than that of loose sand
- (D) Ultimate strength is same but peak

Answer: Option C

Question No. 316

The void ratio of a soil sample decreases from 1.50 to 1.25 when the pressure is increased from 25 tonnes/m<sup>2</sup> to 50 tonnes/m<sup>2</sup>, the coefficient of compressibility is

- (A) 0.01
- (B) 0.02
- (C) 0.05
- (D) 0.001

Answer: Option A

Question No. 317

The coefficient of active earth pressure for a loose sand having an angle of internal friction of 30° is

- (A) 1/3
- (B) 3
- (C) 1
- (D) 1/2

Answer: Option B

Question No. 318

The maximum net pressure intensity causing shear failure of soil, is known

- (B) Safe bearing capacity
- (C) Net safe bearing capacity
- (D) Net ultimate bearing capacity
- (E) Ultimate bearing capacity

Answer: Option C

Question No. 319

If the degree of saturation of a partially saturated soil is 60%, then air content of the soil is

- (A) 40 %
- (B) 60 %
- (C) 80 %
- (D) 100 %

Answer: Option A

Question No. 320

Which one of the following statements is true?

- (A) Clays are more porous than sands
- (B) Pressure of organic matter in a soil decreases the bearing capacity of the soil
- (C) Aluminous cement is used for foundations in soils with chemical deposits
- (D) All the above

Answer: Option D

Question No. 321

According to IS classification, the range of silt size particles is

- (A) 4.75 mm to 2.00 mm
- (B) 2.00 mm to 0.425 mm
- (C) 0.425 mm to 0.075 mm
- (D) 0.075 mm to 0.002 mm

Answer: Option D

Question No. 322

Pick up the clay soil group which does not swell when wet from the following:

- (A) Kaolinite group
- (B) Mite group
- (C) Vermiculite group
- (D) Montmorillonite group

Answer: Option B

Question No. 323

Coefficient of consolidation of a soil is affected by

- (A) Compressibility
- (B) Permeability
- (C) Both compressibility and permeability
- (D) None of the above

Answer: Option C

Question No. 324

Pick up the correct statement from the following:

- (A) When water table is above the base of a footing, the dry weight  $m$  should be used for soil below water table
- (B) When water table is located somewhat below the base of a footing, the elastic wedge is partly of moist soil and partly of submerged soil, and a suitable reduction factor is used
- (C) When water table is just at the base of the footing, no reduction factor is used
- (D) None of these

Answer: Option B

Question No. 325

Select the incorrect statement.

Effective angle of shearing resistance

- (A) Increases as the size of particles increases
- (B) Increases as the soil gradation improves
- (C) Is limited to a maximum value of  $45^\circ$
- (D) Is rarely more than  $30^\circ$  for fine grained soil

Answer: Option C

Question No. 326

The relationship between void ratio (e) and porosity ratio (n) is:

- (A)  $n = (1 + e)/(1 - e)$
- (B)  $e = (1 + n)/(1 - e)$
- (C)  $n = e/(1 - e)$
- (D)  $e = n/(1 - n)$

Answer: Option D

Question No. 327

Relative density of a compacted dense sand is approximately equal to

- (A) 0.4
- (B) 0.6
- (C) 0.95
- (D) 1.20

Answer: Option C

Question No. 328

Pick up the correct statement from the following:

- (A) To an agriculturist, soil is the substance existing on the earth's surface, which grows and develops plants
- (B) To a geologist, soil is the material in a relatively thin surface zone within which roots occur, and rest of the crust is termed as rock irrespective of hardness
- (C) To an engineer, soil is the unaggregated and uncemented deposits of minerals and organic particles covering the earth's crust
- (D) All the above

Answer: Option D

Question No. 329

Inorganic soils with low compressibility are represented by

- (A) MH
- (B) SL
- (C) ML
- (D) CH

Answer: Option C

Question No. 332

In a triaxial compression test when drainage is allowed during the first stage (i. e. application of cell pressure) only and not during the second stage (i.e. application of deviator stress at constant cell pressure), the test is known as

- (A) Consolidated drained test
- (B) Consolidated undrained test
- (C) Unconsolidated drained test
- (D) Unconsolidated undrained test

Answer: Option B

Question No. 333

The specific gravity of quartz, is

- (A) 2.65
- (B) 2.72
- (C) 2.85
- (D) 2.90

Answer: Option A

Question No. 334

In hydrometer analysis for a soil mass

- (A) Both meniscus correction and dispersing agent correction are additive
- (B) Both meniscus correction and dispersing agent correction are subtractive
- (C) Meniscus correction is additive and dispersing agent correction is subtractive
- (D) Meniscus correction is subtractive and dispersing agent correction is

additive Answer: Option C

Question No. 335

The capillary rise of water

- (A) Depends upon the force responsible
- (B) Increases as the size of the soil particles increases
- (C) Decreases as the size of the soil particles decreases
- (D) Is less in wet soil than in dry soil

Answer: Option A

Question No. 336

The value of compression index for a remoulded sample whose liquid limit is 50% is

- (A) 0.028
- (B) 0.28
- (C) 0.36
- (D) 0.036

Answer: Option B

Question No. 337

Fine sand possesses

- (A) Good plasticity
- (B) Limited plasticity
- (C) Reasonable plasticity
- (D) Clay

Answer: Option D

Question No. 338

Coarse grained soils are best compacted by a

- (A) Drum roller
- (B) Rubber tyred roller
- (C) Sheep's foot roller
- (D) Vibratory roller

Answer: Option D

Question No. 339

Darcy's law is applicable to seepage if a soil is

- (A) Homogeneous
- (B) Isotropic
- (C) Incompressible
- (C) All the above

Answer: Option D

Question No. 340

According to Atterberg, the soil is said to be of medium plasticity if the plasticity index PI is

- (A)  $0 < PI < 7$
- (B)  $7 < PI < 17$
- (C)  $17 < PI < 27$
- (D)  $PI > 27$

Answer: Option B

Question No. 341

The coefficient of curvature for a well graded soil, must be between

- (A) 0.5 to 1.0
- (B) 1.0 to 3.0
- (C) 3.0 to 4.0
- (D) 4.0 to 5.0

Answer: Option B

Question No. 342

A normally consolidated clay settled 10 mm when effective stress was increased from 100 kN/m<sup>2</sup> to 200 kN/m<sup>2</sup>. If the effective stress is further increased from 200 kN/m<sup>2</sup> to 400 kN/m<sup>2</sup>, then the settlement of the same clay is

- (A) 10 mm
- (B) 20 mm
- (C) 40 mm
- (D) None of the above

Answer: Option A

Question No. 343

The lateral earth pressure on a retaining wall

- (A) Is equal to mass of the soil retained
- (B) Proportional to the depth of the soil
- (C) Proportional to the square of the depth of the soil
- (D) Proportional to the internal friction of the soil

Answer: Option D

Question No. 344

If the permeability of a soil is 0.8 mm/sec, the type of soil is

- (A) Gravel
- (B) Sand
- (C) Silt
- (D) Clay

Answer: Option B

Question No. 345

A compacted soil sample using 10% moisture content has a weight of 200 g and mass unit weight of 2.0 g/cm<sup>3</sup>. If the specific gravity of soil particles and water are 2.7 and 1.0, the degree of saturation of the soil is

- (A) 11.1 %
- (B) 55.6 %
- (C) 69.6 %
- (D) None of these

Answer: Option B

Question No. 346

Which of the following soils has more plasticity index?

- (A) Sand
- (B) Silt
- (C) Clay
- (D) Gravel

Answer: Option C

Question No. 347

The liquid limit and plastic limit exist in

- (A) Sandy soils
- (B) Silty soils
- (C) Gravel soils
- (D) Clay soils

Answer: Option D



Question No. 348

For determining the moisture content of a soil sample, the following data is available Weight of container = 260 g, Weight of soil sample and = 320 g container, Weight of soil sample (dried) and = 310 g container. The moisture content of the soil sample, is

- (A) 15 %
- (B) 18 %
- (C) 20 %
- (D) 25 %

Answer: Option C

Question No. 349

For a homogeneous earth dam 50 m high having 2 m free broad, a flow net was constructed and the results were : Number of potential drops = 2.4 Number of flow channels = 0.4. If co - efficiency of permeability of the dam material is  $3 \times 10^{-3}$  cm<sup>3</sup>/sec, the discharge per metre length of dam, is

- (A)  $12 \times 10^{-5}$  m<sup>3</sup>/sec
- (B)  $24 \times 10^{-3}$  m<sup>3</sup>/sec
- (C)  $6 \times 10^{-5}$  m<sup>3</sup>/sec
- (D)  $24 \times 10^{-5}$  m<sup>3</sup>/sec

Answer: Option D

Question No. 350

The soil which contains finest grain particles, is

- (A) Coarse sand
- (B) Fine sand
- (C) Silt
- (D) Clay

Answer: Option D

Question No. 351

Si particles

- (A) Show dilatancy
- (B) Swell when moist
- (C) Possess high strength when dry
- (D) Disintegrate easily

Answer: Option A

Question No. 353

The minimum centre to centre distance of friction piles of 1 m diameter, is

- (A) 2 m
- (B) 2 m to 3 m
- (C) 3 m to 4 m

(D) 5 m

Answer: Option C

Question No. 354

When drainage is permitted under initially applied normal stress only and full primary consolidation is allowed to take place, the test is known as

- (A) Quick test
- (B) Drained test
- (C) Consolidated undrained test
- (D) None of these

Answer: Option C

Question No. 355

If the failure of a finite slope occurs through the toe, it is known as

- (A) Slope failure
- (C) Face failure
- (D) Base failure
- (E) Toe failure

Answer: Option D

Question No. 356

The liquidity index is defined as a ratio expressed as percentage of

- (A) Plastic limit minus the natural water content, to its plasticity index
- (B) Natural water content minus its plastic limit to its plasticity index
- (C) Natural water content plus its plastic limit to its plasticity index
- (D) Liquid limit minus the natural water content to the plasticity index

Answer: Option B

Question No. 357

Number of piles required to support a column, is

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Answer: Option C

Question No. 358

According to the Indian Standards the specific gravity is the ratio of the unit weight of soil solids to that of water at a temperature of

- (A) 17°C
- (B) 23°C
- (C) 27°C
- (D) 30°C

Answer: Option C

Question No. 359

Maximum size of clay particles is:

- (A) 0.002 mm
- (B) 0.04 mm
- (C) 0.06 mm
- (D) 0.08 mm

Answer: Option A

Question No. 361

The compression resulting from a long term static load and consequent escape of pore water, is known as

- (A) Compaction
- (B) Consolidation
- (C) Swelling
- (D) None of these

Answer: Option B

Question No. 362

Minimum size of the particles of silt soil, is

- (A) 0.002 mm
- (B) 0.04 mm
- (C) 0.06 mm
- (D) 0.08 mm

Answer: Option A

Question No. 363

The ultimate Settlement of a soil is directly proportional to:

- (A) Depth of the compressible soil strata
- (B) Compressive index
- (C) Both (a) and (b)
- (D) None of these

Answer: Option D

Question No. 364

A pile is being driven with a drop hammer weighing 1800 kg and having a free fall of 1.00 m. If the penetration with last blow is 5 mm, the load carrying capacity of the pile, -according to the Engineering News formula, is

- (A) 100 tonnes
- (B) 50 tonnes
- (C) 20 tonnes
- (D) 10 tonnes

Answer: Option D

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Question No. 366

Water formed transported soil is

- (A) Alluvial
- (B) Marine
- (C) Lacustrine
- (D) Loess

Answer: Option D

Question No. 370

The weight of a pycnometer containing 400 g sand and water full to the top is 2150 g. The weight of pycnometer full of clean water is 1950 g. If specific gravity of the soil is 2.5, the water content is

- (A) 5 %
- (B) 10 %
- (C) 15 %
- (D) 20 %

Answer: Option D

Question No. 371

A phreatic line is defined as the line within a dam section below which there are

- (A) Positive equipotential lines
- (B) Positive hydrostatic pressure
- (C) Negative hydrostatic pressure
- (D) Negative equipotential lines

Answer: Option B

Question No. 372

The coefficient of curvature is defined

- (A)  $D_{60}/D_{10}$
- (B)  $D_{10}/D_{60}$
- (C)  $D_{30}^2/D_{60} D_{10}$
- (D)  $D_{10}^2/ D_{30} D_{60}$

Answer: Option C

Question No. 373

Accurate determination of water content, is made by

- (A) Calcium carbide method
- (B) Sand bath method
- (C) Alcohol method
- (D) Oven-drying method

Answer: Option D

Question No. 374

The clay soil mainly consists of

- (A) Kaolinite
- (B) Montmorillonite
- (C) Vermiculite
- (D) All the above

Answer: Option D

Question No. 375

The maximum shear stress occurs on the filament which makes an angle with the horizontal plane equal to

- (A) 30°
- (B) 45°
- (C) 60°
- (D) 90°

Answer: Option B

Question No. 377

Water content of a soil sample is the difference of the weight of the given sample at the given temperature and the weight determined after drying it for 24 hours at temperature ranging from

- (A) 80° to 90°C
- (B) 90° to 95°C
- (C) 103° to 105°C
- (D) 105° to 110°C

Answer: Option D

Question No. 378

The equation  $\tau = C + \sigma \tan \phi$  is given by

- (A) Rankine
- (B) Coulomb
- (D) Mohr

Answer: Option B

Question No. 379

Determination of water content of a soil sample suspected to contain gypsum is made by drying the sample for longer period at a temperature not more than

- (A) 60°C
- (B) 80°C
- (C) 100°C
- (D) 110°C

Answer: Option B

Question No. 380

Pick up the correct statement from the following:

- (A) The phenomenon of quicksand generally occurs in the cohesionless soil
- (B) At critical hydraulic gradient, the saturated sand becomes quick
- (C) The critical gradient depends on the void ratio and the specific gravity
- (D) All the above

Answer: Option D

Question No. 381

A soil sample has passing 0.075 mm sieve = 60% liquid limit = 65% and plastic limit = 40%. The group index of the soil, is

- (A) 5
- (B) 20
- (C) 40
- (F) None of these

Answer: Option D

Question No. 382

The plasticity index is the numerical difference between

- (A) Liquid limit and plastic limit
- (B) Plastic limit and shrinkage limit
- (C) Liquid limit and shrinkage limit
- (D) None of these

Answer: Option A

Question No. 383

The specific gravity of sands, is approximately

- (A) 1.6
- (B) 2.0
- (C) 2.2
- (D) 2.6

Answer: Option D

## HYDRAULICS AND FLUID MECHANICS

Fluid Mechanics is that section of applied mechanics, concerned with the statics and dynamics of liquids and gases. Knowledge of fluid mechanics is essential for the chemical engineer, because the majority of chemical processing operations are conducted either partially or totally in the fluid phase. The handling of liquids is much simpler, much cheaper, and much less troublesome than handling solids. Even in many operations a solid is handled in a finely divided state so that it stays in suspension in a fluid. Fluid Statics: treats fluids in the equilibrium state of no shear stress. Fluid Mechanics: treats when portions of fluid are in motion relative to other parts. A fluid is defined as a substance that deforms continuously under the action of a shear stress, however small magnitude present. It means that a fluid deforms under very small shear stress, but a solid may not deform under that magnitude of the shear stress. It is a substance, as a liquid or gas, that is capable of flowing and that changes its shape at a steady rate when acted upon by a force tending to change its shape. The differences between the behaviours of solids and fluids under an applied force are as follows: For a solid, the strain is a function of the applied stress, providing that the elastic limit is not exceeded. For a fluid, the rate of strain is proportional to the applied stress. The strain in a solid is independent of the time over which the force is applied and, if the elastic limit is not exceeded, the deformation disappears when the force is removed. A fluid continues to flow as long as the force is applied and will not recover its original form when the force is removed. **Newtonian fluids:** Fluids which obey the Newton's law of viscosity are called as Newtonian fluids. Newton's law of viscosity is given by

where  $\tau$  = shear stress

$\mu$  = viscosity of fluid

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

$du/dy$  = shear rate, rate of strain or velocity gradient.

All gases and most liquids which have simpler molecular formula and low molecular weight such as water, benzene, ethyl alcohol,  $CCl_4$ , hexane and most solutions of simple molecules are Newtonian fluids. **Non-Newtonian fluids:** Fluids which do not obey the Newton's law of viscosity are called as non-Newtonian fluids. Generally non-Newtonian fluids are complex mixtures: slurries, pastes, gels, polymer solutions etc. Density: The density of a substance is the quantity of matter contained in a unit volume of the substance. Mass Density: Mass Density,  $\rho$ , is defined as the mass of substance per unit volume. Specific Weight: Specific Weight  $\omega$ , (sometimes  $\gamma$ , and sometimes known as specific gravity) is defined as the weight per unit volume or The force exerted by gravity,  $g$ , upon a unit volume of the substance.

**Relative Density:** Relative Density,  $\sigma$ , is defined as the ratio of mass density of a substance to some standard mass density. **Viscosity:** Viscosity, is the property of a fluid, due to cohesion and interaction between molecules, which offers resistance to sheer deformation. Different fluids deform at different rates under the same shear stress. Fluid with a high viscosity such as syrup, deforms more slowly than fluid with a low viscosity such as water.

**Coefficient of Dynamic Viscosity:** The Coefficient of Dynamic Viscosity,  $\mu$ , is defined as the shear force, per unit area, (or shear stress  $\tau$ ), required to drag one layer of fluid with unit velocity past another layer a unit distance away. **Kinematic Viscosity:** Kinematic Viscosity,  $\nu$ , is defined as the ratio of dynamic viscosity to mass density.

$$\nu = \frac{\mu}{\rho}$$

**Vapour Pressure:** The pressure at which a liquid will boil is called its vapor pressure. This pressure is a function of temperature (vapor pressure increases with temperature). In this context we usually think about the temperature at which boiling occurs.

**Compressibility:** All materials, whether solids, liquids or gases, are compressible, i.e. the volume  $V$  of a given mass will be reduced to  $V - dV$  when a force is exerted uniformly all over its surface.

**Surface tension:** It is a fluid property which occurs at the interfaces of a liquid and gas or at the interface of two immiscible liquids. the corresponding net force is referred to as surface tension,  $\delta$ . In short it is apparent tensile stresses which acts at the interface of two immiscible fluids.

**Capillarity:** It is important (in fluid measurements) when using tubes smaller than about 10 mm in diameter. Capillary rise (or depression) in a tube can be calculated by making force balances. The forces acting are force due to surface tension and gravity.

### Pressure Measuring Instruments

A somewhat more complicated device for measuring fluid pressure consists of a bent tube containing one or more liquid of different specific gravities. Such a device is known as manometer. In using a manometer, generally a known pressure (which may be atmospheric) is applied to one end of the manometer tube and the unknown pressure to be determined is applied to the other end. In some cases, however, the difference between pressure at ends of the manometer tube is desired rather than the actual pressure at the either end. A manometer to determine this differential pressure is known as differential pressure manometer.

**Manometers - Various forms:** Simple U - tube Manometer, Inverted U - tube Manometer,

U - tube with one leg enlarged, Two fluid U - tube Manometer, Inclined U - tube Manometer

**Bourdon Gauge:**

The pressure to be measured is applied to a curved tube, oval in cross section. Pressure applied to the tube tends to cause the tube to straighten out, and the deflection of the end of the tube is communicated through a system of levers to a recording needle. This gauge is widely used for



steam and compressed gases. The pressure indicated is the difference between that communicated by the system to the external (ambient) pressure, and is usually referred to as the gauge pressure.

**Buoyancy**

Upthrust on body = weight of fluid displaced by the body

This is known as Archimedes principle.

**Center of Buoyancy:** The line of action of the buoyant force on the object is called the center of buoyancy.

**Metacentric height (GM):** The metacentric height (GM) is a measurement of the initial static stability of a floating body. It is calculated as the distance between the centre of gravity of a ship and its metacentre.

**Centre of Pressure:** The point of application of total pressure on the surface is known as centre of pressure.

### **Fluid Kinematics**

**Fluids** tend to flow easily, which causes a net motion of molecules from one point in space to another point as a function of time. Fluid kinematics is the branch of Fluid Mechanics, which deals with the study of velocity and acceleration of the particles of fluid in motion and their distribution in space without considering any force or energy involved.

### **Description of Fluid Motion**

The motion of fluid particles may be described by the following two methods: Lagrangian method and Eulerian method

**Lagrangian method:** the path, density, velocity and other characteristics of each fluid particle in a flow is traced. The path taken by the particles and the changes in its velocity and acceleration are studied.

**Eulerian method:** study the flow characteristics (velocity, pressure, density, etc.) and their variation with time at fixed points in space.

- **Streamline:** A line everywhere tangent to the fluid velocity  $\sim v$  at a given instant (flow snapshot). It is a strictly Eulerian concept.
- **Streak line:** Instantaneous locus of all fluid particles that have passed a given point (snapshot of certain fluid particles).
- **Path line:** The trajectory of a given particle P in time. The photograph analogy would be a long time exposure of a marked particle. It is a strictly Lagrangian concept.

### **Types of Fluid Flow**

Flow characterized by two parameters – time and distance.

### **Division of flows with respect to time:**

- Steady flow – time independent
- Unsteady flow – time dependent
- Quasi-steady flow – slow changes with time

#### **Division of flows with respect to distance:**

- Uniform flow – constant section area along flow path
- Non-uniform flow – variable section area

#### **Rotational and irrotational flow**

Rotational flow is that type of flow in which the fluid particles while flowing along stream lines also rotate about their own axis. Irrotational flow is that type of flow in which the fluid particles while flowing along stream lines, do not rotate about their own axis.

#### **Laminar and turbulent flow**

**Laminar flow:** Flow along parallel paths, Disturbances in the flow are rapidly damped by viscous action

**Turbulent flow:** Fluid particles moves in a random manner and not in layers, Length scales molecular scales in laminar flow, Rapid continuous mixing, Inertia forces and viscous forces of importance

#### **Compressible and incompressible flow**

**Compressible** is the type of flow in which the density of flow changes from point to point or in other words the density ( $\rho$ ) is not constant for the fluid.  $P \neq \text{constant}$

**Incompressible flow:** It is the type of flow in which the density is constant for the fluid flow from point to point or in other words the density ( $\rho$ ) is constant for the fluid.  $P = \text{constant}$

**One, Two and Three Dimensional Flows:** Term one, two or three dimensional flow refers to the number of space coordinated required to describe a flow. It appears that any physical flow is generally three-dimensional. But these are difficult to calculate and call for as much simplification as possible. This is achieved by ignoring changes to flow in any of the directions, thus reducing the complexity. It may be possible to reduce a three-dimensional problem to a two-dimensional one, even a one-dimensional one at times.

**Rate of Flow or Discharge:** It is defined as the quantity of liquid flowing per unit second through a section of a pipe or a channel. It is denoted by  $Q$ .

**Bernoulli's theorem** states that in a steady flow of ideal incompressible fluid, the sum of pressure head, velocity head and potential head is constant along a stream line provided no energy is added or taken out by external source.

Fluid flow is classified as external and internal, depending on whether the fluid is forced to flow over a surface or in a conduit. If the conduit is completely filled with the fluid, and flow is driven primarily by a pressure difference whereas in open-channel flow where the conduit is partially

filled by the fluid and thus the flow is partially bounded by solid surfaces, as in an irrigation ditch, and flow is driven by gravity alone.

### **LOSS OF ENERGY IN PIPES:**

When a fluid is flowing through a pipe, the fluid experiences some resistance due to which some of the energy of fluid is lost. The energy loss is classified as

**Major Energy Losses** - due to friction

**Minor Energy Losses**

- Sudden expansion of pipes
- Sudden contraction of pipes
- Loss of head at the entrance of the pipe
- Loss of head at the exit of the pipe
- Bend in pipe
- Pipe fittings
- An obstruction in pipe

## **HYDRAULICS AND FLUID MECHANICS**

1. Pascal-second is the unit of
- a) pressure
  - b) kinematic viscosity
  - c) dynamic viscosity
  - d) surface tension

Ans: c

2. An ideal fluid is
- a) one which obeys Newton's law of viscosity
  - b) frictionless and incompressible
  - c) very viscous
  - d) frictionless and compressible

Ans: b

3. The unit of kinematic viscosity is
- a) gm/cm-sec<sup>2</sup>
  - b) dyne-sec/cm<sup>2</sup>
  - c) gm/cm<sup>2</sup>-sec
  - d) cm<sup>2</sup>/sec

Ans: d

4. If the dynamic viscosity of a fluid is 0.5 poise and specific gravity is 0.5, then the kinematic viscosity of that fluid in stokes is
- a) 0.25
  - b) 0.50
  - c) 1.0
  - d) none of the above

Ans: c

5. The viscosity of a gas
- a) decreases with increase in temperature
  - b) increases with increase in temperature
  - c) is independent of temperature
  - d) is independent of pressure for very high pressure intensities

Ans: b

6. Newton's law of viscosity relates
- a) intensity of pressure and rate of angular deformation
  - b) shear stress and rate of angular deformation

- c) shear stress, viscosity and temperature
- d) viscosity and rate of angular deformation

Ans: b

7. An open tank contains 1 m deep water with 50 cm depth of oil of specific gravity 0.8 above it. The intensity of pressure at the bottom of tank will be

- a) 4 kN/m<sup>2</sup>
- b) 10 kN/m<sup>2</sup>
- c) 12 kN/m<sup>2</sup>
- d) 14 kN/m<sup>2</sup>

Ans: d

8. The position of center of pressure on a plane surface immersed vertically in a static mass of fluid is

- a) at the centroid of the submerged area
- b) always above the centroid of the area
- c) always below the centroid of the area
- d) none of the above

Ans: c

9. The total pressure on a plane surface inclined at an angle  $\theta$  with the horizontal is equal to

- a)  $pA$
- b)  $pA \sin \theta$
- c)  $pA \cos \theta$
- d)  $pA \tan \theta$

where  $p$  is pressure intensity at centroid of area and  $A$  is area of plane surface.

Ans: a

10. A vertical rectangular plane surface is submerged in water such that its top and bottom surfaces are 1.5 m and 6.0 m respectively below the free surface. The position of center of pressure below the free surface will be at a distance of

- a) 3.75 m
- b) 4.0 m
- c) 4.2m
- d) 4.5m

Ans: c

11. Centre of buoyancy always

- a) coincides with the centre of gravity
- b) coincides with the centroid of the volume of fluid displaced
- c) remains above the centre of gravity
- d) remains below the centre of gravity

Ans: b

12. If the weight of a body immersed in a fluid exceeds the buoyant force, then the body will
- rise until its weight equals the buoyant force
  - tend to move downward and it may finally sink
  - float
  - none of the above

Ans: b

13. Metacentric height for small values of angle of heel is the distance between the
- centre of gravity and centre of buoyancy
  - centre of gravity and metacentre
  - centre of buoyancy and metacentre
  - free surface and centre of buoyancy

Ans: b

14. A floating body is said to be in a state of stable equilibrium
- when its metacentric height is zero
  - when the metacentre is above the centre of gravity
  - when the metacentre is below the centre of gravity
  - only when its centre of gravity is below its centre of buoyancy

Ans: b

15. The increase in meta centric height
- increases stability
  - decreases stability
  - increases comfort for passengers
  - decreases comfort for passengers

The correct answer is

- (i) and (iii)
- (i) and (iv)
- (ii) and (iii)
- (ii) and (iv)

Ans: b

16. A rectangular block 2 m long, 1 m wide and 1 m deep floats in water, the depth of immersion being 0.5 m. If water weighs 10 kN/m<sup>3</sup>, then the weight of the block is
- 5kN
  - 10kN
  - 15 kN
  - 20 kN

Ans: b

17. The point in the immersed body through which the resultant pressure of the liquid may be taken to act is known as
- a) center of gravity
  - b) center of buoyancy
  - c) center of pressure
  - d) metacentre

Ans: c

18. If a vessel containing liquid moves downward with a constant acceleration equal to 'g' then
- a) the pressure throughout the liquid mass is atmospheric
  - b) there will be vacuum in the liquid
  - c) the pressure in the liquid mass is greater than hydrostatic pressure
  - d) none of the above

Ans: a

19. When a liquid rotates at a constant angular velocity about a vertical axis as a rigid body, the pressure intensity varies
- a) linearly with radial distance
  - b) as the square of the radial distance
  - c) inversely as the square of the radial distance
  - d) inversely as the radial distance

Ans: b

20. An open cubical tank of 2 m side is filled with water. If the tank is rotated with an acceleration such that half of the water spills out, then the acceleration is equal to
- a)  $g/3$
  - b)  $g/2$
  - c)  $2g/3$
  - d)  $g$

Ans: d

21. A right circular cylinder open at the top is filled with liquid and rotated about its vertical axis at such a speed that half the liquid spills out, then the pressure intensity at the center of bottom is
- a) zero
  - b) one-fourth its value when cylinder was full
  - c) one-half its value when cylinder was full
  - d) cannot be predicted from the given data

Ans: a

22. The horizontal component of force on a curved surface is equal to the
- a) product of pressure intensity at its centroid and area

- b) force on a vertical projection of the curved surface
- c) weight of liquid vertically above the curved surface
- d) force on the horizontal projection of the curved surface

Ans: b

23. A closed tank containing water is moving in a horizontal direction along a straight line at a constant speed. The tank also contains a steel ball and a bubble of air. If the tank is decelerated horizontally, then

- i) the ball will move to the front
  - ii) the bubble will move to the front
  - iii) the ball will move to the rear
  - iv) the bubble will move to the rear
- Find out which of the above statements are correct ?
- a) (i) and (ii)
  - b) (i) and (iv)
  - c) (ii) and (iii)
  - d) (iii) and (iv)

Ans: b

24. The eddy viscosity for turbulent flow is

- a) a function of temperature only
- b) a physical property of the fluid.
- c) dependent on the flow
- d) independent of the flow

Ans: c

25. Flow at constant rate through a tapering pipe is

- i) steady flow
- ii) uniform flow
- iii) unsteady flow
- iv) non-uniform flow

The correct answer is

- a) (i) and (ii)
- b) (i) and (iv)
- c) (ii) and (iii)
- d) (ii) and (iv)

Ans: b

26. In a two dimensional incompressible steady flow around an airfoil, the stream lines are 2 cm apart at a great distance from the airfoil, where the velocity is 30 m/sec. The velocity near the airfoil, where the stream lines are 1.5 cm apart, is

- a) 22.5 m/sec.
- b) 33 m/sec.



- c) 40 m/sec.
- d) 90 m/sec.

Ans: c

27. When the velocity distribution is uniform over the cross-section, the correction factor for momentum is

- a) 0
- b) 1
- c) 4/3
- d) 2

Ans: b

28. Least possible value of correction factor for

- i) kinetic energy is zero
- ii) kinetic energy is 1
- iii) momentum is zero
- iv) momentum is 1

The correct statements are

- a) (i) and (iii)
- b) (ii) and (iii)
- c) (i) and (iv)
- d) (ii) and (iv)

Ans: d

29. If the velocity is zero over half of the cross-sectional area and is uniform over the remaining half, then the momentum correction factor is

- a) 1
- b) 4/3
- c) 2
- d) 4

Ans: c

30. If velocity is zero over 1/3rd of a cross-section and is uniform over remaining 2/3rd of the cross-section, then the correction factor for kinetic energy is

- a) 4/3
- b) 3/2
- c) 9/4
- d) 27/8

Ans: c

31. The continuity equation

$\rho_1 V_1 A_1 = \rho_2 V_2 A_2$  is based on the following assumption regarding flow of fluid

- a) steady flow
- b) uniform flow
- c) incompressible flow
- d) frictionless flow

where  $\rho_1$  and  $\rho_2$  are mass densities.

Ans: a

32. Which of the following velocity potentials satisfies continuity equation ?

- a)  $x^2y$
- b)  $x^2-y^2$
- c)  $\cos x$
- d)  $x^2 + y^2$

Ans: b

33. The motion of air mass in a tornado is a

- a) free vortex motion
- b) forced vortex motion
- c) free vortex at center and forced vortex outside
- d) forced vortex at center and free vortex outside

Ans: d

34. In a forced vortex motion, the velocity of flow is

- a) directly proportional to its radial distance from axis of rotation
- b) inversely proportional to its radial distance from the axis of rotation
- c) inversely proportional to the square of its radial distance from the axis of rotation
- d) directly proportional to the square of its radial distance from the axis of rotation

Ans: a

35. Stream lines and path lines always coincide in case of

- a) steady flow
- b) laminar flow
- c) uniform flow
- d) turbulent flow

Ans: a

36. Equation of continuity is based on the principle of conservation of

- a) mass
- b) energy
- c) momentum
- d) none of the above

Ans: a

37. In steady flow of a fluid, the total acceleration of any fluid particle

- a) can be zero
- b) is never zero
- c) is always zero
- d) is independent of coordinates

Ans: a

38. The pitot tube is used to measure

- a) velocity at stagnation point
- b) stagnation pressure
- c) static pressure
- d) dynamic pressure

Ans: b

39. Hot wire anemometer is used to measure

- a) discharge
- b) velocity of gas
- c) pressure intensity of gas
- d) pressure intensity of liquid

Ans: b

40. The theoretical value of coefficient of contraction of a sharp edged orifice is

- a) 0.611
- b) 0.85
- c) 0.98
- d) 1.00

Ans: a

41. Which of the following is used to measure the discharge ?

- a) current meter
- b) venturimeter
- c) pitot tube
- d) hotwire anemometer

Ans: b

42. Select the incorrect statement.

- a) The pressure intensity at vena contracta is atmospheric.
- b) Contraction is least at vena contracta.
- c) Stream lines are parallel throughout the jet at vena contracta.
- d) Coefficient of contraction is always less than one.

Ans: c

43. Size of a venturimeter is specified by
- pipe diameter
  - throat diameter
  - angle of diverging section
  - both pipe diameter as well as throat diameter

Ans: a

44. Due to each end contraction, the discharge of rectangular sharp crested weir is reduced by
- 5%
  - 10%
  - 15%
  - 20%

Ans: a

45. The discharge through a V- notch varies as
- $H^{1/2}$
  - $H^{3/2}$
  - $H^{5/2}$
  - $H^{5/4}$  where H is head.

Ans: c

46. Which of the following is an incorrect statement ?
- Coefficient of contraction of a venturimeter is unity.
  - Flow nozzle is cheaper than venturimeter but has higher energy loss.
  - Discharge is independent of orientation of venturimeter whether it is horizontal, vertical or inclined.
  - None of the above statement is correct.

Ans: d

47. Coefficient of velocity of venturimeter
- is independent of Reynolds number
  - decreases with higher Reynolds number
  - is equal to the coefficient of discharge of venturimeter
  - none of the above

Ans: c

48. The pressure at the summit of a syphon is
- equal to atmospheric
  - less than atmospheric
  - more than atmospheric
  - none of the above

Ans: b

49. Ay between two stream lines represents

- a) velocity
- b) discharge
- c) head
- d) pressure

Ans: b

50. Coefficient of velocity for Borda's mouth piece running full is

- a) 0.611
- b) 0.707
- c) 0.855
- d) 1.00

Ans: b

51. Coefficient of discharge for a totally submerged orifice as compared to that for an orifice discharging free is

- a) slightly less
- b) slightly more
- c) nearly half
- d) equal

Ans: a

52. The major loss of energy in long pipes is due to

- a) sudden enlargement
- b) sudden contraction
- c) gradual contraction or enlargement
- d) friction

Ans: d

53. Coefficient of contraction for an external cylindrical mouthpiece is

- a) 1.00
- b) 0.855
- c) 0.7H
- d) 0.611

Ans: a

54. Which of the following has highest coefficient of discharge ?

- a) sharp edged orifice
- b) venturimeter
- c) Borda's mouthpiece running full
- d) CipoUetti weir

Ans: b

55. In a Sutro weir, the discharge is proportional to

- a)  $H^{1/2}$
- b)  $H^{3/2}$
- c)  $H^{5/2}$
- d)  $H$

where  $H$  is head.

Ans: d

56. The discharge over a broad crested weir is maximum when the depth of flow is

- a)  $H/3$
- b)  $H/2$
- c)  $2H/5$
- d)  $2H/3$

where  $H$  is the available head.

Ans: d

57. Which of the following statements is correct?

- a) Lower critical Reynolds number is of no practical significance in pipe flow problems.
- b) Upper critical Reynolds number is significant in pipe flow problems.
- c) Lower critical Reynolds number has the value 2000 in pipe flow
- d) Upper critical Reynolds number is the number at which turbulent flow changes to laminar flow.

Ans: a

58. For a sphere of radius 15 cm moving with a uniform velocity of 2 m/sec through a liquid of specific gravity 0.9 and dynamic viscosity 0.8 poise, the Reynolds number will be

- a) 300
- b) 337.5
- c) 600
- d) 675

Ans: d

59. The shear stress distribution for a fluid flowing in between the parallel plates, both at rest, is

- a) constant over the cross section
- b) parabolic distribution across the section
- c) zero at the mid plane and varies linearly with distance from mid plane
- d) zero at plates and increases linearly to midpoint

Ans: c

60. If  $x$  is the distance from leading edge, then the boundary layer thickness in laminar flow varies as

- a)  $x$
- b)  $x$
- c)  $x$
- d)  $x/7$

Ans: a

61. Stanton diagram is a

- a) log-log plot of friction factor against Reynolds number
- b) log-log plot of relative roughness against Reynolds number
- c) semi-log plot of friction factor against Reynolds number
- d) semi-log plot of friction factor against relative roughness

Ans: a

62. The depth ' $d$ ' below the free surface at which the point velocity is equal to the average velocity of flow for a uniform laminar flow with a free surface, will be

- a)  $0.423 D$
- b)  $0.577 D$
- c)  $0.223 D$
- d)  $0.707 D$

where  $D$  is the depth of flow.

Ans: b

63. The boundary layer thickness in turbulent flow varies as

- a)  $x^{1/7}$
- b)  $x^{1/2}$
- c)  $x^{4/5}$
- d)  $x^{3/5}$

where  $x$  is the distance from leading edge.

Ans: c

64. The distance  $y$  from pipe boundary, at which the point velocity is equal to average velocity for turbulent flow, is

- a)  $0.223 R$
- b)  $0.423 R$
- c)  $0.577 R$
- d)  $0.707 R$

where  $R$  is radius of pipe.

Ans: a

65. If a sphere of diameter 1 cm falls in castor oil of kinematic viscosity 10 stokes, with a terminal velocity of 1.5 cm/sec, the coefficient of drag on the sphere is

- a) less than 1
- b) between 1 and 100
- c) 160
- d) 200

Ans: c

66. In case of an airfoil, the separation of flow occurs

- a) at the extreme rear of body
- b) at the extreme front of body
- c) midway between rear and front of body
- d) any where between rear and front of body depending upon Reynolds number

Ans: a

67. When an ideal fluid flows past a sphere,

- a) highest intensity of pressure occurs around the circumference at right angles to flow
- b) lowest pressure intensity occurs at front stagnation point
- c) lowest pressure intensity occurs at rear stagnation point
- d) total drag is zero

Ans: d

68. With the same cross-sectional area and immersed in same turbulent flow, the largest total drag will be on

- a) a circular disc of plate held normal to flow
- b) a sphere
- c) a cylinder
- d) a streamlined body

Ans: a

69. In which of the following the friction drag is generally larger than pressure drag?

- a) a circular disc or plate held normal to flow
- b) a sphere
- c) a cylinder
- d) an airfoil

Ans: d

70. For hydro-dynamically smooth boundary, the friction coefficient for turbulent flow is

- a) constant
- b) dependent only on Reynolds number
- c) a function of Reynolds number and relative roughness
- d) dependent on relative roughness only



Ans: b

71. The value of friction factor 'f' for smooth pipes for Reynolds number 106 is approximately equal to

- a) 0.1
- b) 0.01
- c) 0.001
- d) 0.0001

Ans: b

72. For laminar flow in a pipe of circular cross-section, the Darcy's friction factor f is

- a) directly proportional to Reynolds number and independent of pipe wall roughness
- b) directly proportional to pipe wall roughness and independent of Reynolds number
- c) inversely proportional to Reynolds number and independent of pipe wall roughness
- d) inversely proportional to Reynolds number and directly proportional to pipe wall roughness

Ans: c

73. Separation of flow occurs when

- a) the pressure intensity reaches a minimum
- b) the cross-section of a channel is reduced
- c) the boundary layer comes to rest
- d) all of the above

Ans: c

74. The ratio of average velocity to maximum velocity for steady laminar flow in circular pipes is

- a) 1/2
- b) 2/3
- c) 3/2
- d) 2

Ans: a

75. The distance from pipe boundary, at which the turbulent shear stress is one-third the wall shear stress, is

- a)  $1/3 R$
- b)  $1/2 R$
- c)  $2/3 R$
- d)  $3/4 R$

where R is the radius of pipe.

Ans: a

76. The discharge of a liquid of kinematic viscosity  $4 \text{ cm}^2/\text{sec}$  through a 8 cm diameter pipe is  $3200 \text{ cm}^3/\text{sec}$ . The type of flow expected is

- a) laminar flow
- b) transition flow
- c) turbulent flow
- d) not predictable from the given data

Ans: a

77. The Prandtl mixing length is

- a) zero at the pipe wall
- b) maximum at the pipe wall
- c) independent of shear stress
- d) none of the above

Ans: a

78. The velocity distribution for laminar flow through a circular tube

- a) is constant over the cross-section
- b) varies linearly from zero at walls to maximum at centre
- c) varies parabolically with maximum at the centre
- d) none of the above

Ans: c

79. A fluid of kinematic viscosity  $0.4 \text{ cm}^2/\text{sec}$  flows through a 8 cm diameter pipe. The maximum velocity for laminar flow will be

- a) less than 1 m/sec
- b) 1 m/sec
- c) 1.5 m/sec
- d) 2 m/sec

Ans: b

80. The losses are more in

- a) laminar flow
- b) transition flow
- c) turbulent flow
- d) critical flow

Ans: c

81. The wake

- a) always occurs before a separation point
- b) always occurs after a separation point
- c) is a region of high pressure intensity
- d) none of the above

Ans: b

82. The maximum thickness of boundary layer in a pipe of radius  $r$  is

- a) 0
- b)  $r/2$
- c)  $r$
- d)  $2r$

Ans: c

83. The hydraulic grade line is

- a) always above the centre line of pipe
- b) never above the energy grade line
- c) always sloping downward in the direction of flow
- d) all of the above

Ans: b

84. Two pipe systems are said to be equivalent when

- a) head loss and discharge are same in two systems
- b) length of pipe and discharge are same in two systems
- c) friction factor and length are same in two systems
- d) length and diameter are same in two systems

Ans: a

85. In series-pipe problems

- a) the head loss is same through each pipe
- b) the discharge is same through each pipe
- c) a trial solution is not necessary
- d) the discharge through each pipe is added to obtain total discharge

Ans: b

86. Select the correct statement.

- a) The absolute roughness of a pipe de-creases with time.
- b) A pipe becomes smooth after using for long time.
- c) The friction factor decreases with time.
- d) The absolute roughness increases with time.

Ans: d

87. A valve is suddenly closed in a water main in which the velocity is 1 m/sec and velocity of pressure wave is 981 m/sec. The inertia head at the valve will be

- a) 1 m
- b) 10m
- c) 100m
- d) none of the above

Ans: c

88. The speed of a pressure wave through a pipe depends upon

- a) the length of pipe
- b) the viscosity of fluid
- c) the bulk modulus for the fluid
- d) the original head

Ans: c

89. When time of closure  $t_c = L/v_0$  (where  $L$  is length of pipe and  $v_0$  is speed of pressure wave), the portion of pipe length subjected to maximum head is

- a)  $L/4$
- b)  $L/3$
- c)  $L/2$
- d)  $L$

Ans: a

90. If the elevation of hydraulic grade line at the junction of three pipes is above the elevation of reservoirs B and C and below reservoir A, then the direction of flow will be

- a) from reservoir A to reservoirs B and C
- b) from reservoir B to reservoirs C and A
- c) from reservoir C to reservoirs A and B
- d) unpredictable

Ans: c

91. The length of a pipe is 1 km and its diameter is 20 cm. If the diameter of an equivalent pipe is 40 cm, then its length is

- a) 32 km
- b) 20 km
- c) 8 km
- d) 4 km

Ans: a

92. Two pipes of same length and diameters  $d$  and  $2d$  respectively are connected in series. The diameter of an equivalent pipe of same length is

- a) less than  $d$
- b) between  $d$  and  $1.5d$
- c) between  $1.5d$  and  $2d$
- d) greater than  $2d$

Ans: a

93. The horse power transmitted through a pipe is maximum when the ratio of loss of head due to friction and total head supplied is

- a)  $1/3$
- b)  $1/4$
- c)  $1/2$
- d)  $2/3$

Ans: a

94. The boundary layer thickness at a distance of 1 m from the leading edge of a flat plate, kept at zero angle of incidence to the flow direction, is 0.1 cm. The velocity outside the boundary layer is 25 m/sec.

The boundary layer thickness at a distance of 4 m is

- a) 0.40 cm
- b) 0.20 cm
- c) 0.10 cm
- d) 0.05 cm

Assume that boundary layer is entirely laminar.

Ans: b

95. Drag force is a function of

- i) projected area of the body
- ii) mass density of the fluid
- iii) velocity of the body

The correct answer is

- a) (i) and (ii)
- b) (i) and (iii)
- c) (ii) and (iii)
- d) (i), (ii) and (iii)

Ans: d

96. The correct relationship among displacement thickness  $d$ , momentum thickness  $m$  and energy thickness  $e$  is

- a)  $d > m > e$
- b)  $d > e > m$
- c)  $e > m > d$
- d)  $e > d > m$

Ans: d

97. For laminar flow in circular pipes, the Darcy's friction factor  $f$  is equal to

- a)  $16/Re$
- b)  $32/Re$
- c)  $64/Re$
- d) none of the above where  $Re$ , is Reynolds number.

Ans: c

98. Surge wave in a rectangular channel is an example of

- i) steady flow
- ii) unsteady flow
- iii) uniform flow
- iv) non-uniform flow

The correct answer is

- a) (i) and (iii)
- b) (ii) and (iii)
- c) (i) and (iv)
- d) (ii) and (iv)

Ans: d

SAFEC-CIVIL

## **HYDRAULICS & FLUID MECHANICS:**

### Question No. 01

When a body is placed over a liquid, it will sink down if

- (A) Gravitational force is equal to the up-thrust of the liquid
- (B) Gravitational force is less than the up-thrust of the liquid
- (C) Gravitational force is more than the up-thrust of the liquid
- (D) None of the above

Answer: Option C

### Question No. 02

The property by virtue of which a liquid opposes relative motion between its different layers is called

- (A) Surface tension
- (B) Coefficient of viscosity
- (C) Viscosity
- (D) Osmosis

Answer: Option C

### Question No. 03

A weir is said to be narrow-crested weir, if the width of the crest of the weir is \_\_\_\_\_ half the height of water above the weir crest.

- (A) Equal to
- (B) Less than
- (C) More than
- (D) None of these

Answer: Option B

### Question No. 04

Euler's dimensionless number relates the following

- (A) Inertial force and gravity
- (B) Viscous force and inertial force
- (C) Viscous force and buoyancy force
- (D) Pressure force and inertial force

Answer: Option D

### Question No. 05

When a body floating in a liquid, is displaced slightly, it oscillates about

- (A) C.G. of body
- (B) Center of pressure
- (C) Center of buoyancy
- (D) Metacentre

Answer: Option D

### Question No. 06

The pressure of the liquid flowing through the divergent portion of a Venturimeter

- (A) Remains constant

- (D) Increases
- (E) Decreases
- (F) Depends upon mass of liquid

Answer: Option C

Question No. 07

When the Mach number is between \_\_\_\_\_ the flow is called super-sonic flow.

- (A) 1 and 2.5
- (B) 2.5 and 4
- (C) 4 and 6
- (D) 1 and 6

Answer: Option D

Question No. 08

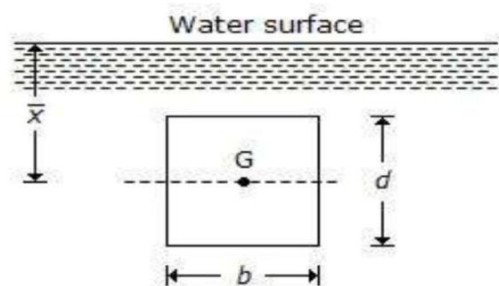
In an immersed body, centre of pressure is

- (A) At the centre of gravity
- (B) Above the centre of gravity
- (C) Below the centre of gravity
- (D) Could be above or below e.g. depending on density of body and liquid

Answer: Option C

Question No. 09

A vertically immersed surface is shown in the below figure. The distance of its centre of pressure from the water surface is



- (D)  $(bd^2/12) +$
- (E)  $(d^2/12) + \bar{x}$
- (F)  $b^2/12 + \bar{x}$
- (G)  $d^2/12 + \bar{x}$

Answer: Option B



Question No. 11

Steady flow occurs when

- (A) The direction and magnitude of the velocity at all points are identical
- (B) The velocity of successive fluid particles, at any point, is the same at successive periods of time
- (C) The magnitude and direction of the velocity do not change from point to point in the fluid
- (D) The fluid particles move in plane or parallel planes and the streamline patterns are identical in each plane

Answer: Option B

Question No. 12

A flow is called super-sonic if the

- (A) Velocity of flow is very high
- (B) Discharge is difficult to measure
- (C) Mach number is between 1 and 6
- (D) None of these

Answer: Option C

Question No. 13

In a forced vortex, the velocity of flow everywhere within the fluid is

- (A) Maximum
- (B) Minimum
- (C) Zero
- (D) Nonzero finite

Answer: Option D

Question No. 15

Mach number is significant in

- (A) Supersonics, as with projectiles and jet propulsion
- (B) Full immersion or completely enclosed flow, as with pipes, aircraft wings, nozzles etc.
- (C) Simultaneous motion through two fluids where there is a surface of discontinuity, gravity force, and wave making effects, as with ship's hulls
- (D) All of the above

Answer: Option A

Question No. 16

A fluid which obeys the Newton's law of viscosity is termed as

- a) Real fluid
- b) Ideal fluid
- c) Newtonian fluid
- d) Non-Newtonian fluid

Answer: Option C

Question No. 17

In order that flow takes place between two points in a pipeline, the differential pressure between these points must be more than

- (A) Frictional force
- (B) Viscosity

- (C) Surface friction
  - (D) All of the above
- Answer: Option D

Question No. 18

The error in discharge ( $dQ/Q$ ) to the error in measurement of head ( $dH/H$ ) over a triangular notch is given by

- (A)  $dQ/Q = 3/2 \times (dH/H)$
- (B)  $dQ/Q = 2 \times (dH/H)$
- (C)  $dQ/Q = 5/2 \times (dH/H)$
- (D)  $dQ/Q = 3 \times (dH/H)$

Answer: Option C

Question No. 19

For similarity, in addition to models being geometrically similar to prototype, the following in both cases should also be equal

- (A) Ratio of inertial force to force due to viscosity
- (B) Ratio of inertial force to force due to gravitation
- (C) Ratio of inertial force to force due to surface tension
- (D) All the four ratios of inertial force to force due to viscosity, gravitation, surface tension, and elasticity

Answer: Option D

Question No. 20

The value of coefficient of velocity for a sharp edged orifice \_\_\_\_\_ with the head of water.

- (A) Decreases
- (B) Increases
- (C) Remain same
- (D) None of these

Answer: Option B

Question No. 21

If cohesion between molecules of a fluid is greater than adhesion between fluid and glass, then the free level of fluid in a dipped glass tube will be

- (A) Higher than the surface of liquid
- (B) The same as the surface of liquid
- (C) Lower than the surface of liquid
- (D) Unpredictable

Answer: Option C

Question No. 22

The ratio of the inertia force to the \_\_\_\_\_ is called Euler's number.

- (A) Pressure force
- (B) Elastic force
- (C) Surface tension force
- (D) Viscous force

Answer: Option A

Question No. 23

A one dimensional flow is one which

- (A) Is uniform flow
- (B) Is steady uniform flow
- (C) Takes place in straight lines
- (D) Involves zero transverse component of flow

Answer: Option D

Question No. 24

According to Manning's formula, the discharge through an open channel is (where M = Manning's constant)

- (A)  $A \times M \times m^{1/2} \times i^{2/3}$
- (B)  $A \times M \times m^{2/3} \times i^{1/2}$
- (C)  $A^{1/2} \times M^{2/3} \times m \times i$
- (D)  $A^{2/3} \times M^{1/3} \times m \times i$

Answer: Option B

Question No. 25

Dimensions of surface tension are

- (A)
- (B)  $\text{ML}^{-1}\text{T}^2$
- (C)  $\text{ML r}^2$
- (D)  $\text{ML}^2\text{T}^2$

Answer: Option A

Question No. 26

An opening in the side of a tank or vessel such that the liquid surface with the tank is below the top edge of the opening, is called

- (A) Weir
- (B) Notch
- (C) Orifice
- (D) None of these

Answer: Option B

Question No. 27

The property of fluid by virtue of which it offers resistance to shear is called

- (A) Surface tension
- (B) Adhesion
- (C) Cohesion
- (D) Viscosity

Answer: Option D

Question No. 28

Coefficient of velocity is defined as the ratio of

- (A) Actual velocity of jet at vena contracta to the theoretical velocity

- (B) Area of jet at vena contracta to the area of orifice
- (C) Actual discharge through an orifice to the theoretical discharge
- (D) None of the above

Answer: Option A

Question No. 30

The mass of  $2.5 \text{ m}^3$  of a certain liquid is 2 tonnes. Its mass density is

- (A)  $200 \text{ kg/m}^3$
- (B)  $400 \text{ kg/m}^3$
- (C)  $600 \text{ kg/m}^3$
- (D)  $800 \text{ kg/m}^3$

Answer: Option D

Question No. 31

A fluid in equilibrium can't sustain

- (A) Tensile stress
- (B) Compressive stress
- (C) Shear stress
- (D) Bending stress

Answer: Option C

Question No. 32

When a plate is immersed in a liquid parallel to the flow, it will be subjected to a pressure \_\_\_\_\_ that if the same plate is immersed perpendicular to the flow.

- (A) Less than
- (B) More than
- (C) Equal to
- (D) None of these

Answer: Option A

Question No. 33

An object having 10 kg mass weighs 9.81 kg on a spring balance. The value of 'g' at this place is

- (A)  $10 \text{ m/sec}^2$
- (B)  $9.81 \text{ m/sec}^2$
- (C)  $9.75 \text{ m/sec}^2$
- (D)  $9 \text{ m/sec}$

Answer: Option A

Question No. 34

A flow is called hyper-sonic, if the Mach number is

- (A) Less than unity
- (B) Unity
- (C) Between 1 and 6
- (D) None of these

Answer: Option D

Question No. 35

## Liquids

- (A) Cannot be compressed
- (B) Occupy definite volume
- (C) Are not affected by change in pressure and temperature
- (D) None of the above

Answer: Option D

### Question No. 36

When a cylindrical vessel containing liquid is resolved, the surface of the liquid takes the shape of

- (A) A triangle
- (B) A paraboloid
- (C) An ellipse
- (D) None of these

Answer: Option B

### Question No. 37

Fluid is a substance that

- (A) Cannot be subjected to shear forces
- (B) Always expands until it fills any container
- (E) Has the same shear stress at a point regardless of its motion
- (F) Cannot remain at rest under action of any shear force

Answer: Option D

### Question No. 38

The force exerted by a moving fluid on an immersed body is directly proportional to the rate of change of momentum due to the presence of the body. This statement is called

- (A) Newton's law of motion
- (B) Newton's law of cooling
- (C) Newton's law of viscosity
- (D) Newton's law of resistance

Answer: Option D

### Question No. 39

The property of a fluid which enables it to resist tensile stress is known as

- (A) Compressibility
- (B) Surface tension
- (C) Cohesion
- (D) Adhesion

Answer: Option C

### Question No. 40

The loss of pressure head in case of laminar flow is proportional to

- (A) Velocity
- (B) (Velocity)<sup>2</sup>
- (C) (Velocity)<sup>3</sup>

(D) (Velocity)<sub>4</sub>

Answer: Option A

Question No. 41

The surface tension of mercury at normal temperature compared to that of water is

- (A) More
- (B) Less
- (C) Same
- (D) More or less depending on size of glass tube

Answer: Option A

Question No. 42

An air vessel is provided at the summit in a siphon to

- (A) Avoid interruption in the flow
- (B) Increase discharge
- (C) Increase velocity
- (D) Maintain pressure difference

Answer: Option A

Question No. 43

The unit of viscosity is

- (A) Metres<sup>2</sup> per sec
- (B) kg-sec/metre
- (C) Newton-sec per metre<sup>2</sup>
- (D) Newton-sec per meter

Answer: Option B

Question No. 44

Select the correct statement

- (A) Weber's number is the ratio of inertia force to elastic force.
- (B) Weber's number is the ratio of gravity force to surface tension force.
- (C) Weber's number is the ratio of viscous force to pressure force.
- (D) Weber's number is the ratio of inertia force to surface tension force.

Answer: Option D

Question No. 45

Choose the wrong statement. Alcohol is used in manometer, because

- (A) Its vapour pressure is low
- (B) It provides suitable meniscus for the inclined tube
- (C) Its density is less
- (D) It provides longer length for a given pressure difference

Answer: Option A

Question No. 46

When a tank containing liquid moves with an acceleration in the horizontal direction, then the free surface of the liquid

- (A) Remains horizontal

- (B) Becomes curved
- (C) Falls on the front end
- (D) Falls on the back end

Answer: Option C

Question No. 47

A pressure of 25 m of head of water is equal to

- (A) 25 kN/ m<sup>2</sup>
- (B) 245 kN/ m<sup>2</sup>
- (C) 2500 kN/m<sup>2</sup>
- (D) 2.5 kN/ m<sup>2</sup>

Answer: Option B

Question No. 48

The hammer blow in pipes occurs when

- (A) There is excessive leakage in the pipe
- (B) The pipe bursts under high pressure of fluid
- (E) The flow of fluid through the pipe is suddenly brought to rest by closing of the valve
- (F) The flow of fluid through the pipe is gradually brought to rest by closing of the valve

Answer: Option C

Question No. 49

The resultant upward pressure of the fluid on an immersed body is called

- (A) Up-thrust
- (B) Buoyancy
- (C) Center of pressure
- (D) All the above are correct

Answer: Option B

Question No. 50

When the water level on the downstream side of a weir is above the top surface of a weir, the weir is known as

- (A) Narrow-crested weir
- (B) Broad-crested weir
- (C) Ogee weir
- (D) Submerged weir

Answer: Option D

Question No. 51

If the surface of liquid is convex, men

- (A) Cohesion pressure is negligible
- (B) Cohesion pressure is decreased
- (C) Cohesion pressure is increased
- (D) There is no cohesion pressure

Answer: Option C

Question No. 53

The atmospheric pressure with rise in altitude decreases

- (A) Linearly
- (B) First slowly and then steeply
- (C) First steeply and then gradually
- (D) Unpredictable

Answer: Option B

Question No. 55

Dynamic viscosity of most of the gases with rise in temperature

- (A) Increases
- (B) Decreases
- (C) Remain unaffected
- (D) Unpredictable

Answer: Option A

Question No. 56

According to Bernoulli's equation

- (A)  $Z + p/w + v^2/2g = \text{constant}$
- (B)  $Z + p/w - v^2/2g = \text{constant}$
- (C)  $Z + p/w + v^2/2g = \text{constant}$
- (D)  $Z + p/w - v^2/2g = \text{constant}$

Answer: Option A

Question No. 59

For a body floating in a liquid the normal pressure exerted by the liquid acts at

- (B) Bottom surface of the body
- (C) C.G. of the body
- (D) Metacentre
- (E) All points on the surface of the body

Answer: Option D

Question No. 60

Newton's law of viscosity is a relationship between

- (A) Pressure, velocity and temperature
- (B) Shear stress and rate of shear strain
- (C) Shear stress and velocity
- (D) Rate of shear strain and temperature

Answer: Option B

Question No. 61

Differential manometer is used to measure

- (A) Pressure in pipes, channels etc.
- (B) Atmospheric pressure



- (C) Very low pressure
- (D) Difference of pressure between two points

Answer: Option D

Question No. 63

Non uniform flow occurs when

- (A) The direction and magnitude of the velocity at all points are identical
- (B) The velocity of successive fluid particles, at any point, is the same at successive periods of time
- (C) Velocity, depth, pressure, etc. change from point to point in the fluid flow.
- (D) The fluid particles move in plane or parallel planes and the streamline patterns are identical in each plane

Answer: Option C

Question No. 64

When a tube of smaller diameter is dipped in water, the water rises in the tube with an upward \_\_\_\_\_ surface.

- (A) Concave
- (A) Convex
- (B) Plane
- (C) None of these

Answer: Option A

Question No. 65

A piece of metal of specific gravity 7 floats in mercury of specific gravity 13.6. What fraction of its volume is under mercury?

- (A) 0.5
- (B) 0.4
- (C) 0.515
- (D) 0.5

Answer: Option C

Question No. 66

A flow through an expanding tube at constant rate is called

- (A) Steady uniform flow
- (B) Steady non-uniform flow
- (C) Unsteady uniform flow
- (D) Unsteady non-uniform flow

Answer: Option B

Question No. 67

Reynolds number is significant in

- (A) Supersonics, as with projectile and jet propulsion
- (B) Full immersion or completely enclosed flow, as with pipes, aircraft wings, nozzles etc.

- (C) Simultaneous motion through two fluids where there is a surface of discontinuity, gravity forces, and wave making effect, as with ship's hulls  
(D) All of the above

Answer: Option B

Question No. 68

The loss of head due to friction in a pipe of uniform diameter in which a viscous flow is taking place, is (where  $R_N$  = Reynold number)

- (A)  $1/R_N$   
(B)  $4/R_N$   
(C)  $16/R_N$   
(D)  $64/R_N$

Answer: Option C

Question No. 69

Practical fluids

- (A) Are viscous  
(B) Possess surface tension  
(C) Are compressible  
(E) Possess all the above properties

Answer: Option D

Question No. 71

The tendency of a liquid surface to contract is due to the following property

- (A) Cohesion  
(B) Adhesion  
(C) Viscosity  
(D) Surface tension

Answer: Option D

Question No. 72

The Newton's law of resistance is based on the assumption that the

- (A) Planes of the body are completely smooth  
(B) Space around the body is completely filled with the fluid  
(C) Fluid particles do not exert any influence on one another  
(D) All of the above

Answer: Option D

Question No. 73

For manometer, a better liquid combination is one having

- (A) Higher surface tension  
(B) Lower surface tension  
(C) Surface tension is no criterion  
(D) High density and viscosity

Answer: Option A

Question No. 74

The flow in a pipe is neither laminar nor turbulent when Reynold number is

- (A) Less than 2000
- (B) Between 2000 and 2800
- (C) More than 2800
- (D) None of these

Answer: Option B

Question No. 75

The point in the immersed body through which the resultant pressure of the liquid may be taken to act is known as

- (A) Meta center
- (B) Center of pressure
- (C) Center of buoyancy
- (D) Center of gravity

Answer: Option B

Question No. 76

Stoke is the unit of

- (A) Kinematic viscosity in C. G. S. units
- (B) Kinematic viscosity in M. K. S. units
- (C) Dynamic viscosity in M. K. S. units
- (D) Dynamic viscosity in S. I. units

Answer: Option A

Question No. 77

The vapour pressure over the concave surface is

- (A) Less than the vapour pressure over the plane surface
- (B) Equal to the vapour pressure over the plane surface
- (C) Greater than the vapour pressure over the plane surface
- (D) Zero

Answer: Option A

Question No. 78

The velocity at which the flow changes from laminar flow to turbulent flow is called

- (A) Critical velocity
- (B) Velocity of approach
- (C) Sub-sonic velocity
- (D) Super-sonic velocity

Answer: Option A

Question No. 79

Mercury is often used in barometer because

- (A) It is the best liquid
- (B) The height of barometer will be less
- (C) Its vapour pressure is so low that it may be neglected
- (D) Both (B) and (C)

Answer: Option D

Question No. 80

A vertical wall is subjected to a pressure due to one kind of liquid, on one of its sides. Which of the following statement is correct?

- (A) The pressure on the wall at the liquid level is minimum
- (B) The pressure on the bottom of the wall is maximum
- (C) The pressure on the wall at the liquid level is zero, and on the bottom of the wall is maximum
- (D) The pressure on the bottom of the wall is zero

Answer: Option C

Question No. 81

Center of pressure compared to e.g. is

- (A) Above it
- (B) Below it
- (C) At same point
- (D) Above or below depending on area of body

Answer: Option B

Question No. 82

The centre of gravity of the volume of the liquid displaced by an immersed body is called

- (A) Centre of gravity
- (B) Centre of pressure
- (C) Metacentre
- (D) Centre of buoyancy

Answer: Option D

Question No. 84

Gradually varied flow is

- (A) Steady uniform
- (B) Non-steady non-uniform
- (C) Non-steady uniform
- (D) Steady non-uniform

Answer: Option D

Question No. 85

The viscosity of water at 20°C is

- (A) One stoke
- (B) One centistoke
- (C) One poise
- (D) One centipoise

Answer: Option D

Question No. 86

The velocity of jet of water travelling out of opening in a tank filled with water is proportional to

- (A) Head of water (h)

(B)  $h^2$

(C)  $V/T$

(D)  $h/2$

Answer: Option C

Question No. 87

According to Darcy's formula, the loss of head due to friction in the pipe is (where  $f$  = Darcy's coefficient,  $l$  = Length of pipe,  $v$  = Velocity of liquid in pipe, and  $d$  = Diameter of pipe)

(A)  $flv^2/2gd$

(B)  $flv^2/gd$

(C)  $3flv^2/2gd$

(D)  $4flv^2/2gd$

Answer: Option D

Question No. 88

According to Bernoulli's equation for steady ideal fluid flow

(A) Principle of conservation of mass holds

(B) Velocity and pressure are inversely proportional

(C) Total energy is constant throughout

(D) The energy is constant along a streamline but may vary across streamlines

Answer: Option D

Question No. 89

The discharge through a convergent mouthpiece is \_\_\_\_\_ the discharge through an internal mouthpiece of the same diameter and head of water.

(A) Equal to

(B) One-half

(C) Three fourth

(D) Double

Answer: Option D

Question No. 90

Bernoulli equation deals with the law of conservation of

(A) Mass

(B) Momentum

(C) Energy

(D) Work

Answer: Option C

Question No. 92

Principle of similitude forms the basis of

(A) Comparing two identical equipments

(B) Designing models so that the result can be converted to prototypes

(C) Comparing similarity between design and actual equipment

(D) Hydraulic designs

Answer: Option B

Question No. 93

The rise of liquid along the walls of a revolving cylinder about the initial level is \_\_\_\_\_ the depression of the liquid at the axis of rotation.

- (A) Same as
- (B) Less than
- (C) More than
- (D) None of these

Answer: Option A

Question No. 94

Hot wire anemometer is used to measure

- (A) Pressure in gases
- (B) Liquid discharge
- (C) Pressure in liquids
- (D) Gas velocities

Answer: Option D

Question No. 95

Venturimeter is used to

- (A) Measure the velocity of a flowing liquid
- (B) Measure the pressure of a flowing liquid
- (C) Measure the discharge of liquid flowing in a pipe
- (D) Measure the pressure difference of liquid flowing between two points in a pipe line

Answer: Option C

Question No. 96

The two important forces for a floating body are

- (A) Buoyancy, gravity
- (E) Buoyancy, pressure
- (F) Buoyancy, inertial
- (G) Inertial, gravity

Answer: Option A

Question No. 97

The kinematic viscosity of an oil (in stokes) whose specific gravity is 0.95 and viscosity 0.011 poise, is

- (E) 0.0116 stoke
- (F) 0.116 stoke
- (G) 0.0611 stoke
- (H) 0.611 stoke

Answer: Option A

Question No. 98

According to the principle of buoyancy a body totally or partially immersed in a fluid will be lifted up by a force equal to

- (A) The weight of the body
- (B) More than the weight of the body
- (C) Less than the weight of the body
- (D) Weight of the fluid displaced by the body

Answer: Option D

Question No. 99

The pressure measured with the help of a pressure gauge is called

- (A) Atmospheric pressure
- (B) Gauge pressure
- (C) Absolute pressure
- (D) Mean pressure

Answer: Option B

Question No. 100

The total pressure force on a plane area is equal to the area multiplied by the intensity of pressure at the Centroid, if

- (A) The area is horizontal
- (B) The area is vertical
- (C) The area is inclined
- (D) All of the above

Answer: Option D

Question No. 103

The most economical section of a rectangular channel is one which has hydraulic mean depth or hydraulic radius equal to

- (A) Half the depth
- (B) Half the breadth
- (C) Twice the depth
- (D) Twice the breadth

Answer: Option A

Question No. 104

Capillary action is due to the

- (A) Surface tension
- (B) Cohesion of the liquid
- (C) Adhesion of the liquid molecules and the molecules on the surface of a solid
- (D) All of the above

Answer: Option D

Question No. 105

The intensity of pressure on an immersed surface \_\_\_\_\_ with the increase in depth.

- (A) Does not change
- (B) Increases

- (C) Decreases
  - (D) None of these
- Answer: Option B

Question No. 106

Free surface of a liquid behaves like a sheet and tends to contract to smallest possible area due to the

- e) Force of adhesion
  - f) Force of cohesion
  - g) Force of friction
  - h) Force of diffusion
- Answer:

Option B

Question No. 107

Which of the following statement is correct?

- (A) In a compressible flow, the volume of the flowing liquid changes during the flow
- (B) A flow, in which the volume of the flowing liquid does not change, is called incompressible flow
- (C) When the particles rotate about their own axes while flowing, the flow is said to be rotational flow
- (D) All of the above

Answer: Option D

Question No. 108

A bucket of water is hanging from a spring balance. An iron piece is suspended into water without touching sides of bucket from another support. The spring balance reading will

- (A) Increase
- (B) Decrease
- (C) Remain same
- (D) Increase/decrease depending on depth of immersion

Answer: Option C

Question No. 109

A flow through a long pipe at constant rate is called

- (A) Steady uniform flow
- (B) Steady non-uniform flow
- (C) Unsteady uniform flow
- (D) Unsteady non-uniform flow

Answer: Option A

Question No. 110

Choose the wrong statement

- (A) Viscosity of a fluid is that property which determines the amount of its resistance to a shearing force



- (B) Viscosity is due primarily to interaction between fluid molecules  
(C) Viscosity of liquids decreases with increase in temperature  
(D) Viscosity of liquids is appreciably affected by change in pressure  
Answer: Option D

Question No. 111

The unit of dynamic viscosity in S.I. units is

- (A) N-m/s<sup>2</sup>  
(B) N-s/m<sup>2</sup>  
(C) Poise  
(D) Stoke

Answer: Option B

Question No. 112

A perfect gas

- (A) Has constant viscosity  
(B) Has zero viscosity  
(C) Is incompressible  
(D) None of the above

Answer: Option D

Question No. 113

In a free nappe,

- (A) The pressure below the nappe is atmospheric  
(B) The pressure below the nappe is negative  
(C) The pressure above the nappe is atmospheric  
(D) The pressure above the nappe is negative

Answer: Option A

Question No. 114

In a static fluid

- (A) Resistance to shear stress is small  
(B) Fluid pressure is zero  
(C) Linear deformation is small  
(D) Only normal stresses can exist

Answer: Option D

Question No. 115

One litre of water occupies a volume of

- (A) 100 cm<sup>3</sup>  
(B) 250 cm<sup>3</sup>  
(C) 500 cm<sup>3</sup>  
(D) 1000 cm<sup>3</sup>

Answer: Option A

Question No. 116

A balloon lifting in air follows the following principle

- (A) Law of gravitation
- (B) Archimedes principle
- (C) Principle of buoyancy
- (D) All of the above

Answer: Option D

Question No. 117

The maximum discharge over a broad crested weir is

- (A)  $0.384 C_d \times L \times H_{1/2}$
- (B)  $0.384 C_d \times L \times H_{3/2}$
- (C)  $1.71 C_d \times L \times H_{1/2}$
- (E)  $1.71 C_d \times L \times H_{3/2}$

Answer: Option D

Question No. 118

The ratio of absolute viscosity to mass density is known as

- (A) Specific viscosity
- (B) Viscosity index
- (C) Kinematic viscosity
- (D) Coefficient of viscosity

Answer: Option C

Question No. 119

Reynold's number is the ratio of inertia force to

- (A) Pressure force
- (B) Elastic force
- (C) Gravity force
- (D) Viscous force

Answer: Option D

Question No. 120

Metacentric height is given as the distance between

- (A) The center of gravity of the body and the metacentre
- (B) The center of gravity of the body and the center of buoyancy
- (C) The center of gravity of the body and the center of pressure
- (D) Center of buoyancy and metacentre

Answer: Option A

Question No. 121

In a footstep bearing, if the speed of the shaft is doubled, then the torque required to overcome the viscous resistance will be

- (A) Double
- (B) Four times
- (C) Eight times
- (D) Sixteen times

Answer: Option A

Question No. 122

The continuity equation is connected with

- (A) Open channel/pipe flow
- (B) Compressibility of fluids
- (C) Conservation of mass
- (D) Steady/unsteady flow

Answer: Option C

Question No. 123

The most economical section of a trapezoidal channel is one which has hydraulic mean depth equal to

- (A)  $1/2 \times \text{depth}$
- (B)  $1/2 \times \text{breadth}$
- (C)  $1/2 \times \text{sloping side}$
- (D)  $1/4 \times (\text{depth} + \text{breadth})$

Answer: Option A

Question No. 125

The absolute pressure is equal to

- (A) Gauge pressure + atmospheric pressure
- (B) Gauge pressure - atmospheric pressure
- (C) Atmospheric pressure - gauge pressure
- (D) Gauge pressure - vacuum pressure

Answer: Option A

Question No. 126

Unit of surface tension is

- (A) Energy/unit area
- (B) Velocity/unit area
- (C) Both of the above
- (D) It has no units

Answer: Option A

Question No. 127

A Piezometer tube is used only for measuring

- (A) Low pressure
- (B) High pressure
- (C) Moderate pressure
- (D) Vacuum pressure

Answer: Option C

Question No. 128

The capillary rise at 20°C in a clean glass tube of 1 mm bore containing water is approximately

- (A) 5 mm

- (B) 10 mm
- 6. 20 mm
- 7. 30 mm Answer:

Option D

Question No. 129

The Cipoletti weir is a \_\_\_\_\_ weir.

- (A) Rectangular
- (B) Triangular
- (C) Trapezoidal
- (D) Circular

Answer: Option C

Question No. 130

Pressure of the order of 10" torr can be measured by

- (A) Bourdon tube
- (B) Pirani Gauge
- (C) Micro -manometer
- (D) Ionisation gauge

Answer: Option D

Question No. 131

The volume of a fluid \_\_\_\_\_ as the pressure increases.

- (A) Remains same
- (B) Decreases
- (C) Increases
- (D) None of these

Answer: Option B

Question No. 132

Buoyant force is

- (A) The resultant force acting on a floating body
- (B) The resultant force on a body due to the fluid surrounding it
- (C) Equal to the volume of liquid displaced
- (D) The force necessary to maintain equilibrium of a submerged body

Answer: Option B

Question No. 133

A flow through a long pipe at decreasing rate is called \_\_\_\_\_ uniform flow.

- (A) Steady
- (B) Unsteady
- (C) Both A and B
- (D) None of these

Answer: Option B

Question No. 134

Choose the wrong statement

- (A) The center of buoyancy is located at the center of gravity of the displaced liquid
- (B) For stability of a submerged body, the center of gravity of body must lie directly below the center of buoyancy
- (C) If C.G. and center of buoyancy coincide, the submerged body must lie at neutral equilibrium for all positions
- (D) All floating bodies are stable

Answer: Option D

Question No. 135

The intensity of pressure at any point, in a liquid, is \_\_\_\_\_ to the depth of liquid from the surface.

- (A) Equal
- (B) Directly proportional
- (C) Inversely proportional
- (D) None of these

Answer: Option B

Question No. 136

True one- dimensional flow occurs when

- (A) The direction and magnitude of the velocity at all points are identical
- (B) The velocity of successive fluid particles, at any point, is the same at successive periods of time
- (C) The magnitude and direction of the velocity do not change from point to point in the fluid
- (D) The fluid particles move in plane or parallel planes and the streamline patterns are identical in each plane

Answer: Option A

Question No. 137

The discharge in an open channel corresponding to critical depth is

- (A) Zero
- (B) Minimum
- (C) Maximum
- (D) None of these

Answer: Option C

Question No. 138

A piece of wood having weight 5 kg floats in water with 60% of its volume under the liquid. The specific gravity of wood is

- (A) 0.83
- (B) 0.6
- (C) 0.4
- (D) 0.3

Answer: Option B

Question No. 139

A pitot tube is used to measure the

- (A) Velocity of flow at the required point in a pipe
- (B) Pressure difference between two points in a pipe
- (C) Total pressure of liquid flowing in a pipe
- (D) Discharge through a pipe

Answer: Option A

Question No. 140

The total energy of each particle at various places in the case of perfect incompressible fluid flowing in continuous stream

- (A) Keeps on increasing
- (B) Keeps on decreasing
- (C) Remain constant
- (D) May increase/decrease

Answer: Option C

Question No. 141

The critical depth meter is used to measure

- (A) Velocity of flow in an open channel
- (B) Depth of flow in an open channel
- (C) Hydraulic jump
- (D) Depth of channel

Answer: Option C

Question No. 142

Two pipe systems can be said to be equivalent, when the following quantities are same

- (A) Friction loss and flow
- (B) Length and diameter
- (C) Flow and length
- (D) Friction factor and diameter

Answer: Option A

Question No. 143

In a footstep bearing, if the radius of the shaft is doubled, then the torque required to overcome the viscous resistance will be

- (A) Double
- (B) Four times
- (C) Eight times
- (D) Sixteen times

Answer: Option D

Question No. 144

Surface tension has the units of

- (A) Newton-sec/m

- (F) Newton-m/sec
- (G) Newton/m
- (H) Newton

Answer: Option C

Question No. 145

The value of bulk modulus of a fluid is required to determine

- (A) Reynold's number
- (B) Froude's number
- (C) Mach number
- (D) Euler's number

Answer: Option C

Question No. 146

Fluid is a substance which offers no resistance to change of

- (A) Pressure
- (B) Flow
- (C) Shape
- (D) Volume

Answer: Option C

Question No. 147

The pressure less than atmospheric pressure is known as

- (A) Suction pressure
- (B) Vacuum pressure
- (C) Negative gauge pressure
- (D) All of these

Answer: Option D

Question No. 148

The normal stress in a fluid will be constant in all directions at a point only if

- (A) It is incompressible
- (B) It has uniform viscosity
- (C) It has zero viscosity
- (D) It is at rest

Answer: Option D

Question No. 149

The power transmitted through a pipe is (where  $w$  = Specific weight in  $N/m^3$ , and  $Q$  = Discharge in  $m^3/s$ )

- (A)  $w \times Q \times H$
- (B)  $w \times Q \times h_f$
- (C)  $w \times Q (H - h_f)$
- (D)  $w \times Q (H + h)$

Answer: Option C

Question No. 151

A compound pipe is required to be replaced by a new pipe. The two pipes are said to be equivalent, if

- (A) Length of both the pipes is same
- (B) Diameter of both the pipes is same
- (C) Loss of head and discharge of both the pipes is same
- (D) Loss of head and velocity of flow in both the pipes is same

Answer: Option C

Question No. 152

The center of gravity of the volume of the liquid displaced by an immersed body is called

- (A) Metacentre
- (B) Center of pressure
- (C) Center of buoyancy
- (D) Center of gravity

Answer: Option C

Question No. 153

A flow is called sub-sonic, if the Mach number is

- (A) Less than unity
- (B) Unity
- (C) Between 1 and 6
- (D) More than 6

Answer: Option A

Question No. 154

Barometer is used to measure

- (A) Pressure in pipes, channels etc.
- (B) Atmospheric pressure
- (C) Very low pressure
- (D) Difference of pressure between two points

Answer: Option B

Question No. 155

The hydraulic gradient line lies over the centre line of the pipe by an amount equal to the

- (A) Pressure head
- 7. Velocity head
- 8. Pressure head + velocity head
- 9. Pressure head - velocity head

Answer: Option A

Question No. 156

The center of pressure of a surface subjected to fluid pressure is the point

- (A) On the surface at which resultant pressure acts



- (B) On the surface at which gravitational force acts
- (C) At which all hydraulic forces meet
- (D) Similar to metacentre

Answer: Option A

Question No. 157

The variation in the volume of a liquid with the variation of pressure is called its

- (A) Surface tension
- (B) Compressibility
- (C) Capillarity
- (D) Viscosity

Answer: Option B

Question No. 159

The surface tension of mercury at normal temperature is \_\_\_\_\_ that of water.

- (A) Same as
- (B) Lower than
- (C) Higher than
- (D) None of these

Answer: Option C

Question No. 160

Flow of water in a pipe about 3 metres in diameter can be measured by

- (A) Orifice plate
- (B) Venturimeter
- (C) Rotameter
- (D) Pitot tube

Answer: Option D

Question No. 161

According to Francis formula, the discharge over a rectangular weir is (where n = Number of end contractions)

- (A)  $(2/3) \times C_d (L - nH) \times \sqrt{2gh}$
- (B)  $(2/3) \times C_d (L - 0.1nH) \sqrt{2g} \times H^{3/2}$
- (C)  $(2/3) \times C_d (L - nH) \sqrt{2g} \times H^{3/2}$
- (D)  $(2/3) \times C_d (L - nH) \sqrt{2g} \times H^{5/2}$

Answer: Option B

Question No. 162

The equation of continuity holds good when the flow

- (A) Is steady
- (B) Is one dimensional
- (C) Velocity is uniform at all the cross sections
- (D) All of the above

Answer: Option D

Question No. 163

A thick liquid like syrup has a \_\_\_\_\_ viscosity than a light liquid like water.

- (A) Lesser
- (B) Greater
- (C) Same
- (D) None of these

Answer: Option B

Question No. 164

Cavitation will begin when

- (A) The pressure at any location reaches an absolute pressure equal to the saturated vapour pressure of the liquid
- (B) Pressure becomes more than critical pressure
- (C) Flow is increased
- (D) Pressure is increased

Answer: Option A

Question No. 165

When a liquid is flowing through a pipe, the velocity of the liquid is

- (A) Maximum at the centre and minimum near the walls
- (B) Minimum at the centre and maximum near the walls
- (C) Zero at the centre and maximum near the walls
- (D) Maximum at the centre and zero near the walls

Answer: Option A

Question No. 166

Metacentric height is the distance between the metacentre and

- (A) Water surface
- (E) Center of pressure
- (F) Center of gravity
- (G) Center of buoyancy

Answer: Option C

Question No. 167

The velocity through a channel of circular section will be maximum when the depth of water is \_\_\_\_\_ the diameter of the circular channel.

- (A) 0.34 times
- (B) 0.67 times
- (C) 0.81 times
- (D) 0.95 times

Answer: Option C

Question No. 168

Resultant pressure of the liquid in the case of an immersed body acts through

- (A) Centre of gravity
- (B) Centre of pressure
- (C) Metacentre
- (D) Centre of buoyancy

Answer: Option B

Question No. 169

A fluid is said to be ideal, if it is

- (A) Incompressible
- (B) Viscous and incompressible
- (C) Inviscous and compressible
- (D) Inviscous and incompressible

Answer: Option D

Question No. 170

In a depressed nappe

- (A) The pressure below the nappe is atmospheric
- (B) The pressure below the nappe is negative
- (C) The pressure above the nappe is atmospheric
- (D) The pressure above the nappe is negative

Answer: Option B

Question No. 171

The value of the coefficient of compressibility for water at ordinary pressure and temperature in kg/cm is equal to

- (A) 2100
- (B) 2700
- (C) 10,000
- (D) 21,000

Answer: Option D

Question No. 172

In one dimensional flow, the flow

- (A) Is steady and uniform
- (B) Takes place in straight line
- (C) Takes place in curve
- (D) Takes place in one direction

Answer: Option B

Question No. 173

To avoid vaporisation in the pipe line, the pipe line over the ridge is laid such that it is not more than

- (A) 2.4 m above the hydraulic gradient
- (B) 6.4 m above the hydraulic gradient
- (C) 10.0 m above the hydraulic gradient
- (D) 5.0 above the hydraulic gradient

Answer: Option B

Question No. 174

The loss of head at exit of a pipe is (where  $v$  = Velocity of liquid in the pipe)

- (A)  $v^2/2g$
- (B)  $0.5v^2/2g$
- (C)  $0.375v^2/2g$
- (D)  $0.75v^2/2g$

Answer: Option A

Question No. 175

Metacentre is the point of intersection of

- (A) Vertical upward force through e.g. of body and center line of body
- (B) Buoyant force and the center line of body
- (C) Midpoint between e.g. and center of buoyancy
- (D) All of the above

Answer: Option B

Question No. 176

The imaginary line drawn in the fluid in such a way that the tangent to any point gives the direction of motion at that point, is known as

- (A) Path line
- (B) Stream line
- (C) Steak line
- (D) Potential line

Answer: Option B

Question No. 177

An open vessel of water is accelerated up an inclined plane. The free water surface will

- (A) Be horizontal
- (B) Make an angle in direction of inclination of inclined plane
- (C) Make an angle in opposite direction to inclination of inclined plane
- (D) Any one of above is possible

Answer: Option C

Question No. 178

The discharge over a rectangular notch is

- (A) Inversely proportional to  $H^{3/2}$

- (B) Directly proportional to  $H^{3/2}$
- (C) Inversely proportional to  $H^{5/2}$
- (D) Directly proportional to  $H^{5/2}$

Answer: Option B

Question No. 179

The flow in which each liquid particle has a definite path and their paths do not cross each other is called

- (A) One dimensional flow
- (B) Streamline flow
- (C) Steady flow
- (D) Turbulent flow

Answer: Option B

Question No. 180

The magnitude of water hammer depends upon the

- (A) Elastic properties of the pipe material
- (B) Elastic properties of the liquid flowing through the pipe
- (C) Speed at which the valve is closed
- (D) All of the above

Answer: Option D

Question No. 181

The fluid forces considered in the Navier Stokes equation are

- (A) Gravity, pressure and viscous
- (B) Gravity, pressure and turbulent
- (C) Pressure, viscous and turbulent
- (D) Gravity, viscous and turbulent

Answer: Option A

Question No. 182

When the Venturimeter is inclined, then for a given flow it will show \_\_\_\_\_ reading.

- (A) Same
- (B) More
- (T) Less
- (U) None of these

Answer: Option A

Question No. 183

Cavitation is caused by

- (A) High velocity
- (B) High pressure
- (C) Weak material
- (D) Low pressure

Answer: Option D

Question No. 184

A vertical wall is subjected to a pressure due to one kind of liquid, on one of its sides. The total pressure on the wall acts at a distance \_\_\_\_\_ from the liquid surface.

- (A)  $H/3$
- (B)  $H/2$
- (C)  $2H/3$
- (D)  $3H/4$

Answer: Option C

Question No. 185

An ideal flow of any fluid must fulfill the following

- (A) Newton's law of motion
- (B) Newton's law of viscosity
- (C) Pascal' law
- (D) Continuity equation

Answer: Option D

Question No. 186

The flow in a pipe or channel is said to be uniform when

- (A) The liquid particles at all sections have the same velocities
- (B) The liquid particles at different sections have different velocities
- (C) The quantity of liquid flowing per second is constant
- (D) Each liquid particle has a definite path

Answer: Option A

Question No. 187

Surface tension

- (A) Acts in the plane of the interface normal to any line in the surface
- (B) Is also known as capillarity
- (C) Is a function of the curvature of the interface
- (D) Decreases with fall in temperature

Answer: Option A

Question No. 188

Select the wrong statement

- (A) An equivalent pipe is treated as an ordinary pipe for all calculations
- (B) The length of an equivalent pipe is equal to that of a compound pipe
- (C) The discharge through an equivalent pipe is equal to that of a compound pipe
- (D) The diameter of an equivalent pipe is equal to that of a compound pipe

Answer: Option D

Question No. 189

Alcohol is used in

- (A) It has low vapour pressure
- (B) It is clearly visible
- (C) It has low surface tension
- (D) It can provide longer column due to low density

Answer: Option D

$$1 \times \sqrt{2}$$

Question No. 191

If no resistance is encountered by displacement, such a substance is known as

- (A) Fluid
- (B) Water
- (C) Gas
- (D) Ideal fluid

Answer: Option D

Question No. 192

The kinematic viscosity is the

- (A) Ratio of absolute viscosity to the density of the liquid
- (B) Ratio of density of the liquid to the absolute viscosity
- (C) Product of absolute viscosity and density of the liquid
- (D) Product of absolute viscosity and mass of the liquid

Answer: Option A

Question No. 193

Choose the correct relationship

- (F) Specific gravity = gravity  $\times$  density
- (G) Dynamic viscosity = kinematic viscosity  $\times$  density
- (H) Gravity = specific gravity  $\times$  density
- (I) Kinematic viscosity = dynamic viscosity  $\times$

density Answer: Option B

Question No. 194

The viscosity of water is \_\_\_\_\_ than that of mercury.

- (A) Higher

- (B) Lower
  - (C) Same as
  - (D) None of these
- Answer: Option A

Question No. 195

Surface energy per unit area of a surface is numerically equal to

- (A) Atmospheric pressure
- (B) Surface tension
- (C) Force of adhesion
- (D) Force of cohesion

Answer: Option B

Question No. 196

The specific weight of sea water is \_\_\_\_\_ that of pure water.

- (A) Same as
- (B) Less than
- (C) More than
- (D) None of these

Answer: Option C

Question No. 197

Which of the following instruments is used to measure flow on the application of Bernoulli's theorem?

- (A) Venturimeter
- (B) Orifice plate
- (C) Nozzle
- (D) All of the above

Answer: Option D

Question No. 199

The depth of the centre of pressure on a vertical rectangular gate 8 m wide and 6 m high, when the water surface coincides with the top of the gate, is

- (A) 2.4 m
- (B) 3.0 m
- (C) 4.0 m
- (D) 5.0 m

Answer: Option B

Question No. 200

An internal mouthpiece is said to be running free if the length of the mouthpiece is \_\_\_\_\_ the diameter of the orifice.

- (A) Less than twice
- (B) More than twice



- (C) Less than three times
- (D) More than three times

Answer: Option C

Question No. 201

An ideal flow of any fluid must satisfy

- (A) Pascal law
- (B) Newton's law of viscosity
- (C) Boundary layer theory
- (D) Continuity equation

Answer: Option D

Question No. 202

The height of a water column equivalent to a pressure of 0.15 MPa is

- (A) 15.3 m
- (B) 25.3 m
- (C) 35.3 m
- (D) 45.3 m

Answer: Option A

Question No. 203

The region between the separation streamline and the boundary surface of the solid body is known as

- (A) Wake
- (B) Drag
- (C) Lift
- (D) Boundary layer

Answer: Option A

Question No. 205

Froude number is significant in

- (A) Supersonics, as with projectile and jet propulsion
- (B) Full immersion or completely enclosed flow, as with pipes, aircraft wings, nozzles etc.
- (C) Simultaneous motion through two fluids where there is a surface of discontinuity, gravity forces, and wave making effect, as with ship's hulls
- (D) All of the above

Answer: Option C

Question No. 206

The ratio of specific weight of a liquid to the specific weight of pure water at a standard temperature is called

- (A) Density of liquid
- (B) Specific gravity of liquid

(C) Compressibility of liquid

(D) Surface tension of liquid

Answer: Option B

Question No. 207

A hydraulic press has a ram of 15 cm diameter and plunger of 1.5 cm. It is required to lift a weight of 1 tonne. The force required on plunger is equal to

(A) 10 kg

(B) 100 kg

(C) 1000 kg

(D) 1 kg

Answer: Option A

Question No. 208

The total head of a liquid particle in motion is equal to

(A) Pressure head + kinetic head + potential head

(B) Pressure head - (kinetic head + potential head)

(C) Potential head - (pressure head + kinetic head)

(D) Kinetic head - (pressure head + potential head)

Answer: Option A

Question No. 209

The bulk modulus of elasticity with increase in pressure

(A) Increases

(B) Decreases

(C) Remain constant

(D) Increases first up to certain limit and then

decreases Answer: Option A

Question No. 211

Free surface of a liquid tends to contract to the smallest possible area due to force of

(A) Surface tension

(B) Viscosity

(C) Friction

(D) Cohesion

Answer: Option A

Question No. 212

The Metacentric heights of two floating bodies A and B are 1 m and 1.5 m respectively. Select the correct statement.

(A) The bodies A and B have equal stability

(B) The body A is more stable than body B

(C) The body B is more stable than body A

(D) The bodies A and B are unstable

Answer: Option C

Question No. 213

The rise or depression of liquid in a tube due to surface tension will increase in size of tube will

(A) Increase

(B) Remain unaffected

(C) May increase or decrease depending on the characteristics of liquid

(D) Decrease

Answer: Option D

Question No. 214

A body floats in stable equilibrium

(A) When its metacentric height is zero

(F) hen the metacentre is above e.g.

(G) When its e.g. is below its center of buoyancy

(H) Metacentre has nothing to do with position of e.g. for determining stability

Answer: Option B

Question No. 215

The total pressure on a horizontally immersed surface is (where  $w$  = Specific weight of the liquid,  $A$  = Area of the immersed surface, and  $x$  = Depth of the centre of gravity of the immersed surface from the liquid surface)

(A)  $wA$

(B)  $wx$

(C)  $wAx$

(D)  $wA/x$

Answer: Option C

Question No. 216

The discharge of a depressed nappe is 6 to 7 percent \_\_\_\_\_ that of a free nappe.

(A) Less than

(B) More than

(C) Equal to

(D) None of these

Answer: Option B

Question No. 217

The line of action of the buoyant force acts through the Centroid of the

(A) Submerged body

(B) Volume of the floating body

(C) Volume of the fluid vertically above the body

(D) Displaced volume of the fluid

Answer: Option D

Question No. 218

The intensity of pressure at any point, in a liquid, is

- (A) Directly proportional to the area of the vessel containing liquid
- (B) Directly proportional to the depth of liquid from the surface
- (C) Directly proportional to the length of the vessel containing liquid
- (D) Inversely proportional to the depth of liquid from the surface

Answer: Option B

Question No. 219

During the opening of a valve in a pipe line, the flow is

- (A) Steady
- (B) Unsteady
- (C) Uniform
- (D) Laminar

Answer: Option B

Question No. 220

A manometer is used to measure

- (A) Atmospheric pressure
- (B) Pressure in pipes and channels
- (C) Pressure in Venturimeter
- (D) Difference of pressures between two points in a pipe

Answer: Option B

Question No. 221

For hypersonic flow, the Mach number is

- (A) Unity
- (B) Greater than unity
- (C) Greater than 2
- (D) Greater than 4

Answer: Option D

Question No. 222

The theoretical velocity of jet at vena contracta is (where H = Head of water at vena contracta)

- (A)  $2gH$
- (B)  $H \times g$
- (C)  $2g \sqrt{H}$
- (D)  $\sqrt{2gh}$

Answer: Option D

Question No. 223

For pipes, laminar flow occurs when Reynolds number is

- (A) Less than 2000
- (B) Between 2000 and 4000
- (C) More than 4000
- (D) Less than 4000

Answer: Option A

Question No. 224

When the flow in an open channel is gradually varied, the flow is said to be

- (A) Steady uniform flow
- (B) Steady non-uniform flow
- (C) Unsteady uniform flow
- (D) Unsteady non-uniform flow

Answer: Option B

Question No. 225

Property of a fluid by which molecules of different kinds of fluids are attracted to each other is

called

- (D) Adhesion
- (E) Cohesion
- (F) Viscosity
- (G) Compressibility

Answer: Option A

Question No. 226

In an internal mouthpiece, if the jet after contraction does not touch the sides of the mouthpiece, then the mouthpiece is said to be

- (A) Running full
- (B) Running free
- (C) Partially running full
- (D) Partially running free

Answer: Option B

Question No. 227

The units of kinematic viscosity are

- (A) Metres<sup>2</sup> per sec
- (B) kg sec/metre
- (C) Newton-sec per metre
- (D) Newton-sec per metre

Answer: Option A

Question No. 228

The length of a liquid stream while flowing over a weir \_\_\_\_\_ at the ends of the sill.

- (A) Expands
- (B) Does not change
- (C) Contracts
- (D) None of these

Answer: Option C

Question No. 229

Newton's law of viscosity is a relationship between

- (A) Shear stress and the rate of angular distortion
- (B) Shear stress and viscosity
- (C) Shear stress, velocity and viscosity
- (D) Pressure, velocity and viscosity

Answer: Option A

Question No. 230

The total energy line lies over the hydraulic gradient line by an amount equal to the

- (A) Pressure head
- (B) Velocity head
- (C) Pressure head + velocity head
- (D) Pressure head - velocity head

Answer: Option B

Question No. 231

Choose the wrong statement

- (A) The horizontal component of the hydrostatic force on any surface is equal to the normal force on the vertical projection of the surface
- (B) The horizontal component acts through the center of pressure for the vertical projection
- (C) The vertical component of the hydrostatic force on any surface is equal to the weight of the volume of the liquid above the area
- (D) The vertical component passes through the center of pressure of the volume

Answer: Option D

Question No. 232

In open channels, the specific energy is the

- (A) Total energy per unit discharge
- (B) Total energy measured with respect to the datum passing through the bottom of the channel
- (C) Total energy measured above the horizontal datum
- (D) Kinetic energy plotted above the free surface of water

Answer: Option B

Question No. 233

For a floating body to be in stable equilibrium, its metacentre should be

- (A) Below the center of gravity

- (B) Below the center of buoyancy
- (C) Above the center of buoyancy
- (D) Above the center of gravity

Answer: Option D

Question No. 234

A water tank contains 1.3 m deep water. The pressure exerted by the water per metre length of the tank is

- (A) 2.89 kN
- (B) 8.29 kN
- (C) 9.28 kN
- (D) 28.9 kN

Answer: Option B

Question No. 235

Total pressure on a 1m x 1m gate immersed vertically at a depth of 2 m below the free water surface will be

- (A) 1000 kg
- (B) 4000 kg
- (C) 2000 kg
- (D) 8000 kg

Answer: Option A

Question No. 236

If a body floating in a liquid occupies a new position and remains at rest in this new position, when given a small angular displacement, the body is said to be in \_\_\_\_\_ equilibrium.

- (A) Neutral
- (B) Stable
- (C) Unstable
- (D) None of these

Answer: Option A

Question No. 237

A streamline is defined as the line

- (A) Parallel to central axis flow
- (B) Parallel to outer surface of pipe
- (C) Of equal velocity in a flow
- (D) Along which the pressure drop is uniform

Answer: Option C

Question No. 238

The flow in a pipe or channel is said to be non-uniform when

- (A) The liquid particles at all sections have the same velocities
- (B) The liquid particles at different sections have different velocities

- (C) The quantity of liquid flowing per second is constant
- (D) Each liquid particle has a definite path

Answer: Option B

Question No. 239

Hydrometer is used to determine

- (A) Specific gravity of liquids
- (B) Specific gravity of solids
- (C) Specific gravity of gases
- (D) Relative humidity

Answer: Option A

Question No. 240

The dynamic viscosity of the liquid \_\_\_\_\_ with rise in temperature.

- (A) Remain unaffected
- (B) Increases
- (C) Decreases
- (D) None of these

Answer: Option C

Question No. 241

For pipes, turbulent flow occurs when Reynolds number is

- (A) Less than 2000
- (B) Between 2000 and 4000
- (C) More than 4000
- (D) Less than 4000

Answer: Option C

Question No. 242

The velocity of the liquid flowing through the divergent portion of a Venturimeter

- (A) Remains constant
- (B) Increases
- (C) Decreases
- (D) Depends upon mass of liquid

Answer: Option C

Question No. 243

The volumetric change of the fluid caused by a resistance is known as

- (A) Volumetric strain
- (B) Volumetric index
- (C) Compressibility
- (D) Adhesion

Answer: Option C



Question No. 244

If the depth of water in an open channel is less than the critical depth, the flow is called

- (A) Critical flow
- (B) Turbulent flow
- (C) Tranquil flow
- (D) Torrential flow

Answer: Option D

Question No. 245

Choose the wrong statement

- (A) Fluids are capable of flowing
- (B) Fluids conform to the shape of the containing vessels
- (C) When in equilibrium, fluids cannot sustain tangential forces
- (D) When in equilibrium, fluids can sustain shear forces

Answer: Option D

Question No. 246

An orifice is said to be large, if

- (A) The size of orifice is large
- (B) The velocity of flow is large
- (C) The available head of liquid is more than 5 times the height of orifice
- (D) The available head of liquid is less than 5 times the height of orifice

Answer: Option D

Question No. 247

A piece of metal of specific gravity 13.6 is placed in mercury of specific gravity 13.6, what fraction of its volume is under mercury?

- (A) The metal piece will simply float over the mercury
- (B) The metal piece will be immersed in mercury by half
- (C) Whole of the metal piece will be immersed with its top surface just at mercury level
- (D) Metal piece will sink to the bottom

Answer: Option C

Question No. 248

The centre of pressure acts \_\_\_\_\_ the centre of gravity of immersed surface.

- (A) At
- (B) Above
- (C) Below
- (D) None of these

Answer: Option C

Question No. 249

Dynamic viscosity of most of the liquids with rise in temperature

- (A) Increases
- (B) Decreases
- (C) Remain unaffected
- (D) Unpredictable

Answer: Option B

Question No. 250

The discharge over a right angled notch is (where H = Height of liquid above the apex of notch)

- (A)  $(8/15) C_d \cdot 2g \cdot H$
- (B)  $(8/15) C_d \cdot 2g \cdot H^{3/2}$
- (C)  $(8/15) C_d \cdot 2g \cdot H^2$
- (D)  $(8/15) C_d \cdot 2g \cdot H^{5/2}$

Answer: Option D

Question No. 251

A square surface 3 m × 3 m lies in a vertical line in water pipe its upper edge at water surface. The hydrostatic force on square surface is

- (A) 9,000 kg
- (B) 13,500 kg
- (C) 18,000 kg
- (D) 27,000 kg

Answer: Option B

Question No. 253

Select the correct statement

- (A) Local atmospheric pressure depends upon elevation of locality only
- (B) Standard atmospheric pressure is the mean local atmospheric pressure at sea level
- (C) Local atmospheric pressure is always below standard atmospheric pressure
- (D) A barometer reads the difference between local and standard atmospheric pressure

Answer: Option B

Question No. 254

The shear stress-strain graph for a Newtonian fluid is a

- (A) Straight line
- (B) Parabolic curve
- (C) Hyperbolic curve
- (D) Elliptical

Answer: Option A

Question No. 255

The flow in which the particles of a fluid attain such velocities that varies from point to point in magnitude and direction as well as from instant to instant, is known as

- (A) One dimensional flow

- (B) Uniform flow
  - (C) Steady flow
  - (D) Turbulent flow
- Answer: Option D

Question No. 256

For a perfect incompressible liquid, flowing in a continuous stream, the total energy of a particle remains the same, while the particle moves from one point to another. This statement is called

- (A) Continuity equation
- (B) Bernoulli's equation
- (C) Pascal's law
- (D) Archim

Answer: c

Question No. 257

Uniform flow occurs when

- (A) The direction and magnitude of the velocity at all points are identical
- (B) The velocity of successive fluid particles, at any point, is the same at successive periods of time
- (C) The magnitude and direction of the velocity do not change from point to point in the fluid
- (D) The fluid particles move in plane or parallel planes and the streamline patterns are identical in each pleasure

Answer: Option C

Question No. 258

The critical depth for a channel is given by (where  $q$  = Unit discharge (discharge per unit width) through the channel)

- (A)  $(q/g)^{1/2}$
- (B)  $(q^2/g)^{1/3}$
- (C)  $(q^3/g)^{1/4}$
- (D)  $q^{4/5}$

Answer: B

Question No. 259

At the center line of a pipe flowing under pressure where the velocity gradient is zero, the shear stress will be

- (A) Minimum
- (B) Maximum
- (C) Zero
- (D) Could be any value

Answer: Option D

Question No. 260

The discharge through a channel of trapezoidal section is maximum when  
(A) Width of channel at the top is equal to twice the width at the bottom (B)  
Depth of channel is equal to the width at the bottom (C) The sloping side is  
equal to half the width at the top  
(D) The sloping side is equal to the width at the bottom

Answer: Option C

Question No. 261

Piezometer is used to measure

- (A) Pressure in pipe, channels etc.
- (B) Atmospheric pressure
- (C) Very low pressures
- (D) Difference of pressure between two points

Answer: Option C

Question No. 262

The point at which the resultant pressure on an immersed surface acts, is known as

- (A) Centre of gravity
- (B) Centre of depth
- (C) Centre of pressure
- (D) Centre of immersed surface

Answer: Option C

Question No. 263

Choose the wrong statement

- (A) Any weight, floating or immersed in a liquid, is acted upon by a buoyant force
- (B) Buoyant force is equal to the weight of the liquid displaced
- (C) The point through which buoyant force acts, is called the center of buoyancy
- (D) Center of buoyancy is located above the center of gravity of the displaced liquid

Answer: Option D

Question No. 265

The pressure in the air space above an oil (sp. gr. 0.8) surface in a tank is 0.1 kg/cm<sup>2</sup>. The pressure at 2.5 m below the oil surface will be

- (A) 2 metres of water column
- (B) 3 metres of water column
- (C) 3.5 metres of water column
- (D) 4 m of water column

Answer: Option B

Question No. 266

The total pressure on the top of a closed cylindrical vessel completely filled up with a liquid is

- (A) Directly proportional to (radius)<sup>2</sup>

- (B) Inversely proportional to (radius)<sup>2</sup>
  - (C) Directly proportional to (radius)<sup>4</sup>
  - (D) Inversely proportional to (radius)<sup>4</sup>
- Answer: Option C

Question No. 267

The flow which neglects changes in a transverse direction is known as

- (A) One dimensional flow
- (B) Uniform flow
- (C) Steady flow
- (D) Turbulent flow

Answer: Option A

Question No. 268

Normal depth in open channel flow is the depth of flow corresponding to

- (A) Steady flow
- (F) Unsteady flow
- (G) Laminar flow
- (H) Uniform flow

Answer: Option D

Question No. 270

The mass per unit volume of a liquid at a standard temperature and pressure is called

- (A) Specific weight
- (B) Mass density
- (C) Specific gravity
- (D) None of these

Answer: Option B

Question No. 271

A large Reynold number is indication of

- (A) Smooth and streamline flow
- (B) Laminar flow
- (C) Steady flow
- (D) Highly turbulent flow

Answer: Option D

Question No. 272

Which of the following statement is wrong?

- (A) A flow whose streamline is represented by a curve is called two dimensional flow.
- (B) The total energy of a liquid particle is the sum of potential energy, kinetic energy and pressure energy.
- (C) The length of divergent portion in a Venturimeter is equal to the convergent portion.

(D) A pitot tube is used to measure the velocity of flow at the required point in a pipe.

Answer: Option C

Question No. 273

Density of water is maximum at

- (A) 0° C
- (B) 0° K
- (C) 4° C
- 100° C

Answer: Option C

Question No. 274

A weir is said to be broad crested weir, if the width of the crest of the weir is \_\_\_\_\_ half the height of water above the weir crest.

- (A) Equal to
- (B) Less than
- (C) More than
- (D) None of these

Answer: Option C

Question No. 275

The bulk modulus of elasticity

- (A) Has the dimensions of 1/pressure
- (B) Increases with pressure
- (C) Is large when fluid is more compressible
- (D) Is independent of pressure and viscosity

Answer: Option B

Question No. 277

Kinematic viscosity is equal to

- (A) Dynamic viscosity/density
- (B) Dynamic viscosity  $\times$  density
- (C) Density/dynamic viscosity
- (D) 1/dynamic viscosity  $\times$  density

Answer: Option A

Question No. 278

The atmospheric pressure at sea level is

- (A) 103 kN/m<sup>2</sup>
- (B) 10.3 m of water
- (C) 760 mm of mercury
- (D) All of these

Answer: Option D

Question No. 279

The conditions for the stable equilibrium of a floating body are

- (A) The metacentre should lie above the center of gravity
- (B) The center of buoyancy and the center of gravity must lie on the same vertical line
- (C) A righting couple should be formed
- (D) All the above are correct

Answer: Option D

Question No. 280

A glass tube of smaller diameter is used while performing an experiment for the capillary rise of water because

- (A) It is easier to see through the glass tube
- (B) Glass tube is cheaper than a metallic tube
- (C) It is not possible to conduct this experiment with any other tube
- (D) All of the above

Answer: Option A

Question No. 281

To avoid an interruption in the flow of a siphon, an air vessel is provided

- (A) At the inlet
- (B) At the outlet
- (C) At the summit
- (D) At any point between inlet and outlet

Answer: Option C

Question No. 282

When the coefficient of discharge ( $C_d$ ) is 0.623, then the general equation for discharge over a rectangular weir is

- (A)  $1.84(L - 0.1nH)H^{3/2}$
- (B)  $1.84(L - nH)H^2$
- (C)  $1.84(L - 0.1nH)H^{5/2}$
- (D)  $1.84(L - nH)H^3$

Answer: Option A

Question No. 283

In an isothermal atmosphere, the pressure

- (A) Decreases linearly with elevation
- (B) Remain constant
- (C) Varies in the same way as the density
- (D) Increases exponentially with elevation

Answer: Option C

Question No. 284

The pressure of a liquid measured with the help of a Piezometer tube is

- (A) Vacuum pressure

- (G) Gauge pressure
- (H) Absolute pressure
- (I) Atmospheric pressure

Answer: Option B

Question No. 285

If the atmospheric pressure on the surface of an oil tank (sp. gr. 0.8) is  $0.2 \text{ kg/cm}^2$ , the pressure at a depth of 50 m below the oil surface will be

- (A) 2 meters of water column
- (B) 3 meters of water column
- (C) 5 meters of water column
- (D) 6 meters of water Column

Answer: Option D

Question No. 286

The pressure intensity in  $\text{kN/m}^2$  (or  $\text{kPa}$ ) at any point in a liquid is (where  $w$  = Specific weight of liquid, and  $h$  = Depth of liquid from the surface)

- (A)  $w$
- (B)  $wh$
- (C)  $w/h$
- (D)  $h/w$

Answer: Option B

Question No. 287

The resultant upward pressure of a fluid on a floating body is equal to the weight of the fluid displaced by the body. This definition is according to

- (A) Buoyancy
- (B) Equilibrium of a floating body
- (C) Archimedes' principle
- (D) Bernoulli's theorem

Answer: Option C

Question No. 288

The liquid used in manometers should have

- (A) Low density
- (B) High density
- (C) Low surface tension
- (D) High surface tension

Answer: Option D

Question No. 289

Which of the following instrument can be used for measuring speed of an aeroplane?

- (A) Venturimeter
- (B) Orifice plate



- (C) Pitot tube
- (D) Rotameter

Answer: Option C

Question No. 290

A jet of water discharging from a 40 mm diameter orifice has a diameter of 32 mm at its vena contracta. The coefficient of contraction is

- (A) 0.46
- (B) 0.64
- (C) 0.78
- (D) 0.87

Answer: Option B

Question No. 291

Buoyant force is

- (A) Resultant force acting on a floating body
- (B) Equal to the volume of liquid displaced
- (C) Force necessary to keep a body in equilibrium
- (D) The resultant force on a body due to the fluid surrounding it

Answer: Option D

Question No. 292

In case of flow through parallel pipes,

- (A) The head loss for all the pipes is same
- (B) The total discharge is equal to the sum of discharges in the various pipes
- (C) The total head loss is the sum of head losses in the various pipes
- (D) Both (A) and (B)

Answer: Option D

Question No. 293

Rotameter is a device used to measure

- (A) Absolute pressure
- (B) Velocity of fluid
- (C) Flow
- (D) Rotation

Answer: Option C

Question No. 294

In a broad-crested weir, the discharge is maximum if the head of water on the downstream side of weir is \_\_\_\_\_ the head of water on the upstream side of weir.

- (A) Equal to
- (B) One-third
- (C) Two-third
- (D) Three-fourth

Answer: Option C

Question No. 295

When a body, floating in a liquid, is given a small angular displacement, it starts oscillating about a point known as

- (A) Centre of pressure
- (B) Centre of gravity
- (C) Centre of buoyancy
- (D) Metacentre

Answer: Option D

Question No. 296

A nozzle is generally made of

- (A) Cylindrical shape
- (B) Convergent shape
- (C) Divergent shape
- (D) Convergent-divergent shape

Answer: Option B

Question No. 297

Pitot tube is used for measurement of

- (A) Pressure
- (B) Flow
- (C) Velocity
- (D) Discharge

Answer: Option C

Question No. 298

Coefficient of discharge  $C_d$  is equal to (where  $C_c$  = Coefficient of contraction,  $C_v$  = Coefficient of velocity, and  $C_r$  = Coefficient of resistance)

- (A)  $C_c \times C_v$
- (B)  $C_c \times C_r$
- (C)  $C_v \times C_r$
- (D)  $C / C$

Answer: Option A

Question No. 299

The value of mass density in kg-sec-V-

- (A) 1
- (B) 1000
- (C) 100
- (D) 101.9

Answer: Option D

Question No. 300

The shear stress between the two liquid layers is \_\_\_\_\_ proportional to the distance between two layers.

- (A) Directly
- (B) Inversely
- (C) Both A and B
- (D) None of these

Answer: Option B

Question No. 301

Viscosity of water in comparison to mercury is

- (A) Higher
- (B) Lower
- (C) Same
- (D) Higher/lower depending on temperature

Answer: Option A

Question No. 302

The power transmitted through the pipe is maximum when the head lost due to friction is equal to

- (A) One-fourth of the total supply head
- (B) One-third of the total supply head
- (C) One-half of the total supply head
- (D) Two-third of the total supply head

Answer: Option B

Question No. 303

Falling drops of water become spheres due to the property of

- (A) Adhesion
- (B) Cohesion
- (C) Surface tension
- (D) Viscosity

Answer: Option C

Question No. 305

The difference of pressure between the inside and outside of a liquid drop is

- (A)  $p = T \times r$
- (B)  $p = T/r$
- (C)  $p = T/2r$
- (D)  $p = 2T/r$

Answer: Option D

Question No. 306

A venturi -flume is used to measure

- (A) Pressure of liquid
- (B) Discharge of liquid
- (C) Pressure difference between two points in a channel
- (D) Pressure difference between two points in a pipe

Answer: Option B

Question No. 307

Working principle of dead weight pressure gauge tester is based on

- (A) Pascal's law
- (B) Dalton's law of partial pressure
- (C) Newton's law of viscosity
- (D) Avogadro's hypothesis

Answer: Option A

Question No. 308

The metacentric height of a ship is 0.6 m and the radius of gyration is 4 m. The time of rolling of a ship is

- (A) 4.1 s
- (B) 5.2 s
- (C) 10.4 s
- (D) 14.1 s

Answer: Option C

Question No. 309

The discharge through a channel of rectangular section will be maximum, if

- (A) Its depth is twice the breadth
- (B) Its breadth is twice the depth
- (C) Its depth is thrice the breadth
- (D) Its breadth is thrice the depth

Answer: Option B

Question No. 310

The discharge through a channel of circular section will be maximum when the depth of water is \_\_\_\_\_ the diameter of the circular channel.

- (A) 0.34 times
- (B) 0.67 times
- (C) 0.81 times
- (D) 0.95 times

Answer: Option D

Question No. 311

Uniform flow occurs when

- (A) The flow is steady
- (B) The flow is streamline
- (C) Size and shape of the cross section in a particular length remain constant
- (D) Size and cross section change uniformly along length

Answer: Option C

Question No. 312

Bulk modulus of a fluid is the ratio of

- (A) Shear stress to shear strain
- (B) Increase in volume to the viscosity of fluid
- (C) Increase in pressure to the volumetric strain
- (D) Critical velocity to the viscosity of fluid

Answer: Option C

Question No. 314

An average value of coefficient of velocity is

- (A) 0.62
- (B) 0.76
- (C) 0.84
- (D) 0.97

Answer: Option D

Question No. 315

A liquid would wet the solid, if adhesion forces as compared to cohesion forces are

- (A) Less
- (B) More
- (C) Equal
- (D) Less at low temperature and more at high temperature

Answer: Option B

Question No. 316

When a cylindrical vessel containing liquid is revolved about its vertical axis at a constant angular velocity, the pressure

- (A) Varies as the square of the radial distance
- (B) Increases linearly as its radial distance
- (C) Increases as the square of the radial distance
- (D) Decreases as the square of the radial distance

Answer: Option A

According to Bazin's formula, the discharge over a rectangular weir is  $mL^2g \times H^{3/2}$  where  $m$  is equal to

- (A)  $0.405 + (0.003/H)$
- (B)  $0.003 + (0.405/H)$
- (C)  $0.405 + (H/0.003)$
- (D)  $0.003 +$

$(H/0.405)$  Answer:

Option A

Question No. 319

Which of the following is the unit of kinematic viscosity?

- (A) Pascal
- (B) Poise
- (C) Stoke
- (D) Faraday

Answer: Option C

Question No. 321

Operation of McLeod gauge used for low pressure measurement is based on the principle of

- (A) Gas law
- (B) Boyle's law
- (C) Charles law

Pascal's law Answer: Option B

Question No. 322

Reynold's number is the ratio of the inertia force to the

- (A) Surface tension force
- (B) Viscous force
- (C) Gravity force
- (D) Elastic force

Answer: Option B

Question No. 323

A piece weighing 3 kg in air was found to weigh 2.5 kg when submerged in water. Its specific gravity is

- (A) 1
- (B) 5
- (C) 7
- (D) 6

Answer: Option D

Question No. 324

A differential manometer is used to measure

- (A) Atmospheric pressure

- (B) Pressure in pipes and channels
- (C) Pressure in Venturimeter
- (D) Difference of pressures between two points in a pipe

Answer: Option D

Question No. 326

In a venturi-flume, the flow takes place at

- (A) Atmospheric pressure
- (B) Gauge pressure
- (C) Absolute pressure
- (D) None of these

Answer: Option A

Question No. 327

The normal stress is same in all directions at a point in a fluid

- (A) Only when the fluid is frictionless
- (B) Only when the fluid is incompressible and has zero viscosity
- (C) When there is no motion of one fluid layer relative to an adjacent layer
- (D) Irrespective of the motion of one fluid layer relative to an adjacent layer

Answer: Option C

Question No. 328

The highest efficiency is obtained with a channel of \_\_\_\_\_ section.

- (A) Circular
- (B) Square
- (C) Rectangular
- (D) Trapezoidal

Answer: Option D

Question No. 329

A vertical wall is subjected to a pressure due to one kind of liquid, on one of its sides. The total pressure on the wall per unit length is (where  $w$  = Specific weight of liquid, and  $H$  = Height of liquid)

- (A)  $wH$
- (B)  $wH/2$
- (C)  $wH^2/2$
- (D)  $wH^2/3$

Answer: Option C

Question No. 330

Which of the following manometer has highest sensitivity?

- (A) U-tube with water
- (B) Inclined U-tube
- (C) U-tube with mercury
- (D) Micro-manometer with water

Answer: Option D

Question No. 331

The velocity corresponding to Reynold number of 2800, is called

- (A) Sub-sonic velocity
- (B) Super-sonic velocity
- (C) Lower critical velocity
- (D) Higher critical velocity

Answer: Option D

Question No. 332

For a floating body to be in equilibrium

- (A) Meta centre should be above e.g.
- (B) Centre of buoyancy and e.g. must lie on same vertical plane
- (C) A righting couple should be formed
- (D) All of the above

Answer: Option D

Question No. 333

When an internal mouthpiece is running free, the discharge through the mouthpiece is (where  $a =$  Area of mouthpiece, and  $H =$  Height of liquid above the mouthpiece)

- (A)  $0.5 a \sqrt{gH}$
- (B)  $0.707 a \sqrt{gH}$
- (C)  $0.855 a \sqrt{gH}$
- (D)  $a \sqrt{gH}$

Answer: Option A

Question No. 334

A uniform body 3 m long, 2 m wide and 1 m deep floats in water. If the depth of immersion is 0.6 m, then the weight of the body is

- (A) 3.53 kN
- (B) 33.3 kN
- (C) 35.3 kN
- (D) None of these

Answer: Option C

Question No. 335

The force per unit length is the unit of

- (A) Surface tension
- (B) Compressibility
- (C) Capillarity
- (D) Viscosity

Answer: Option A

Question No. 336

When the Mach number is more than 6, the flow is called

- (A) Sub-sonic flow



- (B) Sonic flow
- (C) Super -sonic flow
- (D) Hyper-sonic flow

Answer: Option D

Question No. 337

The upper surface of a weir over which water flows is known is

- (A) Crest
- (B) Nappy
- (C) Sill
- (D) Weir top

Answer: Option C

Question No. 338

One cubic metre of water weighs

- (A) 100 litres
- (B) 250 litres
- (C) 500 litres
- (D) 1000 litres

Answer: Option D

Question No. 339

Kinematic viscosity is dependent upon

- (A) Pressure
- (B) Distance
- (C) Density
- (D) Flow

Answer: Option C

Question No. 340

The discharge through a large rectangular orifice is given by (where  $H_1$  = Height of the liquid above the top of the orifice,  $H_2$  = Height of the liquid above the bottom of the orifice,  $b$  = Breadth of the orifice, and  $C_d$  = Coefficient of discharge)

- (A)  $Q = (2/3) C_d \times b \times \sqrt{2g} \times (H_2 - H_1)$
- (B)  $Q = (2/3) C_d \times b \times \sqrt{2g} \times (H_2^{1/2} - H_1^{1/2})$
- (C)  $Q = (2/3) C_d \times b \times \sqrt{2g} \times (H_2^{3/2} - H_1^{3/2})$
- (D)  $Q = (2/3) C_d \times b \times \sqrt{2g} \times (H_2^2 - H_1^2)$

Answer: Option C

Question No. 341

An error of 1% in measuring head over the apex of the notch (H) will produce an error of \_\_\_\_\_ in discharge over a triangular notch.

- (A) 1 %
- (B) 1.5 %
- (C) 2 %
- (D) 2.5 %

Answer: Option D

Question No. 342

The Euler's equation for the motion of liquids is based upon the assumption that

- (A) The fluid is non - viscous, homogeneous and incompressible
- (B) The velocity of flow is uniform over the section
- (C) The flow is continuous, steady and along the stream line
- (D) All of the above

Answer: Option D

Question No. 343

The ratio of the inertia force to the viscous force is called

- (A) Reynold's number
- (B) Froude's number
- (C) Weber's number
- (D) Euler's number

Answer: Option A

Question No. 344

The total energy of a liquid particle in motion is equal to

- (A) Pressure energy + kinetic energy + potential energy
- (B) Pressure energy - (kinetic energy + potential energy)
- (C) Potential energy - (pressure energy + kinetic energy)
- (D) Kinetic energy - (pressure energy + potential energy)

Answer: Option A

Question No. 345

Which of the following instrument can be used for measuring speed of a submarine moving in deep sea?

- (A) Venturimeter
- (B) Orifice plate
- (C) Hot wire anemometer
- (D) Pitot tube

Answer: Option D

Question No. 346

The force present in a moving liquid is

- (A) Inertia force
- (B) Viscous force
- (C) Gravity force
- (D) All of these

Answer: Option D

Question No. 347

A ship whose hull length is 100 m is to travel at 10 m/sec. For dynamic similarity, at what velocity should a 1:25 model be towed through water?

- (A) 10 m/sec

(B) 25 m/sec

(C) 2 m/sec

(D) 50 m/sec

Answer: Option C

Question No. 348

The pressure of liquid at throat in a Venturimeter is \_\_\_\_\_ than that at inlet.

(A) Higher

4. Lower

5. Same

6. None of these

Answer: Option B

Question No. 349

The flow in which the velocity vector is identical in magnitude and direction at every point, for any given instant, is known as

(A) One dimensional flow

(B) Uniform flow

(C) Steady flow

(D) Turbulent flow

Answer: Option B

Question No. 350

The coefficient of discharge for an external mouthpiece depends upon

(A) Velocity of liquid

(B) Pressure of liquid

(C) Area of mouthpiece

(D) Length of mouthpiece

Answer: Option D

Question No. 351

The specific weight of water is 1000 kg/m<sup>3</sup>

(A) At normal pressure of 760 mm

(B) At 4°C temperature

(C) At mean sea level

(D) All the above

Answer: Option D

Question No. 352

If the depth of water in an open channel is greater than the critical depth, the flow is called

(A) Critical flow

(B) Turbulent flow

(C) Tranquil flow

(D) Torrential flow

Answer: Option C

Question No. 353

When a cylindrical vessel, containing some liquid, is rotated about its vertical axis, the liquid surface is depressed down at the axis of its rotation and rises up near the walls of the vessel on all sides. This type of flow is known as

- (A) Steady flow
- (B) Turbulent flow
- (C) Vortex flow
- (A) Uniform flow

Answer: Option C

Question No. 354

The body will sink down if the force of buoyancy is \_\_\_\_\_ the weight of the liquid displaced.

- (A) Equal to
- (B) Less than
- (C) More than
- (D) None of these

Answer: Option B

Question No. 355

The total pressure on the surface of a vertical sluice gate 2 m x 1 m with its top 2 m surface being 0.5 m below the water level will be

- (A) 500 kg
- (B) 1000 kg
- (C) 1500 kg
- (D) 2000 kg

Answer: Option D

Question No. 356

The velocity at which the laminar flow stops, is known as

- (A) Velocity of approach
- (B) Lower critical velocity
- (C) Higher critical velocity
- (D) None of these

Answer: Option B

Question No. 357

The line of action of the buoyant force acts through the

- (A) Centroid of the volume of fluid vertically above the body
- (B) Centre of the volume of floating body
- (C) Center of gravity of any submerged body
- (D) Centroid of the displaced volume of fluid

Answer: Option D

Question No. 358

The buoyancy depends upon the

- (A) Weight of the liquid displaced

- (B) Pressure with which the liquid is displaced
- (C) Viscosity of the liquid
- (D) Compressibility of the liquid

Answer: Option A

Question No. 360

Two dimensional flows occurs when

- (A) The direction and magnitude of the velocity at all points are identical
- (B) The velocity of successive fluid particles, at any point, is the same at successive periods of time
- (C) The magnitude and direction of the velocity do not change from point to point in the fluid
- (D) The fluid particles move in plane or parallel planes and the streamline patterns are identical in each plane

Answer: Option D

Question No. 361

Whenever a plate is held immersed at some angle with the direction of flow of the liquid, it is subjected to some pressure. The component of this pressure, in the direction of flow of the liquid, is known as

- (A) Lift
- (B) Drag
- (C) Stagnation pressure
- (D) Bulk modulus

Answer: Option B

Question No. 362

Which of the following is dimensionless?

- (A) Specific weight
- (B) Specific volume
- (C) Specific speed
- (D) Specific gravity

Answer: Option D

Question No. 363

Coefficient of resistance is the ratio of

- (A) Actual velocity of jet at vena -contracta to the theoretical velocity
- (B) Area of jet at vena-contracta to the area of orifice
- (C) Loss of head in the orifice to the head of water available at the exit of the orifice
- (D) Actual discharge through an orifice to the theoretical discharge

Answer: Option C

Question No. 364

Mercury does not wet glass. This is due to property of liquid known as

- (A) Adhesion

- (B) Cohesion
- (C) Surface tension
- (D) Viscosity

Answer: Option C

Question No. 365

A flow in which \_\_\_\_\_ force is dominating over the viscosity is called turbulent flow.

- (A) Elastic
- (B) Surface tension
- (C) Viscous
- (D) Inertia

Answer: Option D

Question No. 366

Specific weight of sea water is more than that of pure water because it contains

- (A) Dissolved air
- (B) Dissolved salt
- (C) Suspended matter
- (D) All of the above

Answer: Option D

Question No. 367

In an internal mouthpiece, the absolute pressure head at vena contracta is \_\_\_\_\_ the atmospheric pressure head by an amount equal to height of the liquid above the vena contracta.

- (A) Less than
- (B) More than
- (C) Equal to
- (D) None of these

Answer: Option A

Question No. 368

An odd shaped body weighing 7.5 kg and occupying 0.01 m<sup>3</sup> volume will be completely submerged in a fluid having specific gravity of

- (A) 1
- (B) 1.2
- (C) 0.8
- (D) 0.75

Answer: Option D

Question No. 269

The frictional resistance of a pipe varies approximately with \_\_\_\_\_ of the liquid.

- (A) Pressure

- (B) Velocity
- (C) Square of velocity
- (D) Cube of velocity

Answer: Option C

Question No. 370

For measuring flow by a Venturimeter, it should be installed in

- (A) Vertical line
- (B) Horizontal line
- (C) Inclined line with flow downward
- (D) In any direction and in any location

Answer: Option D

Question No. 371

The ratio of the inertia force to the elastic force is called

- (A) Reynold's number
- (B) Froude's number
- (C) Weber's number
- (D) Mach number

Answer: Option D

Question No. 372

All the terms of energy in Bernoulli's equation have dimension of

- (A) Energy
- (B) Work
- (C) Mass
- (D) Length

Answer: Option D

Question No. 373

The pressure at a point 4 m below the free surface of water is

- (A) 19.24 kPa
- (B) 29.24 kPa
- (C) 39.24 kPa
- (D) 49.24 kPa

Answer: Option C

Question No. 374

Specific weight of water in S.I. units is equal to

- (A) 1000 N/m<sup>3</sup>
- (B) 10000 N/m<sup>3</sup>
- (C)  $9.81 \times 10^3$  N/m<sup>3</sup>
- (D) \_\_\_\_\_ m<sup>3</sup>

Answer: <sup>1</sup> [REDACTED]

Question No. 375

The length AB of a pipe ABC in which the liquid is flowing has diameter ( $d_1$ ) and is suddenly enlarged to diameter ( $d_2$ ) at B which is constant for the length BC. The loss of head due to sudden enlargement is

- (A) -
- (B)  $(v_1 - v_2)^2/g$
- (C)  $(v_1 - v_2)/g$
- (D)  $(v_1 - v_2)^2/2g$

Answer:  C

Question No. 376

In an external mouthpiece, the absolute pressure head at vena contracta is \_\_\_\_\_ the atmospheric pressure head by an amount equal to 0.89 times the height of the liquid, above the vena contracta.

- (A) Less than
- (B) More than
- (C) Equal to
- (D) None of these

Answer: Option A

Question No. 377

Poise is the unit of

- (A) Surface tension
- (B) Capillarity
- (C) Viscosity
- (D) Shear stress in fluids

Answer: Option C

Question No. 378

Viscous force is the \_\_\_\_\_ of shear stress due to viscosity and cross-section area of flow.

- (A) Sum
- (B) Different
- (C) Product
- (D) Ratio

Answer: Option C

Question No. 379

The siphon will work satisfactorily, if the minimum pressure in the pipe is \_\_\_\_\_ vapour pressure of liquid.

- (A) Equal to
- (B) Less than
- (C) More than
- (D) None of these

Answer: Option C



Question No. 380

The tangential velocity of the water element having a free vortex is

- (A) Directly proportional to its distance from the centre
- (B) Inversely proportional to its distance from the centre
- (C) Directly proportional to its (distance)<sup>2</sup> from the centre
- (D) Inversely proportional to its (distance)<sup>2</sup> from the centre

Answer: Option B

Question No. 381

The horizontal component of buoyant force is

- (A) Negligible
- (B) Same as buoyant force
- (C) Zero
- (D) None of the above

Answer: Option C

Question No. 382

A flow in which the quantity of liquid flowing per second is constant, is called \_\_\_\_\_ flow.

- (A) Steady
- (B) Streamline
- (C) Turbulent
- (D) Unsteady

Answer: Option A

Question No. 383

The divergent portion of a Venturimeter is made longer than convergent portion in order to

- (A) Avoid the tendency of breaking away the stream of liquid
- (B) To minimise frictional losses
- (C) Both (A) and (B)
- (D) None of these

Answer: Option C

Question No. 384

According to Chezy's formula, the discharge through an open channel is (where A = Area of flow, C =

Chezy's constant, m = Hydraulic mean depth, and i = Uniform slope in bed)

- (C)  $A \times m \times i$
- (D)  $C \times \sqrt{m \times i}$
- (E)  $AC \sqrt{m \times i}$
- (F)  $mi \times \sqrt{C}$

Answer:  C

Question No. 385

In a free vortex motion, the radial component of velocity everywhere is

- (A) Maximum
- (B) Minimum

- (E) Zero
- (F) Nonzero and finite

Answer: Option C

Question No. 386

Coefficient of contraction is the ratio of

- (A) Actual velocity of jet at vena contracta to the theoretical velocity
- (B) Loss of head in the orifice to the head of water available at the exit of the orifice
- (C) Loss of head in the orifice to the head of water available at the exit of the orifice
- (D) Area of jet at vena-contracta to the area of orifice

Answer: Option D

Question No. 387

The Bernoulli's equation is based on the assumption that

- (A) There is no loss of energy of the liquid flowing
- (B) The velocity of flow is uniform across any cross-section of the pipe
- (C) No force except gravity acts on the fluid
- (D) All of the above

Answer: Option D

Question No. 388

The flow in a pipe is turbulent when Reynold number is

- (A) Less than 2000
- (B) Between 2000 and 2800
- (C) More than 2800
- (D) None of these

Answer: Option C

Question No. 389

When the flow parameters at any given instant remain same at every point, then flow is said to be

- (A) Quasi-static
- (B) Steady state
- (C) Laminar
- (D) Uniform

Answer: Option D

Question No. 391

Rain drops are spherical because of

- (A) Viscosity
- (B) Air resistance
- (C) Surface tension forces
- (D) Atmospheric pressure

Answer: Option C

Question No. 392

The discharge over the trapezoidal notch is equal to the discharge over the rectangular notch \_\_\_\_\_ the discharge over the triangular notch.

- (A) Plus
- (B) Minus
- (C) Divide
- (D) None of these

Answer: Option A

Question No. 394

The sheet of water flowing over a notch or a weir is known as

- (A) Sill or crest
- (B) Nappe or vein
- (C) Orifice
- (D) None of these

Answer: Option B

Question No. 395

A structure used to dam up a stream or river over which the water flows is called

- (A) Orifice
- (B) Notch
- (C) Weir
- (D) Dam

Answer: Option C

Question No. 396

A body floating in a liquid is said to be in neutral equilibrium, if its metacentre

- (A) Coincides with its centre of gravity
- (B) Lies above its centre of gravity
- (B) Lies below its centre of gravity
- (C) Lies between the centre of buoyancy and centre of gravity

Answer: Option A

Question No. 397

General energy equation holds for

- (A) Steady flow
  - (B) Turbulent flow
  - (C) Laminar flow
  - (D) Non-uniform flow
- Answer: Option D

Question No. 398

The buoyancy depends on

- (A) Mass of liquid displaced
- (B) Viscosity of the liquid
- (C) Pressure of the liquid displaced
- (D) Depth of immersion

Answer: Option A

Question No. 399

The centre of gravity of the volume of the liquid displaced is called

- (A) Centre of pressure
- (B) Centre of buoyancy
- (C) Metacentre
- (D) None of these

Answer: Option B

Question No. 400

The Reynold's number of a ship is \_\_\_\_\_ to its velocity and length.

- (A) Directly proportional
- (B) Inversely proportional
- (C) Square root of velocity
- (D) None of these

Answer: Option A

## IRRIGATION ENGINEERING

1. Which of the following methods of applying water may be used on rolling land ?

- a) boarder flooding
- b) check flooding
- c) furrow flooding
- d) free flooding

**Ans: a**

2. The value of Sodium Absorption Ratio for high sodium water lies between

- a) 0 to 10
- b) 10 to 18
- c) 18 to 26
- d) 26 to 34

**Ans: c**

3. Optimum depth of kor watering for rice is

- a) 135 mm
- b) 165 mm
- c) 190 mm
- d) 215 mm

Ans: c

4. Irrigation water having the concentration of  $\text{Na}^{++}$  ,  $\text{Ca}^{++}$  and  $\text{Mg}^{++}$  as 20, 3 and 1 Milli equivalent per litre respectively will be classified as

- a) low sodium water
- b) medium sodium water
- c) high sodium water
- d) very high sodium water

Ans: b

5. The duty is largest

- a) at the head of water course

- b) on the field
- c) at the head of a main canal
- d) same at all places

Ans: b

6. The "outlet discharge factor" is the duty at the head of

- a) main canal
- b) branch canal
- c) watercourse
- d) distributory

Ans: c

7. The kor depth for rice is 190 mm and kor period is 14 days. The outlet factor for this will be

- a) 637 hectares/m<sup>3</sup>/sec
- b) 837 hectares/m<sup>3</sup>/sec
- c) 972 hectares/m<sup>3</sup>/sec
- d) 1172 hectares/m<sup>3</sup>/sec

Ans: a

8. For supplying water to rabi crop, kharif crop and sugarcane, the channel is designed for a capacity equal to the greater of the water requirement of

- a) rabi or kharif
- b) rabi and kharif or sugarcane
- c) rabi and sugarcane or kharif and sugarcane
- d) rabi or kharif or sugarcane

Ans: c

9. The ratio of the quantity of water stored in the root zone of the crops to the quantity of water actually delivered in the field is known as

- a) water conveyance efficiency
- b) water application efficiency
- c) water use efficiency
- d) none of the above

Ans: b

10. The water utilizable by plants is available in soils mainly in the form of

- a) gravity water
- b) capillary water
- c) hygroscopic water
- d) chemical water

Ans: b

11. The amount of irrigation water required to meet the evapotranspiration needs of the crop during its full growth is called

- a) effective rainfall
- b) consumptive use
- c) consumptive irrigation requirement
- d) net irrigation requirement

Ans: c

12. With the increase in the quantity of water supplied, the yield of most crops

- a) increases continuously
- b) decreases continuously
- c) increases upto a certain limit and then becomes constant
- d) increases upto a certain limit and then decreases

Ans: d

13. Hydrograph is the graphical representation of

- a) runoff and time
- b) surface runoff and time
- c) ground waterflow and time
- d) rainfall and time

Ans: a

14. Infiltration rate is always

- a) more than the infiltration capacity
- b) less than the infiltration capacity
- c) equal to or less than the infiltration capacity
- d) equal to or more than the infiltration capacity

Ans: c

15. The depth of water required to bring the soil moisture content of a given soil upto its field capacity is called

- a) hygroscopic water
- b) equivalent moisture
- c) soil moisture deficiency
- d) pellicular water

Ans: c

16. Infiltration capacity

- a) is a constant factor
- b) changes with time
- c) changes with location
- d) changes with both time and location

Ans: d

17. Infiltration is the

- a) movement of water through the soil
- b) absorption of water by soil surface
- c) both (a) and (b)
- d) none of the above

Ans: a

18. If the intensity of rainfall is more than the infiltration capacity of soil, then the infiltration rate will be

- a) equal to rate of rainfall
- b) equal to infiltration capacity
- c) more than rate of rainfall
- d) more than infiltration capacity

Ans: b

19. Cyclonic precipitation is caused by lifting of an air mass due to

- a) pressure difference
- b) temperature difference
- c) natural topographical barriers
- d) all of the above

Ans: a

20. Which of the following is a non-recording rain gauge ?

- a) tipping bucket type rain gauge
- b) Simon's rain gauge
- c) Steven's weighing type rain gauge
- d) floating type rain gauge

Ans: b

21. A rain gauge should preferably be fixed

- a) near the building
- b) under the tree
- c) in an open space
- d) in a closed space

Ans: c

22. Which of the following types of rain gauges is used for measuring rain in remote hilly inaccessible areas ?

- a) tipping bucket type
- b) weighing type



- c) floating type
- d) Simon's rain gauge

Ans: a

23. Rate of evaporation from a water surface increases if
- i) difference of vapour pressure between water and air is increased
  - ii) velocity of wind is decreased
  - iii) concentration of soluble solids in water is decreased
- The correct answer is
- a) (i) and (ii)
  - b) (i) and (iii)
  - c) (ii) and (iii)
  - d) (i), (ii) and (iii)

Ans: b

24. A 70% index of wetness means
- a) rain excess of 30%
  - b) rain deficiency of 30%
  - c) rain deficiency of 70%
  - d) none of the above

Ans: b

25. Under the same conditions, which of the following shapes of water surface will give the highest rate of evaporation ?
- a) flat water surface
  - b) convex water surface
  - c) concave water surface
  - d) independent of shape of water surface

Ans: b

26. Assertion A : To estimate the rainfall over a catchment, the number of rain gauges required per unit area is large for hilly areas.

Reason R : Rainfall gradient is steep. Select your correct answer according to the coding system given below :

- a) Both A and R are true and R is the correct explanation of A
- b) Both A and R are true but R is not the correct explanation of A
- c) A is true but R is false
- d) A is false but R is true

Ans: a

27. When surface of transpiration is submerged under water, then potential evapotranspiration is
- a) much more than evapotranspiration
  - b) much less than evapotranspiration

- c) equal to evapotranspiration
- d) equal to or less than evapotranspiration

Ans: a

28. Unit of runoff in M.K.S. system is

- a) cubic metre/sec
- b) metre/sec
- c) cubic metre
- d) square metre

Ans: a

29. The runoff increases with

- a) increase in intensity of rain
- b) increase in infiltration capacity
- c) increase in permeability of soil
- d) all of the above

Ans: a

30. The area between the isohyets 45 cm and 55 cm is 100 square km and between 55 cm and 65 cm is 150 square km. The average depth of annual precipitation over the above basin of 250 square km will be

- a) 50 cm
- b) 55 cm
- c) 56 cm
- d) 60 cm

Ans: c

31. A current meter is used to measure the

- a) velocity of flow of water
- b) depth of flow of water
- c) discharge
- d) none of the above

Ans: a

32. If it rains between 2 P.M. and 3 P.M. and the entire basin area just starts contributing water at 3 P.M. to the outlet, then time of concentration will be

- a) 15 minutes
- b) 20 minutes
- c) 30 minutes
- d) 60 minutes

Ans: d

33. The rainfall on five successive days were measured as 100 mm, 80 mm, 60 mm, 40 mm and 20 mm respectively. If the infiltration index or the storm loss rate for the catchment area is earlier estimated as 50 mm/day, the total surface run off will be

- a) 50 mm
- b) 60 mm
- c) 90 mm
- d) 140 mm

Ans: c

34. The normal annual precipitation at stations X, A, B and C are 700 mm, 1000 mm, 900 mm and 800 mm respectively. If the storm precipitation at three station A, B and C were 100 mm, 90 mm and 80 mm respectively, then the storm precipitation for station X will be

- a) 70mm
- b) 80mm
- c) 90 mm
- d) 105 mm

Ans: a

35. The best unit duration of storm for a unit hydrograph is

- a) 1 hour
- b) one-fourth of basin lag
- c) one-half of basin lag
- d) equal to basin lag

Ans: b

36. The unit hydrograph due to a storm may be obtained by dividing the ordinates of the direct runoff hydrograph by

- a) direct runoff volume
- b) period of storm
- c) total rainfall
- d) none of the above

Ans: a

37. The unit hydrograph of a specified duration can be used to evaluate the hydrograph of storms of

- a) same duration only
- b) same and shorter duration
- c) same and longer duration
- d) any duration

Ans: d

38. S-hydrograph is used to obtain unit hydrograph of

- a) shorter duration from longer duration
- b) longer duration from shorter duration
- c) both (a) and (b)
- d) none of the above

Ans: c

39. The relation between probability (P) and recurrence interval (T) is given by

- a)  $PT = 1$
- b)  $PT^2 = 1$
- c)  $P/T = 1$
- d)  $P/T^2 = 1$

Ans: a

40. Dimensions of coefficient of transmissibility are

- a)  $M^{\circ}L^{\circ}T^{\circ}$
- b)  $rvfL'T''1$
- c)  $M^{\circ}L^2T^1$
- d)  $MLV$

Ans: c

41. If d is the depth of the aquifer through which water is flowing, then the relationship between permeability k and transmissibility T is given by

- a)  $T = kd$
- b)  $T = k/d$
- c)  $T = Vkd$
- d)  $k = VTd$

Ans: a

42. An artesian aquifer is the one where

- a) water surface under the ground is at atmospheric pressure
- b) water is under pressure between two impervious strata
- c) water table serves as upper surface of zone of saturation
- d) none of the above

Ans: b

43. A deep well

- a) is always deeper than a shallow well
- b) has more discharge than a shallow well
- c) is weaker structurally than a shallow well
- d) both (a) and (b)

Ans: b

44. A multipurpose reservoir is the one which is
- a) designed for one purpose but serves more than one purpose
  - b) planned and constructed to serve various purposes
  - c) both (a) and (b)
  - d) none of the above

Ans: b

45. The useful storage is the volume of water stored in the reservoir between
- a) minimum pool level and maximum pool level
  - b) minimum pool level and normal pool level
  - c) normal pool level and maximum pool level
  - d) river bed and minimum pool level

Ans: b

46. The water stored in the reservoir below the minimum pool level is called
- a) useful storage
  - b) dead storage
  - c) valley storage
  - d) surcharge storage

Ans: b

47. For a flood control reservoir, the effective storage is equal to
- a) useful storage - valley storage
  - b) useful storage + surcharge storage
  - c) useful storage + surcharge storage + valley storage
  - d) useful storage + surcharge storage - valley storage

Ans: d

48. Trap efficiency of a reservoir is a function of
- a) capacity/inflow ratio
  - b) capacity/outflow ratio
  - c) outflow/inflow ratio
  - d) none of the above

Ans: a

49. The total capacity of a reservoir is 25 million cubic metres and dead storage is 5 million cubic metres. If the average volume of sediment deposition is 0.10 million cubic metre per year, then the usefulness of the reservoir will start reducing after

- a) 50 years
- b) 150 years
- c) 200 years
- d) 250 years

Ans: a

50. The forces, which are considered for the analysis of an elementary profile of a gravity dam under empty reservoir condition, are

- i) Water pressure
- ii) Self weight
- iii) Uplift
- iv) Pressure due to earthquake

The correct answer is

- a) Only (ii)
- b) (i), (ii) and (iii)
- c) (i), (ii) and (iv)
- d) (i), (ii), (iii) and (iv)

Ans: a

51. When the upstream face of a gravity dam is vertical, then the intensity of water pressure at the water surface and at the base respectively will be

- a) 0 and  $wH^2/2$
- b)  $wH^2/2$  and  $wH^2/3$
- c)  $wH$  and 0
- d) 0 and  $wH^2$

where  $w$  is unit weight of water and  $H$  is the depth of water.

Ans: d

52. The uplift pressure on a dam can be controlled by

- i) constructing cutoff under upstream face
- ii) constructing drainage channels between the dam and its foundation
- iii) by pressure grouting in foundation

The correct answer is

- a) only (i)
- b) both (i) and (ii)
- c) both (i) and (iii)
- d) (i), (ii) and (iii)

Ans: d

53. The uplift pressure on the face of a drainage gallery in a dam is taken as

- a) hydrostatic pressure at toe
- b) average of hydrostatic pressure at toe and heel
- c) two-third of hydrostatic pressure at toe plus one-third of hydrostatic pressure at heel
- d) none of the above

Ans: c

54. Horizontal acceleration due to earthquake results in

- a) hydrodynamic pressure
- b) inertia force into the body of the dam
- c) both (a) and (b)
- d) none of the above

Ans: c

55. Hydrodynamic pressure due to earthquake acts at a height of

- a)  $3H/47I$  above the base
- b)  $3H/47t$  below the water surface
- c)  $4H/37I$  above the base
- d)  $4H/37t$  below the water surface where H is the depth of water.

Ans: c

56. The major resisting force in a gravity dam is

- a) water pressure
- b) wave pressure
- c) self-weight of dam
- d) uplift pressure

Ans: c

57. When the reservoir is full, the maximum compressive force in a gravity dam is produced

- a) at the toe
- b) at the heel
- c) within the middle third of base
- d) at centre of base

Ans: a

58. The maximum permissible eccentricity for no tension at the base of a gravity dam is

- a)  $B/2$
- b)  $B/3$
- c)  $B/4$
- d)  $B/6$

Ans: d

59. Presence of tail water in a gravity dam

- i) increases the principal stress
- ii) decreases the principal stress
- iii) increases the shear stress
- iv) decreases the shear stress

The correct answer is

- a) (i) and (iii)

- b) (i) and (iv)
- c) (ii) and (iii)
- d) (ii) and (iv)

Ans: d

60. For wave action in dams, the maximum height of freeboard is generally taken to be equal to

- a)  $0.5 h_w$
- b)  $0.75 h_w$
- c)  $1.25 h_w$
- d)  $1.50 h_w$

where  $h_w$  is height of wave.

Ans: d

61. As compared to gravity dams, earthen dams

- a) are costlier
- b) are less susceptible to failure
- c) require sound rock foundations
- d) require less skilled labour

Ans: d

62. The most suitable material for the central impervious core of a zoned embankment type dam is

- a) clay
- b) coarse sand
- c) silty clay
- d) clay mixed with fine sand

Ans: d

63. Seepage through embankments in an earthen dam is controlled by

- a) drainage filters
- b) relief wells
- c) drain trenches
- d) provision of downstream berms

Ans: c

64. Seepage through foundation in an earthen dam is controlled by providing

- a) rock toe
- b) horizontal blanket
- c) impervious cut off
- d) chimney drain

Ans: c



65. The flow of water after spilling over the weir crest in chute spillway and side channel spillway respectively are

- a) at right angle and parallel to weir crest
- b) parallel and at right angle to weir crest
- c) parallel to weir crest in both
- d) at right angle to weir crest in both

Ans: a

66. The discharge passing over an ogee spillway is given by

- a)  $CLH^{3/2}$
- b)  $CHL^{3/2}$
- c)  $CLH^{5/2}$
- d)  $CLH^{1/2}$

where, L is effective length of spillway crest and H is the total head over the spillway crest including velocity head.

Ans: a

67. Coefficient of discharge of an ogee spillway

- a) depends on depth of approach and upstream slope
- b) depends on downstream apron interference and downstream submergence
- c) remains constant
- d) both (a) and (b)

Ans: d

68. Which of the following spillways is least suitable for an earthen dam ?

- a) ogee spillway
- b) chute spillway
- c) side channel spillway
- d) shaft spillway

Ans: a

69. In case of non-availability of space due to topography, the most suitable spillway is

- a) straight drop spillway
- b) shaft spillway
- c) chute spillway
- d) ogee spillway

Ans: b

70. In a chute spillway, the flow is usually

- a) uniform
- b) subcritical
- c) critical

d) super critical

Ans: d

71. For the upstream face of an earthen dam, the most adverse condition for stability of slope is

- a) sudden drawdown
- b) steady seepage
- c) during construction
- d) sloughing of slope

Ans: a

72. If there are two canals taking off from each flank of a river, then there will be

- a) one divide wall and one undersluice
- b) one divide wall and two undersluices
- c) two divide walls and one undersluice
- d) two divide walls and two undersluices

Ans: d

73. Generally the weir is aligned at right angles to the direction of the main river current because

- a) it ensures less length of the weir
- b) it gives better discharging capacity
- c) it is economical
- d) all of the above

Ans: d

74. The main function of a divide wall is to

- a) control the silt entry in the canal
- b) prevent river floods from entering the canal
- c) separate the undersluices from weir proper
- d) provide smooth flow at sufficiently low velocity

Ans: c

75. A divide wall is provided

- a) at right angle to the axis of weir
- b) parallel to the axis of weir and up-stream of it
- c) parallel to the axis of weir and down-stream of it
- d) at an inclination to the axis of weir

Ans: a

76. As compared to crest of the normal portion of the weir, the crest of the under sluice portion of weir is kept at

- a) lower level

- b) higher level
- c) same level
- d) any of the above depending on the design

Ans: a

77. Silt excluders are constructed on the

- a) river bed upstream of head regulator
- b) river bed downstream of head regulator
- c) canal bed upstream of head regulator
- d) canal bed downstream of head regulator

Ans: a

78. According to Khosla's theory, the exit gradient in the absence of a downstream cutoff is

- a) 0
- b) unity
- c) infinity
- d) very large

Ans: c

79. The minimum size of stone that will remain at rest in a channel of longitudinal slope  $S$  and hydraulic mean depth  $R$  is given by

- a)  $4RS$
- b)  $11RS$
- c)  $7RS$
- d)  $15RS$

Ans: b

80. The ratio of average values of shear stresses produced on the bed and the banks of a channel due to flowing water is

- a) less than 1
- b) equal to 1
- c) greater than 1
- d) equal to zero

Ans: c

81. If the critical shear stress of a channel is  $x_c$ , then the average value of shear stress required to move the grain on the bank is

- a)  $0.5 x_c$
- b)  $0.75 TC$
- c)  $x_c$
- d)  $1.33 TC$

Ans: b

82. As per Lacey's theory, the silt factor is
- a) directly proportional to average particle size
  - b) inversely proportional to average particle size
  - c) directly proportional to square root of average particle size
  - d) not related to average particle size

Ans: c

83. Wetted perimeter of a regime channel for a discharge of 64 cumecs as per Lacey's theory will be

- a) 19 m
- b) 38m
- c) 57m
- d) 76m

Ans: b

84. Which of the following canal structures is used to remove surplus water from an irrigation channel into a natural drain ?

- a) canal fall
- b) canal outlet
- c) canal escape
- d) canal regulator

Ans: c

85. For a proportional outlet, the flexibility is

- a) zero
- b) between zero and 1
- c) 1
- d) greater than 1

Ans: c

86. The sensitivity of a rigid module is

- a) zero
- b) between zero and one
- c) 1
- d) infinity

Ans: a

87. Which of the following is a flexible outlet ?

- a) submerged pipe outlet
- b) Kennedy's gauge outlet
- c) Gibb's outlet

d) none of the above

Ans: b

88. A straight glacis type fall with a baffle platform and a baffle wall is called

a) vertical dropfall

b) glacis fall

c) Montague type fall

d) inglis fall

Ans: d

89. Which of the following types of falls use parabolic glacis for energy dissipation ?

a) vertical drop fall

b) glacis fall

c) Montague type fall

d) inglis fall

Ans: c

90. In a Sarda type fall, rectangular crest is used for discharge upto

a) 6 cumecs

b) 10 cumecs

c) 14 cumecs

d) 20 cumecs

Ans: c

91. Which of the following can be used as a meter fall ?

a) vertical drop fall

b) flumed glacis fall

c) unflumed glacis fall

d) all of the above

Ans: a

92. Vertical drop fall is satisfactory for a height upto

a) 0.5 m

b) 1.5 m

c) 3.5 m

d) 5.0 m

Ans: b

93. Which of the following canal outlets maintains a constant discharge ?

a) non-modular outlet

b) flexible outlet

c) rigid module

d) none of the above

Ans: c

94. The ratio of rate of change of the discharge of an outlet to the rate of change of the discharge of distributing channel is called

- a) proportionality
- b) flexibility
- c) setting
- d) sensitivity

Ans: b

95. The drainage water intercepting the canal can be disposed of by passing the canal below the drainage in

- a) aqueduct and syphon aqueduct
- b) aqueduct and super passage
- c) super passage and canal syphon
- d) level crossing

Ans: c

96. If the R.L's of canal bed level and high flood level of drainage are 212.0 m and 210.0 m respectively, then cross drainage work will be

- a) aqueduct
- b) superpassage
- c) syphon
- d) syphon aqueduct

Ans: c

97. The aqueduct or superpassage type of works are generally used when

- a) high flood drainage discharge is small
- b) high flood drainage discharge is large and short lived
- c) high flood drainage discharge is large and continues for a long time
- d) none of the above

Ans: a

98. An aggrading river is a

- a) silting river
- b) scouring river
- c) both silting and scouring river
- d) neither silting nor scouring river

Ans: a

99. Tortuosity of a meandering river is the ratio of

- a) meander belt to meander length
- b) meander length to meander belt
- c) curved length along the channel to the direct axial length of the river reach
- d) direct axial length of the river reach to curved length along the channel

Ans: c

100. The meander pattern of a river is developed by

- a) average discharge
- b) dominant discharge
- c) maximum discharge
- d) critical discharge

Ans: b

101. The main cause of meandering is

- a) presence of an excessive bed slope in the river
- b) degradation
- c) the extra turbulence generated by the excess of river sediment during floods
- d) none of the above

Ans: c

102. Tortuosity of a meandering river is always

- a) equal to 1
- b) less than 1
- c) greater than 1
- d) less than or equal to 1

Ans: c

103. Select the correct statement.

- a) A meander increases the river length but a cut off reduces the river length.
- b) A cutoff increases the river length but a meander reduces the river length.
- c) Both meander and cutoff increase the river length.
- d) Both meander and cutoff decrease the river length.

Ans: a

104. River training for depth is achieved by

- a) groynes
- b) construction of dykes or levees
- c) both (a) and (b)
- d) groynes and bandalling

Ans: d

105. Main purpose of mean water training for rivers is

- a) flood control
- b) to provide sufficient depth of water in navigable channels, during low water periods
- c) to preserve the channel in good shape by efficient disposal of suspended and bed load
- d) all of the above

Ans: c

106. If  $D$  is the depth of scour below original bed, then the width of launching apron is generally taken as

- a)  $1.2 D$
- b)  $1.5 D$
- c)  $2.0 D$
- d)  $2.5 D$

Ans: b

107. Study the following statements.

- i) Levees are constructed parallel to river flow,
- ii) Spurs are constructed parallel to river flow,
- iii) Levees are constructed transverse to river flow,
- iv) Spurs are constructed transverse to river flow.

The correct answer is

- a) (i) and (ii)
- b) (i) and (iv)
- c) (ii) and (iii)
- d) (iii) and (iv)

Ans: b

108. A repelling groyne is aligned

- a) pointing upstream
- b) pointing downstream
- c) perpendicular to bank
- d) parallel to bank

Ans: a

109. A river training work is generally required when the river is

- a) aggrading type
- b) degrading type
- c) meandering type
- d) both (a) and (b)

Ans: c

110. A river bend characterized by silting

- a) scouring on concave side



- b) silting on convex side
- c) scouring on convex side and on concave side
- d) scouring on concave side and silting on convex side

Ans: d

111. Select the incorrect statement.

- a) Intensive irrigation should be avoided in areas susceptible to water logging.
- b) Extensive irrigation should be adopted in areas susceptible to water logging.
- c) Lift irrigation increases water logging.
- d) all of the above

Ans: c

112. A land is known as waterlogged

- a) when the permanent wilting point is reached
- b) when gravity drainage has ceased
- c) capillary fringe reaches the root zone of plants
- d) none of the above

Ans: c

113. Lining of irrigation channels

- a) increases the waterlogging area
- b) decreases the waterlogging area
- c) does not change the water logging area
- d) none of the above

Ans: b

114. A runoff river plant is

- a) a low head scheme
- b) a medium head scheme
- c) a high head scheme
- d) none of the above

Ans: a

115. The net speed under which the turbine reaches its peak efficiency is called

- a) design speed
- b) rated speed
- c) gross speed
- d) operating speed

Ans: a

116. A runoff river plant

- a) is a medium head scheme

- b) generates power during peak hours only
- c) is suitable only on a perennial river
- d) has no pondage at all

Ans: c

117. The net head under which the turbine reaches its peak efficiency at synchronous speed is called

- a) design head
- b) rated head
- c) gross head
- d) operating head

Ans: a

118. The ratio of the average load to the installed capacity of the plant whose reserve capacity is zero will be equal to

- a) load factor
- b) plant factor
- c) utilisation factor
- d) both (a) and (b)

Ans: d

119. A hydroelectric scheme operating under a head of 80 m will be classified as

- a) low head scheme
- b) medium head scheme
- c) high head scheme
- d) none of the above

Ans: c

120. A hyetograph is a graphical representation of

- a) rainfall intensity and time
- b) rainfall depth and time
- c) discharge and time
- d) cumulative rainfall and time

Ans: a

121. Variability of rainfall is

- i) largest in regions of high rainfall
- ii) largest in coastal areas
- iii) largest in regions of scanty rainfall

The correct answer is

- a) only (i)
- b) (i) and (ii)

- c) only (iii)
- d) (ii) and (iii)

Ans: c

122. In India, which of the following is adopted as standard recording rain gauge ?

- a) Symon's rain gauge
- b) tipping bucket type
- c) natural syphon type
- d) weighing bucket type

Ans: c

123. The maximum average depth due to one day storm over an area of 100 km<sup>2</sup> is 100 mm. Depth-Area-Duration (DAD) curves indicate that for the same area of 100 km<sup>2</sup> the maximum average depth for a 3 hour storm will be

- a) 100 mm
- b) more than 100 mm
- c) less than 100 mm
- d) none of the above

Ans: b

124. The maximum rainfall depth of 300 mm in 24 hours has a return period of 100 years. The probability of 24 hours rainfall equal to or greater than 300 mm occurring at least once in 10 years is given by

- a)  $(0.99)^{10}$
- b)  $1 - (0.99)^{10}$
- c)  $(0.9)^{100}$
- d)  $1 - (0.9)^{100}$

Ans: b

125. The most suitable chemical which can be applied to the water surface for reducing evaporation is

- a) methyl alcohol
- b) ethyl alcohol
- c) cetyl alcohol
- d) butyl alcohol

Ans: c

126. Interception losses are due to

- i) evaporation
- ii) transpiration
- iii) stream flow

The correct answer is

- a) only (i)
- b) (i) and (ii)
- c) (ii) and (iii)
- d) (i), (ii) and (iii)

Ans: a

127. A 6 hours storm had 4 cm of rainfall and the resulting runoff was 2 cm. If  $\phi$  index remains at the same value, the runoff due to 10 cm of rainfall in 12 hours in the catchment is

- a) 4.5 cm
- b) 6.0 cm
- c) 7.5 cm
- d) 9.0 cm

Ans: b

128. Which of the following methods is used to estimate flood discharge based on high water marks left over in the past ?

- a) slope-area method
- b) area-velocity method
- c) moving boat method
- d) ultra-sonic method

Ans: a

129. To determine the discharge at a section in a stream from its rating curve, the required data are

- i) slope of water surface at the section
  - ii) stage at the section
  - iii) current meter readings at the section
- The correct answer is

- a) (i) and (ii)
- b) (ii) and (iii)
- c) only (ii)
- d) only (iii)

Ans: c

130. The stage of river carrying a discharge of  $Q \text{ m}^3/\text{sec}$  at a point is 10 m and slope of water surface is  $(1/4000)$ . The discharge of a flood at the same point and same stage of 10 m with a water surface slope of  $(1/1000)$  will be

- a)  $\sqrt{2} Q \text{ m}^3/\text{sec}$
- b)  $0.5 Q \text{ m}^3/\text{sec}$
- c)  $2 Q \text{ m}^3/\text{sec}$
- d)  $4 Q \text{ m}^3/\text{sec}$

Ans: c

131. The stream which does not have any base flow contribution is called

- a) perennial stream
- b) intermittent stream
- c) ephemeral stream
- d) none of the above

Ans: c

132. The flow-mass curve is graphical representation of

- a) cumulative discharge and time
- b) discharge and percentage probability of flow being equaled or exceeded
- c) cumulative discharge, volume and time in chronological order
- d) discharge and time in chronological order

Ans: c

133. If the demand line drawn from a ridge in a flow mass curve does not intersect the curve again, it indicates that

- a) demand cannot be met by inflow
- b) reservoir was not full at the beginning
- c) both (a) and (b)
- d) none of the above

Ans: a

134. The shape of recession limb of a hydrograph depends upon

- a) basin characteristics only
- b) storm characteristics only
- c) both (a) and (b)
- d) none of the above

Ans: a

135. Instantaneous unit hydrograph is a hydrograph of

- i) unit duration
- ii) unit rainfall excess
- iii) infinitely small duration
- iv) infinitely small rainfall excess

The correct answer is

- a) (i) and (ii)
- b) (i) and (iv)
- c) (ii) and (iii)
- d) (iii) and (iv)

Ans: c

136. For a catchment area of 120 km<sup>2</sup>, the equilibrium discharge in m<sup>3</sup>/hour of an S-curve obtained by the summation of 6

hour unit hydro graph is

- a)  $0.2 \times 10^6$
- b)  $0.6 \times 10^6$
- c)  $2.4 \times 10^6$
- d)  $7.2 \times 10^6$

Ans: a

137. A unit hydro graph has one unit of

- a) rainfall duration
- b) rainfall excess
- c) time base of direct runoff
- d) discharge

Ans: b

138. The peak of a 4 hour flood hydrograph is  $240 \text{ m}^3/\text{sec}$ . If the rainfall excess is 80 mm and base flow which is constant is  $40 \text{ m}^3/\text{sec}$ , then the peak of 4-hours unit hydrograph will be

- a)  $20 \text{ m}^3/\text{sec}$
- b)  $25 \text{ m}^3/\text{sec}$
- c)  $30 \text{ m}^3/\text{sec}$
- d)  $35 \text{ m}^3/\text{sec}$

Ans: b

139. To estimate the magnitude of a flood with a return period of T years, Gumbel's distribution method requires the following data pertaining to annual flood series

- i) mean value
- ii) standard deviation
- iii) length of record
- iv) coefficient of skew

The correct answer is

- a) (i) and (ii)
- b) (i),(ii) and (iii)
- c) (i), (ii) and (iv)
- d) (i), (ii), (iii) and (iv)

Ans: b

140. For an annual flood series arranged in descending order of magnitude, the return for a magnitude listed at position period m in a total data N is

- a)  $N/(m+1)$
- b)  $m/(N+1)$
- c)  $m/N$
- d)  $(N+1)/m$

Ans: d

141. If the risk of a flood occurring in the next 10 years is accepted to 10%, then the return period for design should be

- a)  $1 + (0.9)^{10}$
- b)  $1 - (0.9)^{10}$
- c)  $1/(1 - 0.9^{10})$
- d)  $1/(1 + 0.9^{10})$

Ans: c

SAFEC-CIVIL

### **STRENGTH OF MATERIALS**

1. Modulus of rigidity is defined as the ratio of
  - a) longitudinal stress to longitudinal strain
  - b) shear stress to shear strain

- c) stress to strain
- d) stress to volumetric strain

**Ans: b**

2. If the Young's modulus of elasticity of a material is twice its modulus of rigidity, then the Poisson's ratio of the material is
- a) -1
  - b) -0.5
  - c) 0.5
  - d) zero

**Ans: d**

3. Limit of proportionality depends upon
- a) area of cross-section
  - b) type of loading
  - c) type of material
  - d) all of the above

**Ans: c**

4. For an isotropic, homogeneous and elastic material obeying Hooke's law, number of independent elastic constants is
- a) 2
  - b) 3
  - c) 9
  - d) 1

**Ans: a**

5. In a thin cylindrical shell, the ratio of longitudinal stress to hoop stress is
- a) 0.5
  - b) 1
  - c) 2
  - d) 4

**Ans: c**

6. If all the dimensions of a prismatic bar are doubled, then the maximum stress produced in it under its own weight will
- a) decrease
  - b) remain unchanged
  - c) increase to two times



d) increase to four times

**Ans: c**

7. The relationship between Young's, modulus of elasticity  $E$ , bulk modulus  $K$  and Poisson's ratio  $\mu$  is given by

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

b)  $E = 3K(1 + \mu)$

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

d)  $E = 2K(1 + \mu)$

**Ans: c**

8. Limiting values of Poisson's ratio are

a) - 1 and 0.5

b) -1 and -0.5

c) 1 and - 0.5

d) 0 and 0.5

**Ans: a**

9. The elongation of a conical bar under its own weight is equal to

a) that of a prismatic bar of same length

b) one half that of a prismatic bar of same length

c) one third that of a prismatic bar of same length

d) one fourth that of a prismatic bar of same length

**Ans: c**

10. If a material has identical properties in all directions, it is said to be

a) homogeneous

b) isotropic

c) elastic

d) orthotropic

**Ans: b**

11. Two bars of different materials are of the same size and are subjected to same tensile forces. If the bars have unit elongations in the ratio of 4 : 7, then the ratio of moduli of elasticity of the two materials is

a) 7:4

b) 4:7

c) 4:17

d) 16 :49

**Ans: a**

12. A prismatic bar of volume  $V$  is subjected to a tensile force in longitudinal direction.

If Poisson's ratio of the material is  $\mu$  and longitudinal strain is  $e$ , then the final volume of the bar becomes

- a)  $(1 + e)(1 - \mu)^2 V$
- b)  $(1 - e)^2(1 + \mu e)V$
- c)  $(1 + e)(1 - \mu e)^2 V$
- d)  $(1 - \mu e)^3 V$

**Ans: c**

13. If a composite bar of steel and copper is heated, then the copper bar will be under

- a) tension
- b) compression
- c) shear
- d) torsion

**Ans: b**

14. Effective length of a weld is equal to

- a) overall length - weld size
- b) overall length - throat thickness
- c) overall length - 2 x weld size
- d) overall length - 2 x throat thickness

**Ans: c**

15. Size of a right angled fillet weld is given by

- a) 0.707 x throat thickness
- b) 0.414 x throat thickness
- c) 2.0 x throat thickness
- d) throat thickness

**Ans: b**

16. The effective length of a fillet weld designed to transmit axial load shall not be less than

- a) 2 x size of weld
- b) 4 x size of weld
- c) 6 x size of weld
- d) 10 x size of weld

**Ans: b**

17. Size of fillet weld with unequal legs is equal to

- a) smaller leg length
- b) longer leg length
- c) throat thickness
- d) average of smaller and longer leg lengths

**Ans: a**

18. Weakest section in a fillet weld is

- a) throat of the fillet
- b) smaller side
- c) side parallel to force
- d) side perpendicular to force

**Ans: a**

19. Effective throat thickness of a fillet weld is

- a)  $0.707 \times$  size of weld
- b)  $1.414 \times$  size of weld
- c) a function of the angle between fusion faces
- d) equal to the side of the fillet

**Ans: c**

20. According to Unwin's formula, the diameter of rivet in mm to suit the  $t$  mm thickness of plate is given by

- a)  $6t$
- b)  $6\sqrt{t}$
- c)  $1.9 \times t$
- d)  $1.5t + 4$

**Ans: b**

21. A flat carrying a pull of 69 kN is connected to a gusset plate using rivets. If the pulls required to shear the rivet, to crush the rivet and to tear the plate per pitch length are 68.5 kN, 46 kN and 69 kN respectively, then the number of rivets required is

- a) 10
- b) 12
- c) 15
- d) 20

**Ans: c**

22. If the rivet value is 16.8 kN and force in the member is 16.3 kN, then the number of rivets required for the connection of the member to a gusset plate is

- a) 1
- b) 2
- c) 3
- d) 4

**Ans: b**

23. At a point in a strained body carrying two unequal unlike principal stresses  $p_1$  and  $p_2$  ( $p_1 > p_2$ ) the maximum shear stress is given by

- a)  $p/2$
- b)  $p^2/2$
- c)  $(p, -p^2)/2$
- d)  $(p, + p^2)/2$

**Ans: d**

24. If a point in a strained material is subjected to equal normal and tangential stresses, then the angle of obliquity is

- a)  $0^\circ$
- b)  $45^\circ$
- c)  $\tan^{-1}(1/2)$
- d)  $\tan^{-1}(2)$

**Ans: b**

25. If a prismatic member with area of cross-section  $A$  is subjected to a tensile load  $P$ , then the maximum shear stress and its inclination with the direction of load respectively are

- a)  $P/A$  and  $45^\circ$
- b)  $P/2A$  and  $45^\circ$
- c)  $P/2A$  and  $60^\circ$
- d)  $P/A$  and  $30^\circ$

**Ans: b**

26. The sum of normal stresses is

- a) constant
- b) variable
- c) dependent on the planes
- d) none of the above

**Ans: a**

27. The radius of Mohr's circle for two equal unlike principal stresses of magnitude  $p$  is

- a)  $p$
- b)  $p/2$
- c) zero
- d) none of the above

**Ans: a**

28. Shear stress on principal planes is

- a) zero
- b) maximum
- c) minimum
- d) none of the above

**Ans: a**

29. The state of pure shear stress is produced by
- a) tension in one direction and equal compression in perpendicular direction
  - b) equal tension in two directions at right angles
  - c) equal compression in two directions at right angles
  - d) none of the above

**Ans: a**

30. According to Rankine's hypothesis, the criterion of failure of a brittle material is
- a) maximum principal stress
  - b) maximum shear stress
  - c) maximum strain energy
  - d) maximum shear strain energy

**Ans: a**

31. Maximum bending moment in a beam occurs where
- a) deflection is zero
  - b) shear force is maximum
  - c) shear force is minimum
  - d) shear force changes sign

**Ans: d**

32. Rate of change of bending moment is equal to
- a) shear force
  - b) deflection
  - c) slope
  - d) rate of loading

**Ans: d**

33. The diagram showing the variation of axial load along the span is called
- a) shear force diagram
  - b) bending moment diagram
  - c) thrust diagram
  - d) influence line diagram

**Ans: a**

34. The difference in ordinate of the shear curve between any two sections is equal to the area under

- a) load curve between these two sections
- b) shear curve between these two sections
- c) bending moment curve between these two sections
- d) load curve between these two sections plus concentrated loads applied between the sections

**Ans: d**

35. The variation of the bending moment in the portion of a beam carrying linearly varying load is

- a) linear
- b) parabolic
- c) cubic
- d) constant

**Ans: c**

36. The maximum bending moment due to a moving load on a fixed ended beam occurs

- a) at a support
- b) always at the midspan
- c) under the load only
- d) none of the above

**Ans: a**

37. A cantilever beam AB of length  $l$  carries a concentrated load  $W$  at its midspan C. If the free end B is supported on a rigid prop, then there is a point of contraflexure

- a) between A and C
- b) between C and B
- c) one between A and C and other between C and B
- d) nowhere in the beam

**Ans: a**

38. A prismatic beam fixed at both ends carries a uniformly distributed load. The ratio of bending moment at the supports to the bending moment at mid-span is

- a) 0.5
- b) 1.0
- c) 1.5
- d) 2.0

**Ans: d**

39. A beam of overall length  $l$  with equal overhangs on both sides carries a uniformly distributed load over the entire length. To have numerically equal bending moments at centre of the beam and at supports, the distance between the supports should be

- a) 0.2771
- b) 0.403  $l$
- c) 0.5861
- d) 0.7071

**Ans: c**

40. A prismatic beam of length  $l$  and fixed at both ends carries a uniformly distributed load. The distance of points of contraflexure from either end is

- a) 0.2071
- b) 0.2111
- c) 0.2771
- d) 0.251

**Ans: b**

41. A simply supported beam of length  $l$  carries a load varying uniformly from zero at left end to maximum at right end. The maximum bending moment occurs at a distance of

- a)  $l/3$  from left end
- b)  $l/3$  from left end
- c)  $l/3$  from right end
- d)  $l/3$  from right end

**Ans: a**

42. A portion of a beam between two sections is said to be in pure bending when there is

- a) constant bending moment and zero shear force
- b) constant shear force and zero bending moment
- c) constant bending moment and constant shear force
- d) none of the above

**Ans: a**

43. The ratio of width to depth of a strongest beam that can be cut out of a cylindrical log of wood is

- a)  $1/2$
- b)  $1/\sqrt{2}$
- c)  $1/3$
- d)  $2/3$

**Ans: b**

44. Of the several prismatic beams of equal lengths, the strongest in flexure is the one having maximum

- a) moment of inertia
- b) section modulus
- c) tensile strength
- d) area of cross-section

**Ans: b**

45. Of the two prismatic beams of same material, length and flexural strength, one is circular and other is square in cross-section. The ratio of weights of circular and square beams is

- a) 1.118

- b) 1.342
- c) 1.000
- d) 0.793

**Ans: a**

46. A flitched beam consists of a wooden joist 150 mm wide and 300 mm deep strengthened by steel plates 10 mm thick and 300 mm deep one on either side of the joist. If modulus of elasticity of steel is 20 times that of wood, then the width of equivalent wooden section will be

- a) 150 mm
- b) 350 mm
- c) 500 mm
- d) 550 mm

**Ans: d**

47. A beam of rectangular cross-section is 100 mm wide and 200 mm deep. If the section is subjected to a shear force of 20 kN, then the maximum shear stress in the section is

- a) 1 N/mm<sup>2</sup>
- b) 1.125 N/mm<sup>2</sup>
- c) 1.33 N/mm<sup>2</sup>
- d) 1.5 N/mm<sup>2</sup>

**Ans: d**

48. A beam of square cross-section with side 100 mm is placed with one diagonal vertical. If the shear force acting on the section is 10 kN, the maximum shear stress is

- a) 1 N/mm<sup>2</sup>
- b) 1.125 N/mm<sup>2</sup>
- c) 2 N/mm<sup>2</sup>
- d) 2.25 N/mm<sup>2</sup>

**Ans: b**

49. A prismatic bar when subjected to pure bending assumes the shape of

- a) catenary
- b) cubic parabola
- c) quadratic parabola
- d) arc of a circle

**Ans: d**

50. A beam of triangular cross section is placed with its base horizontal. The maximum shear stress intensity in the section will be

- a) at the neutral axis



- b) at the base
- c) above the neutral axis
- d) below the neutral axis

**Ans: c**

51. A beam of uniform strength has at every cross-section same

- a) bending moment
- b) bending stress
- c) deflection
- d) stiffness

**Ans: b**

52. For no torsion, the plane of bending should

- a) be parallel to one of the principal axes
- b) pass through shear centre of section
- c) pass through neutral axis of the section
- d) pass through centre of gravity of the section

**Ans: b**

53. Two beams, one of circular cross-section and other of square cross-section, have equal areas of cross-section. If subjected to bending

- a) circular section is more economical
- b) square section is more economical
- c) both sections are equally strong
- d) both sections are equally stiff

**Ans: b**

54. The portion, which should be removed from top and bottom of a circular cross section of diameter  $d$  in order to obtain maximum section modulus, is

- a)  $0.01 d$
- b)  $0.1 d$
- c)  $0.011 d$
- d)  $0.11 d$

**Ans: c**

55. A beam of overall length  $l$  rests on two simple supports with equal overhangs on both sides. Two equal loads act at the free ends. If the deflection at the centre of the beam is the same as at either end, then the length of either overhang is

- a)  $0.152 l$
- b)  $0.207 l$
- c)  $0.252 l$
- d)  $0.277 l$

**Ans: a**

56. A beam ABC rests on simple supports at A and B with BC as an overhang. D is centre of span AB. If in the first case a concentrated load P acts at C while in the second case load P acts at D, then the

- a) deflection at D in the first case will be equal to the deflection at C in the second case
- b) deflection at C in the first case is equal to the deflection at D in the second case
- c) deflection at D in the first case will always be smaller than the deflection at C in the second case
- d) deflection at D in the first case will always be greater than the deflection at C in the second case

**Ans: a**

57. If the deflection at the free end of a uniformly loaded cantilever beam is 15mm and the slope of the deflection

curve at the free end is 0.02 radian, then the length of the beam is

- a) 0.8 m
- b) 1m
- c) 1.2 m
- d) 1.5m

**Ans: b**

58. If the deflection at the free end of a uniformly loaded cantilever beam of length 1 m is equal to 7.5 mm, then the slope at the free end is

- a) 0.01 radian
- b) 0.015 radian
- c) 0.02 radian
- d) none of the above

**Ans: c**

58. A cantilever beam carries a uniformly distributed load from fixed end to the centre of the beam in the first case and a uniformly distributed load of same intensity from centre of the beam to the free end in the second case. The ratio of deflections in the two cases is

- a) 1/2
- b) 3/11
- c) 5/24
- d) 7/41

**Ans: d**

59. If the length of a simply supported beam carrying a concentrated load at the centre is doubled, the deflection at the centre will become

- a) two times

- b) four times
- c) eight times
- d) sixteen times

**Ans: c**

60. A simply supported beam with rectangular cross-section is subjected to a central concentrated load. If the width and depth of the beam are doubled, then the deflection at the centre of the beam will be reduced to

- a) 50%
- b) 25%
- c) 12.5%
- d) 6.25%

**Ans: d**

61. A laminated spring is given an initial curvature because

- a) it is more economical
- b) it gives uniform strength
- c) spring becomes flat when it is subjected to design load
- d) none of the above

**Ans: c**

62. A laminated spring is supported at

- a) ends and loaded at centre
- b) centre and loaded at ends
- c) ends and loaded anywhere
- d) centre and loaded anywhere

**Ans: b**

63. Laminated springs are subjected to

- a) direct stress
- b) bending stress
- c) shear stress
- d) none of the above

**Ans: b**

64. Deflection in a leaf spring is more if its

- a) strength is more
- b) strength is less
- c) stiffness is less
- d) stiffness is more

**Ans: c**

65. Buckling load for a given column depends upon

- a) length of column only
- b) least lateral dimension only
- c) both length and least lateral dimension
- d) none of the above

**Ans: c**

66. When both ends of a column are fixed, the crippling load is  $P$ . If one end of the column is made free, the value of crippling load will be changed to

- a)  $P/16$
- b)  $P/4$
- c)  $P/2$
- d)  $4P$

**Ans: a**

67. Euler's formula for a mild steel long column hinged at both ends is not valid for slenderness ratio

- a) greater than 80
- b) less than 80
- c) greater than 180
- d) greater than 120

**Ans: b**

68. A long column has maximum crippling load when its

- a) both ends are hinged
- b) both ends are fixed
- c) one end is fixed and other end is hinged
- d) one end is fixed and other end is free

**Ans: b**

69. Effective length of a chimney of 20 m height is taken as

- a) 10 m
- b) 20m
- c) 28.28m
- d) 40m

**Ans: d**

70. Rankine's formula for column is valid when slenderness ratio

- a) lies between 0 and 140
- b) lies between 0 and 100
- c) is less than 80
- d) has any value

**Ans: d**

71. Slenderness ratio of a 5 m long column hinged at both ends and having a circular cross-section with diameter 160 mm is

- a) 31.25
- b) 62.5
- c) 100
- d) 125

**Ans: d**

72. The effect of arching a beam is

- a) to reduce bending moment throughout
- b) to increase bending moment throughout
- c) to increase shear force
- d) to decrease shear force

**Ans: a**

73. Internal forces at every cross-section in a arch are

- a) normal thrust and shear force
- b) shear force and bending moment
- c) normal thrust and bending moment
- d) normal thrust, shear force and bending moment

**Ans: d**

74. According to Eddy's theorem, the vertical intercept between the linear arch and the centre line of actual arch at any point represents to some scale

- a) bending moment
- b) shear force
- c) normal thrust
- d) deflection

**Ans: a**

75. Due to rise in temperature in a three hinged arch, induced stress is

- a) direct compressive
- b) direct tensile
- c) shear
- d) none of the above

**Ans: d**

76. In a three hinged arch, the linear and the actual arch meet at

- a) at least three points
- b) at least two points

- c) all points irrespective of loading
- d) nowhere

**Ans: a**

77. If a three hinged parabolic arch carries a uniformly distributed load over the entire span, then any section of the arch is subjected to

- a) normal thrust only
- b) normal thrust and shear force
- c) normal thrust and bending moment
- d) normal thrust, shear force and bending moment

**Ans: a**

78. Three hinged arch is

- a) statically indeterminate by one degree
- b) statically indeterminate by two degrees
- c) statically determinate
- d) unstable structure

**Ans: c**

79. A linear arch has

- a) normal thrust only
- b) shear force only
- c) bending moment only
- d) normal thrust and shear force

**Ans: a**

80. A three hinged arch is carrying uniformly distributed load over the entire span. The arch is free from shear force and bending moment if its shape is

- a) circular
- b) parabolic
- c) elliptical
- d) none of the above

**Ans: b**

81. For a determinate pin-jointed plane frame, the relation between the number of joints  $j$  and members  $m$  is given by

- a)  $m = 2j - 3$
- b)  $m = 3j - 6$
- c)  $m > 2j - 3$
- d)  $m > 3j - 6$

**Ans: a**

82. The basic perfect frame is a

- a) triangle
- b) rectangle
- c) square
- d) hexagon

**Ans: a**

83. Method of joints is applicable only when the number of unknown forces at the joint under consideration is not more than

- a) one
- b) two
- c) three
- d) four

**Ans: b**

84. A short column of external diameter of 250 mm and internal diameter of 150 mm carries an eccentric load of 1000 kN. The greatest eccentricity which the load can have without producing tension anywhere is

- a) 20 mm
- b) 31.25 mm
- c) 37.5 mm
- d) 42.5 mm

**Ans: d**

85. Proof resilience is the maximum energy stored at

- a) limit of proportionality
- b) elastic limit
- c) plastic limit
- d) none of the above

**Ans: b**

86. Strain energy stored in a member is given by

- a)  $0.5 \times \text{stress} \times \text{volume}$
- b)  $0.5 \times \text{strain} \times \text{volume}$
- c)  $0.5 \times \text{stress} \times \text{strain} \times \text{volume}$
- d)  $0.5 \times \text{stress} \times \text{strain}$

**Ans: c**

87. A rectangular block of size 200 mm x 100 mm x 50 mm is subjected to a shear stress of 100 N/mm<sup>2</sup>. If modulus of rigidity of material is  $1 \times 10^5$  N/mm<sup>2</sup>, strain energy stored will be

- a) 10 N.m
- b) 25 N.m

- c) 50 N.m
- d) 100N.m

**Ans: c**

88. A steel rod of cross sectional area equal to  $1000 \text{ mm}^2$  is 5 m long. If a pull of 100 kN is suddenly applied to it, then the maximum stress intensity will be

- a) 50 N/mm<sup>2</sup>
- b) 100 N/mm<sup>2</sup>
- c) 200 N/mm<sup>2</sup>
- d) 400 N/mm<sup>2</sup>

**Ans: c**

89. If the depth of a beam of rectangular section is reduced to half, strain energy stored in the beam becomes

- a) 1/4 time
- b) 1/8 time
- c) 4 times
- d) 8 times

**Ans: d**

90. The specimen in a Charpy impact test is supported as a

- a) cantilever beam
- b) simply supported beam
- c) fixed beam
- d) continuous beam

**Ans: b**

91. Impact test enables one to estimate the property of

- a) hardness
- b) toughness
- c) strength
- d) creep

**Ans: b**

92. A fletched beam is used to

- a) Change the shape of the beam
- b) Effect the saving in material
- c) Equalize the strength in tension and compression
- d) Increase the cross-section of the beam

**Ans:c**

93. The property of metal which allows it to deform continuously at slow rate without any



further increase in stress is known as

- a) fatigue
- b) creep
- c) plasticity
- d) resilience

**Ans: b**

94. The stress below which a material has a high probability of not failing under reversal of stress is known as

- a) tolerance limit
- b) elastic limit
- c) proportional limit
- d) endurance limit

**Ans: b**

95. A three hinged parabolic arch rib is acted upon by a single load at the left quarter point. If the central rise is increased and the shape of arch altered to segmental without changing the other details, the horizontal thrust will

- a) increase definitely
- b) decrease definitely
- c) be difficult to predict
- d) increase or decrease depending upon the radius of the segmental arch

**Ans: b**

96. For ductile materials, the most appropriate failure theory is

- a) maximum shear stress theory
- b) maximum principal stress theory
- c) maximum principal strain theory
- d) shear strain energy theory

**Ans: a**

97. At a point in a steel member, the major principal stress is  $2000 \text{ kg/cm}^2$  and the minor principal stress is compressive. If the uni-axial tensile yield stress is  $2500 \text{ kg/cm}^2$ , then the magnitude of the minor principal stress at which yielding will commence, according to the maximum shearing stress theory, is

- a)  $1000 \text{ kg/cm}^2$
- b)  $2000 \text{ kg/cm}^2$
- c)  $2500 \text{ kg/cm}^2$
- d)  $500 \text{ kg/cm}^2$

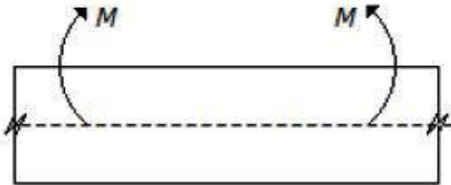
**Ans: d**

98. For the design of a cast iron member, the most appropriate theory of failure is

- a) Mohr's theory
- b) Rankine's theory
- c) Maximum strain theory
- d) Maximum shear energy theory

**Ans: b**

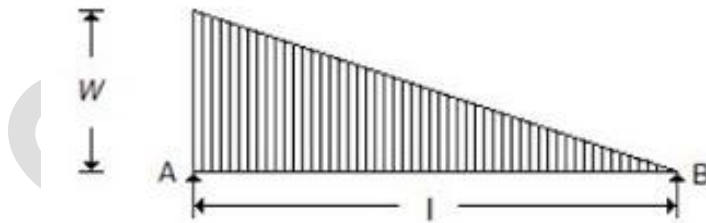
99. The layer at the center of gravity of the beam as shown in the below figure, will be



- a) in tension
- b) in compression
- c) Neither in tension nor in compression
- d) None of these

**Ans:c**

100. A simply supported beam with a gradually varying load from zero at 'B' and ' $w$ ' per unit length at 'A' is shown in the below figure. The shear force at 'B' is equal to



- (a)  $wl/6$
- (b)  $wl/3$
- (c)  $wl$
- (d)  $2wl/3$

**Ans: a**

## **ESTIMATING AND COSTING**

### Question No. 01

The rate of payment is made for 100 cu m (per % cu m) in case of

- (A) Earth work in excavation
- (B) Rock cutting
- (C) Excavation in trenches for foundation
- (D) All the above

Answer: Option D

### Question No. 02

The rate of an item of work depends on

- (A) Specifications of works
- (B) Specifications of materials
- (C) Proportion of mortar
- (D) All the above

Answer: Option D

### Question No. 03

The main factor to be considered while preparing a detailed estimate, is

- (A) Quantity of the materials
- (B) Availability of materials
- (C) Transportation of materials
- (D) All the above

Answer: Option D

### Question No. 04

Pick up the correct statement from the following:

- (A) The estimated value of the work excluding the amount for contingencies, work charged establishment, tool and plants, is called work value
- (B) The actual expenditure involved to complete a work including incidental, establishment and travelling charges, is called actual cost
- (C) The formal acceptance by the administrative department for incurring an expenditure on the work, is called administrative approval
- (D) All the above

Answer: Option D

Question No. 05

Brick walls are measured in sq. m if the thickness of the wall is

- (A) 10 cm
- (B) 15 cm
- (C) 20 cm
- (D) None of these

Answer: Option A

Question No. 06

The plinth area of a building not includes

- (A) Area of the walls at the floor level
- (B) Internal shaft for sanitary installations up to 2 sq m. in area
- (C) Lift and wall including landing
- (D) Area of cantilevered porch

Answer: Option D

Question No. 07

If the formation level of a highway has a uniform gradient for a particular length, and the ground is also having a longitudinal slope, the earthwork may be calculated by

- (A) Mid-section formula
- (B) Trapezoidal formula
- (C) Prismoidal formula
- (D) All the above

Answer: Option D

Question No. 08

While estimating a reinforced cement structure, the omitted cover of concrete is assumed

- (A) At the end of reinforcing bar, not less than 25 mm or twice the diameter of the bar
- (B) In thin slabs, 12 mm minimum or diameter of the bar whichever is more
- (C) For reinforcing longitudinal bar in a beam 25 mm minimum or diameter of the largest bar which is more
- (D) All the above

Answer: Option D

Question No. 09

A cement concrete road is 1000 m long, 8 m wide and 15 cm thick over the sub-base of 10 cm thick gravel. The box cutting in road crust is

- (A) 500 m<sup>3</sup>
- (B) 1000 m<sup>3</sup>
- (C) 1500 m<sup>3</sup>

(D) 2000 m<sup>3</sup>

Answer: Option C

Question No. 10

While estimating the quantities for the construction of a building, the correct metric unit is

- (A) Metre for length
- (B) Cubic metre for area
- (C) Square metres for volume
- (D) Litre for capacity

Answer: Option D

Question No. 11

Pick up the correct statement from the following:

- (A) In order to check up the average depth of excavation, 'Dead man s' are left at the mid-widths of borrow pits
- (B) The earthwork calculation in excavation is made from the difference in levels obtained with a level
- (C) The earth work in excavation to form the road embankment includes the formation of correct profile and depositing the soil in layers
- (D) All the above

Answer: Option D

Question No. 12

The brick work is not measured in cu m in case of

- (A) One or more than one brick wall
- (B) Brick work in arches
- (C) Reinforced brick work
- (D) Half brick wall

Answer: Option D

Question No. 13

Pick up the incorrect statement from the following:

- (A) Lead is the average horizontal straight distance between the borrow pit and the place of spreading soil
- (B) The lead is calculated for each block of the excavated area
- (C) The unit of lead is 50 m for a distance upto 500 m
- (D) The unit of lead is 1 km where the lead exceeds

2 km Answer: Option D

Question No. 14

The assumption on which the trapezoidal formula for volumes is based, is

- (A) The end sections are parallel planes
- (B) The mid-area of a pyramid is half the average area of the ends
- (C) The volume of the Prismoidal is over-estimated and hence a Prismoidal correction is applied
- (D) All the above

Answer: Option D

Question No. 15

In the mid-section formula

- (A) The mean depth is the average of depths of two consecutive sections
- (B) The area of mid-sections is calculated by using mean depth
- (C) The volume of the earth work is calculated by multiplying the mid-section area by the distance between the two original sections
- (D) All of the above

Answer: Option D

Question No. 16

Pick up the correct statement from the following:

- (A) The earth work of cutting in trenches or borrow pits in fairly uniform ground is measured with the help of average depths of the dead men
- (B) The earth work in trenches or borrow pits in irregular ground is measured by taking the difference in levels before and after completion of work
- (C) The earth work in trenches or borrow pits, where neither a nor b is feasible, are measured from the fillings after deduction of voids
- (D) All the above

Answer: Option D

Question No. 17

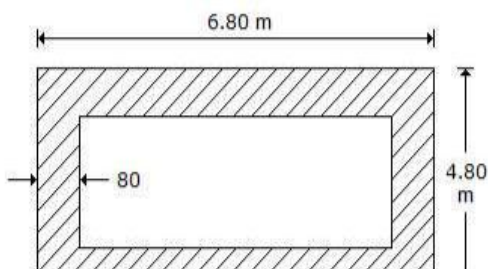
The cross -sections for a highway is taken at

- (A) Right angle to the centre line
- (B) 30 metres apart
- (C) Intermediate points having abrupt change in gradient
- (D) All the above

Answer: Option D

Question No. 18

Referring of given figure, pick up the correct statement from the following:



- (A) The total length of centre line of four walls is 20 m
- (B) Length of long wall out-to-out is 6.80 m
- (C) Length of short walls in-to-in is 3.20 m
- (D) All the above

Answer: Option D

Question No. 19

Pick up the correct statement regarding the centre line method of estimating a building

- (A) Product of the centre line of the walls and area of cross-section of any item, gives total quantity of the item
- (B) The centre line is worked out separately for different sections of walls of a building
- (C) The centre line length is reduced by half the layer of main wall joining the partition wall
- (D) All the above

Answer: Option D

Question No. 20

According to Indian Standards Institute, the actual size of modular bricks is

- (A) 23 cm × 11.5 cm × 7.5 cm
- (B) 25 cm × 13 cm × 7.5 cm
- (C) 19 cm × 9 cm × 9 cm
- (D) 20 cm × 10 cm × 10 cm

Answer: Option C

Question No. 21

The following item of earth work is not measured separately.

- (A) Setting out of works
- (B) Site clearance
- (C) Steps in deep excavation
- (D) All the above

Answer: Option D

Question No. 22

The measurement is made in square metre in case of

- (A) Cement concrete in foundation
- (B) R.C.C. structure

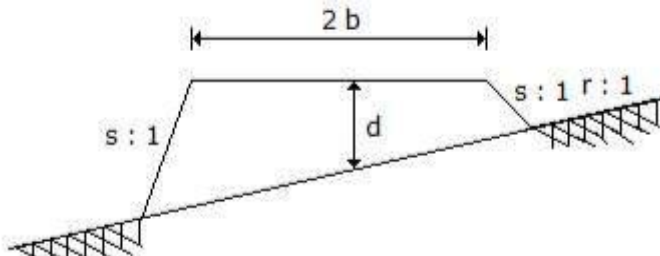
(C) Hollow concrete block wall

(D) None of these

Answer: Option D

Question No. 23

The area of the cross-section of a road fully in banking shown in the given figure, is



(A)  $[sb^2 + r^2 (2bd + sd)^2]/(r^2 - s^2)$

(B)  $[sb^2 + r^2 (2bd + sd)^2]/(r^2 - s^5)$

(C)  $[sb^2 + r^2 (2bd + sd)^2]/(r - s)$

(D) None of these

Answer: Option A

Question No. 24

Cost of fittings and their fixing is specified for the following sanitary fittings

(A) Water closets

(B) Flushing pipes

(C) Lavatory basins

(D) All the above

Answer: Option D

Question No. 25

The excavation exceeding 1.5 m in width and 10 sq.m in plan area with a depth not exceeding 30 cm, is termed as

(A) Excavation

(B) Surface dressing

(C) Cutting

(D) Surface excavation

Answer: Option D

Question No. 26

For the construction of buildings, the subheads of the estimate are

(A) Earthwork, Concrete work, Brick work

(B) Brickwork, Stone work, Roofing

(C) Brickwork Flooring, Wood work, Steel work



- (D) All the above  
Answer: Option D

Question No. 27

Pick up the correct statement from the following:

- (A) Pointing is measured in sq.m  
(B) Plastering is measured in sq.m  
(C) Glazing is measured in sq.m  
(D) All the above

Answer: Option D

Question No. 29

Pick up the correct statement from the following:

- (A) If the bed level is above N.S.L. the canal is called fully in banking and the berms are designed as  $3d$  where  $d$  is full supply depth of water (F.S.D.)  
(B) Area of canal in cutting =  $BD + Sd^2$  where  $B$  = bed width,  $d$  = depth of cutting and  $S$  is the side slope  
(C) If F.S.L. is above N.S.L the canal is called partly in cutting and partly in filling and berms are designed as  $2d$  where  $d$  is full supply depth  
(D) All the above

Answer: Option D

Question No. 30

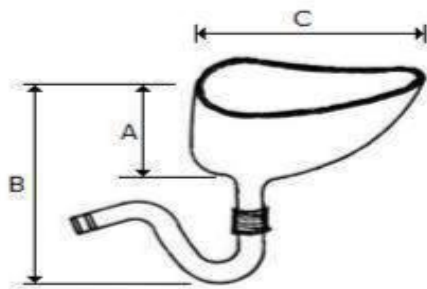
Pick up the incorrect statement from the following:

- (A) No deduction is made for the volume occupied by reinforcement  
(B) No deduction is made for the openings upto  $0.1$  sq.m  
(C) No deduction is made for volumes occupied by pipes, not exceeding  $100$  sq.cm in cross-section  
(D) None of these

Answer: Option D

Question No. 31

The value of 'B' of Indian type W.C. shown in the given figure is:



- a) 45 cm
- b) 50 cm
- c) 30 cm
- d) 25 cm

Answer: Option A

Question No. 32

Pick up the excavation where measurements are made in square metres for payment.

- (A) Ordinary cuttings up to 1 m
- (B) Surface dressing up to 15 cm depths
- (C) Surface excavation up to 30 cm depths
- (D) Both (b) and (c)

Answer: Option D

Question No. 33

As per Indian Standard Specifications, the peak discharge for domestic purposes per capita per minute, is taken

- (A) 1.80 litres for 5 to 10 users
- (B) 1.20 litres for 15 users
- (C) 1.35 for 20 users
- (D) All the above

Answer: Option D

Question No. 34

In long and short wall method of estimation, the length of long wall is the centre to centre distance between the walls and

- (A) Breadth of the wall
- (B) Half breadth of wall on each side
- (C) One fourth breadth of wall on each side
- (D) None of these

Answer: Option B

Question No. 35

The expected out turn of cement concrete 1 : 2 : 4 per mason per day is

- (A) 1.5 m<sup>3</sup>
- (B) 2.5 m<sup>3</sup>

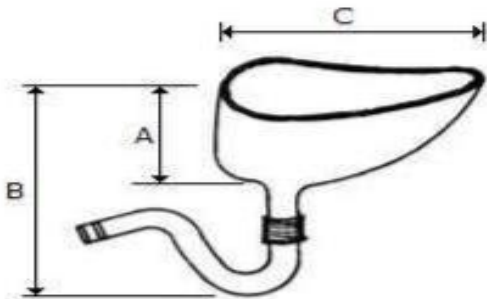
(C) 3.5 m<sup>3</sup>

(D) 5.0 m<sup>3</sup>

Answer: Option D

Question No. 36

The value of 'C' of Indian type W.C. shown in the given figure is:



a) 400 mm

b) 450 mm

c) 500 mm

d) 550 mm

Answer: Option C

Question No. 37

The area is measured correct to the nearest

a) 0.01 sqm

b) 0.02 sqm

c) 0.03 sqm

d) 0.04 sqm

Answer: Option A

Question No. 38

The measurement is not made in square metres in case of

(A) D.P.C. (Damp proof course)

(B) Form works

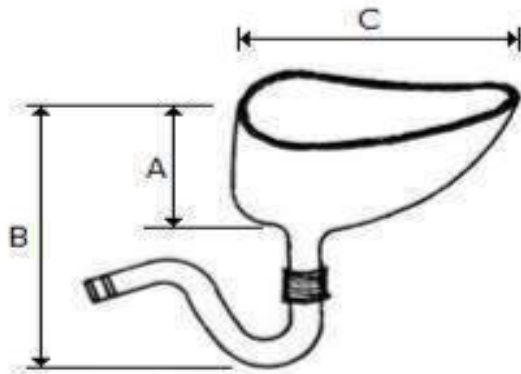
(C) Concrete Jeffries

(D) R.C. Chhajja

Answer: Option D

Question No. 39

The value of 'A' of Indian type W.C. shown in the given figure is:



- a) 25 cm
- b) 30 cm
- c) 40 cm
- d) 45 cm

Answer: Option B

Question No. 40

The trap which is provided to disconnect the house drain from the street sewer is called

- (A) Master trap
- (B) Intercepting trap
- (C) Interception manhole
- (D) All the above

Answer: Option D

Question No. 41

Due to change in price level, a revised estimate is prepared if the sanctioned estimate exceeds

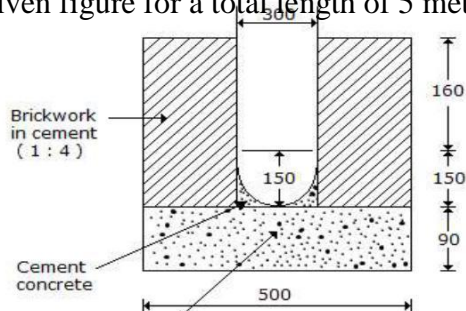
- (A) 2.0 %
- (B) 2.5 %
- (G) 4.0 %
- (H) 5.0 %

Answer: Option D

Question No. 42

The cost of the earthwork in excavation for the surface drain of cross-section shown in the

given figure for a total length of 5 metres @ Rs. 450/cum, is



- (F) Rs. 400
- (G) Rs. 425
- (H) Rs. 450
- (I) Rs. 500

Answer: Option C

Question No. 43

The expected out turn of 2.5 cm cement concrete floor per mansion per day

- (A) 2.5 sqm
- (B) 5.0 sqm
- (C) 7.5 sqm
- (D) 10 sqm

Answer: Option C

Question No. 44

Pick up the correct statement from the following:

- (A) The bent up bars at a support resist the negative bending moment
- (B) The bent up bars at a support resist the sharing force
- (C) The bending of bars near supports is generally at 45°
- (D) All the above

Answer: Option D

Question No. 45

While preparing a detailed estimate

- (A) Dimension should be measured correct to 0.01 m
- (B) Area should be measured correct to 0.01 sqm
- (C) Volume should be measured correct to 0.01 cum
- (D) All the above

Answer: Option D

Question No. 46

The item of the brick structure measured in sq.m, is

- (A) Reinforced brick work
- (B) Broken glass coping
- (C) Brick edging
- (D) Brick work in arches

Answer: Option B

Question No. 47

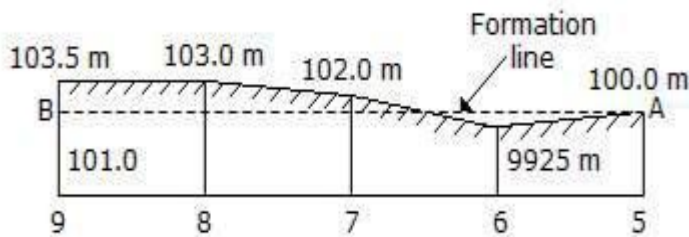
The most reliable estimate is

- (A) Detailed estimate
- (B) Preliminary estimate
- (C) Plinth area estimate
- (D) Cube rate estimate

Answer: Option A

Question No. 48

The reduced levels of points, 30 metres apart along the longitudinal section of a road portion between chainages 5 and 9 are shown in the given figure. If there is a uniform up-gradient of the road 120 in 1, the chainage of the point with no filling or cutting is



- (E) (6 + 15) chains
- (F) (6 + 12) chains
- (G) (6 + 18) chains
- (H) None of these

Answer:

Option B

Question No. 49

According to ISI method of measurement, the order of the sequence is

- (A) Length, breadth, height
- (B) Breadth, length, height
- (C) Height, length, breadth
- (D) None of these

Answer: Option A

Question No. 50

Anti-siphonage pipe is connected to

- (A) Main soil pipe
- (B) Bottom of P trap W.C.
- (C) Top of P trap W.C.

(D) Side of water closet

Answer: Option C

Question No. 51

Pick up the correct statement from the following:

- (A) In a gully trap, a water seal of 6 to 7.5 cm is provided
- (B) The gully trap collects waste water from the kitchen, sink, wash basins, etc.
- (C) The gully trap disconnects the sullage drain from the main drainage system
- (D) The grating provided over gully traps is 23 cm

square Answer: Option B

Question No. 52

Pick up the correct statement from the following:

- (A) Bricks are paid per thousand
- (B) Cement is paid per 50 kg bag
- (C) Lime is paid per quintal
- (D) All the above

Answer: Option D

Question No. 53

Pick up the correct statement from the following:

- (A) All pipes and fittings are classified according to their diameters
- (B) The diameter of the pipes is the nominal diameter of internal bore
- (C) All pipes are measured along the centre line of the pipes in metres
- (D) All the above

Answer: Option D

Question No. 54

A portion of an embankment having a uniform up-gradient 1 in 500 is circular with radius 1000 m of the centre line. It subtends  $180^\circ$  at the centre. If the height of the bank is 1 m at the lower end, and side slopes 2:1, the earth work involved.

- (A) 26,000 m<sup>3</sup>
- (B) 26,500 m<sup>3</sup>
- (C) 27,000 m<sup>3</sup>
- (D) 27,500 m<sup>3</sup>

Answer: Option D

Question No. 55

Pick up the correct statement in case of water supply.

- (A) Pipes laid in trenches and pipes fixed to walls are measured separately  
(B) Cutting through walls and floors are included with the item  
(C) Pipes are classified according to their sizes and quality  
(D) All the above
- Answer: Option D

Question No. 56

The concrete work for the following part of the building of specified thickness is measured in square metres

- (A) Root slabs  
(B) Floors  
(C) Wall panels  
(D) All the above
- Answer: Option D

Question No. 57

The expected out turn of 12 mm plastering with cement mortar is

- (A) 2.5 sq m  
(B) 4.0 sq m  
(C) 6.0 sq m  
(D) 8.0 sq m
- Answer: Option D

Question No. 58

The total length of a cranked bar through a distance (d) at  $45^\circ$  in case of a beam of effective length L, is

- (A)  $L + 0.42 d$   
(B)  $L + (2 \times 0.42 d)$   
(C)  $L - (0.42 d)$   
(D)  $L - (2 \times 0.4 d)$
- Answer: Option B

Question No. 59

The measurement is made for stone work in square metre in case of

- (A) Wall facing  
(B) Columns, lintels, copings  
(C) Building work  
(D) (a) and (d) of the above



Answer: Option D

Question No. 60

Carpet area does not include the area of

- (A) The walls along with doors and other openings
- (B) Bath room and lavatory
- (C) Kitchen and pantry
- (D) All the above

Answer: Option D

Question No. 61

Pick up the correct statement from the following:

- (A) The incidental expenses of a miscellaneous character which could not be predicted during preparation of the estimate, is called contingencies
- (B) Additional supervising staff engaged at work site, is called work charged establishment
- (C) Detailed specifications specify qualities, quantities and the proportions of materials to be used for a particular item
- (D) All the above

Answer: Option D

Question No. 63

The correct Prismoidal formula for volume is

- (A)  $D [\text{first area} + \text{last area} + \sum \text{Even area} + 2 \sum \text{odd areas}]$
- (B)  $D/3 [\text{first area} + \text{last area} + 4 \sum \text{Even area} + 2 \sum \text{odd areas}]$
- (C)  $D/3 [\text{first area} + \text{last area} + 2 \sum \text{Even area} + 4 \sum \text{odd areas}]$
- (D)  $D/6 [\text{first area} + \text{last area} + 2 \sum \text{Even area} + 4 \sum \text{odd areas}]$

Answer: Option B

Question No. 64

In case of laying gullies, siphons, intercepting traps, the cost includes

- (A) Setting and laying
- (B) Bed concreting
- (C) Connection to drains
- (D) All of these

Answer: Option D

Question No. 65

The inspection pit or chamber is a manhole provided in a base drainage system

- (A) At every change of direction
- (B) At every change of gradient
- (C) At every 30 m intervals
- (D) All the above

Answer: Option D

Question No. 66

Pick up the incorrect statement from the following:

- (A) Dimensions are measured to the nearest 0.01 m
- (B) Areas are measured to the nearest 0.01 sq.m
- (C) Cubic contents are measured to the nearest 0.1 cum
- (D) Weights are measured to the nearest 0.001

tonnes Answer: Option C

Question No. 67

The 'centre line method' is specially adopted for estimating

- (A) Circular buildings
- (B) Hexagonal buildings
- (C) Octagonal buildings
- (D) All the above

Answer: Option D

Question No. 68

Pick up the incorrect statement from the following:

- (A) The built up covered area at the floor level of any storey of a building is called plinth area
- (B) The usable covered area of the rooms of any storey of a building is called carpet area
- (C) The carpet area of a building along with area of its kitchen, pantry, store, lavatory, bath room and glazed veranda, is called floor area
- (D) None of these

Answer: Option D

Question No. 69

The unit of measurement is per quintal for the following:

- (A) Collapsible gates with rails
- (B) Rolling shutters
- (C) Expanded metal wire netting
- (D) M.S. reinforcement of R.C.C. works

Answer: Option D

Question No. 70

The diameter of a domestic sewer pipe laid at gradient 1 in 100 is recommended

- (A) 100 mm
- (B) 150 mm

(C) 200 mm

(D) 175 mm

Answer: Option B

Question No. 71

The order of booking dimensions is

(A) Length, breadth, height

(B) Breadth, length, height

(C) Height, breadth, length

(D) None of these

Answer: Option A

Question No. 72

Pick up the incorrect statement regarding a master trap from the following:

(A) It is provided in between the lower end of the house drain and the street sewer

(B) It is provided a cleaning eye at the top of the trap

(C) The mica flap valve which opens inwards only, is fitted at the top of the inlet pipe

(D) The water seal is less than that of ordinary traps

Answer: Option D

Question No. 75

If B is the width of formation, d is the height of the embankment, side slope S : 1, for a highway with no transverse slope, the area of cross-section is

(A)  $B + d + Sd$

(B)  $Bd + Sd^2$

(C)  $B \times d - Sd^2/2$

(D)  $\frac{1}{2} (Bd + Sd^2)$

Answer: Option B

Question No. 77

Pick up the item of work not included in the plinth area estimate

(A) Wall thickness

(B) Room area

(C) W.C. area

(D) Courtyard area

Answer: Option D

Question No. 78

The minimum width of a septic tank is taken

(A) 70 cm

(B) 75 cm

(C) 80 cm

(D) 90 cm

Answer: Option B

Question No. 79

Pick up the item whose weight is added to the weight of respective item, is

(A) Cleats

(B) Brackets

(C) Bolts

(D) All the above

Answer: Option D

Question No. 80

The expected out turn for earth work in excavation in ordinary soil per workman per day is

(A) 1.00 cum

(B) 2.00 cum

(C) 3.00 cum

(D) 4.00 cum

Answer: Option C

Question No. 81

The expected out turn of brick work in cement mortar in foundation and plinth per mason per day,

is

(A) 1.00 m<sup>3</sup>

(B) 1.25 m<sup>3</sup>

(F) 1.50 m<sup>3</sup>

(G) 1.75 m<sup>3</sup>

Answer: Option B

Question No. 82

The brick work is measured in sq metre, in case of

(A) Honey comb brick work

(B) Brick flat soling

(C) Half brick walls or the partition

(D) All the above

Answer: Option D

Question No. 83

The height of the sink of wash basin above floor level is kept

- (A) 60 cm
- (B) 70 cm
- (C) 75 cm to 80 cm
- (D) 80 cm

Answer: Option C

Question No. 84

For 12 mm thick cement plastering 1 : 6 on 100 sq.m new brick work, the quantity of cement required, is

- (A) 0.200 m<sup>3</sup>
- (B) 0.247 m<sup>3</sup>
- (C) 0.274 m<sup>3</sup>
- (D) 0.295 m<sup>3</sup>

Answer: Option C

Question No. 85

The item of steel work which is measured in sq.m, is

- (A) Collapsible gates
- (B) Rolling shutters
- (C) Ventilators and glazing
- (D) All the above

Answer: Option D

Question No. 86

The damp proof course (D.P.C.) is measured in

- (A) Cub. m
- (B) Sq. m
- (C) Metres
- (D) None of these

Answer: Option B

Question No. 87

The volume is measured correct to the nearest

- (A) 0.01 cum
- (B) 0.02 cum
- (C) 0.03 cum
- (D) 0.04 cum

Answer: Option A

Question No. 88

is 1400 kg/cm<sup>2</sup> and bond stress is 6 kg/cm<sup>2</sup>, the

If tensile stress of a steel rod of diameter  
required bond length of the rod is 'D'

- (A) 30 D
- (B) 39D
- (C) 50D
- (D) 59 D

Answer: Option D

Question No. 89

For 100 sq. m cement concrete (1 : 2: 4) 4 cm thick floor, the quantity of cement required, is

- (A) 0.90 m<sup>3</sup>
- (B) 0.94 m<sup>3</sup>
- (C) 0.98 m<sup>3</sup>
- (D) 1.00 m<sup>3</sup>

Answer: Option B

Question No. 90

Size, capacity and materials need be specified for

- (A) Bib-cocks
- (B) Stop-cocks
- (C) Ball valves
- (D) All the above

Answer: Option D

Question No. 91

The expected out turn of half brick partition wall per mason per day is

- (A) 1.5 m<sup>3</sup>
- (B) 2.0 m<sup>3</sup>
- (C) 4.0 m<sup>2</sup>
- (D) 5.0 m<sup>2</sup>

Answer: Option B

Question No. 92

The floor area includes the area of the balcony up to

- (A) 100 %
- (B) 75 %
- (H) 50 %
- (I) 25 %

Answer: Option C

Question No. 93

The slope of the outlet of 'P trap' below the horizontal is kept

- (A) 8°
- (B) 10°
- (C) 12°
- (D) 14°

Answer: Option D

Question No. 94

The weight of an item is measured correct to nearest

- (A) 0.25 kg
- (B) 0.50 kg
- (C) 0.75 kg
- (D) 1.00 kg

Answer: Option D

Question No. 95

Berms are provided in canals if these are

- (A) Fully in excavation
- (B) Partly in excavation and partly in embankment
- (C) Fully in embankment
- (D) All the above

Answer: Option B

## CONSTRUCTION MATERIALS

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1. Gypsum is a

- a) mechanically formed sedimentary rock
- b) igneous rock
- c) chemically precipitated sedimentary rock
- d) metamorphic rock

**Ans: c**

2. Which of the following sedimentary rocks changes into quartzite by metamorphic action ?

- a) sand stone
- b) lime stone
- c) shale
- d) gypsum

**Ans: a**

3. Which of the following represents a metamorphic rock?

- i) slate
- ii) shale
- iii) quartzite

The correct answer is

- a) only (iii)
- b) both (i) and (iii)
- c) both (ii) and (iii)
- d) all (i), (ii) and (iii)

**Ans: b**

4. Quartzite is a

- a) silicious rock
- b) argillaceous rock
- c) calcareous rock
- d) aqueous rock

**Ans: a**

5. Which of the following is a mineral ?

- a) basalt
- b) granite
- c) quartz
- d) syenite

**Ans: c**



6. Slate is formed by metamorphic action on

- a) shale
- b) lime stone
- c) sand stone
- d) granite

**Ans: a**

7. Sandstone is a

- i) sedimentary rock
- ii) aqueous rock
- iii) silicious rock

The correct answer is

- a) only (i)
- b) both (i) and (ii)
- c) both (i) and (iii)
- d) all (i), (ii) and (iii)

**Ans: d**

8. Which of the following is a rock ?

- a) quartz
- b) mica
- c) gypsum
- d) none of the above

**Ans: c**

9. Based on the following rocks and minerals, select the correct statement, quartz, shale, basalt, granite, marble, gypsum, mica

- a) basalt and marble are the only metamorphic rocks
- b) there is no sedimentary rock
- c) granite is the only igneous rock
- d) quartz and mica are minerals

**Ans: d**

10. A heavy stone is suitable for

- a) arches
- b) rubble masonry
- c) roads
- d) retaining walls

**Ans: d**

11. The stone suitable for rubble masonry should be.

- a) hard
- b) tough
- c) heavy
- d) light

**Ans: a**

12. Which of the following metamorphic rocks has the most weather resisting characteristics?

- a) marble
- b) quartzite
- c) slate
- d) lime stone

**Ans: b**

13. A good building stone should not absorb water more than

- a) 5%
- b) 10%
- c) 15%
- d) 20%

**Ans: a**

14. Which of the following has more fire resisting characteristics ?

- a) marble
- b) lime stone
- c) compact sand stone
- d) granite

**Ans: c**

15. Jumper is a tool used for

- a) testing of stones
- b) quarrying of stones
- c) dressing of stones
- d) none of the above

**Ans: b**

16. The important test to be conducted on a stone used in docks and harbours is-

- a) hardness test
- b) workability test
- c) weight test
- d) toughness test

**Ans: c**

17. The predominant constituent which is responsible for strength in granite is

- a) quartz
- b) felspar
- c) mica
- d) none of the above

**Ans: a**

18. Granite is not suitable for ordinary building purpose because

- a) it can not be polished
- sb) it is not a fire proof material

- c) it is costly
- d) it has less crushing strength

**Ans: c**

19. Which of the following stone is best suited for construction of piers and abutments of a railway bridge ?

- a) granite
- b) sand stone
- c) lime stone
- d) quartzite

**Ans: a**

20. The preparation of surface of stone to obtain plain edges or to obtain stones of required size and shape is known as

- a) quarrying of stones
- b) blasting of stones
- c) seasoning of stones
- d) dressing of stones

**Ans: d**

21. Crushing strength of a good building stone should be more than

- a) 50 MPa
- b) 100 MPa
- c) 150 MPa
- d) 200 MPa

**Ans: b**

22. Specific gravity for most of the building stones lies between

- a) 1.5 to 2.0
- b) 2.0 to 2.5
- c) 2.5 to 3.0
- d) 3.0 to 3.5

**Ans: c**

23. Spalling hammer is used for

- a) driving wooden headed chisels
- b) rough dressing of stones
- c) carving of stones
- d) breaking small projection of stones

**Ans: b**

24. Cross cut saw is used for

- a) cutting soft stones
- b) cutting hard stones
- c) cutting large blocks of stones
- d) dressing stones

**Ans: b**

25. Sapwood consists of

- a) innermost annular rings around the pith

- b) portion of timber between heartwood and cambium layer
- c) thin layers below the bark
- d) thin fibre which extends from the pith outwards and holds the annular rings together

**Ans: b**

26. Which of the following trees yields hard wood ?

- a) deodar
- b) chir
- c) shishum
- d) pine

**Ans: c**

27. The radial splits which are wider on the outside of the log and narrower towards the pith are known as

- a) heart shakes
- b) cupshakes
- c) starshakes
- d) rindgalls

**Ans: c**

28. In which of the following pairs both trees yield soft wood?

- a) deodar and shishum
- b) chir and sal
- c) sal and teak
- d) chir and deodar

**Ans: d**

29. Which of the following timbers is suitable for making sports goods ?

- a) mulberry
- b) mahogany
- c) sal
- d) deodar

**Ans: a**

30. Assertion A : Shishum is used for decorative woodwork.

Reason R : Shishum can be polished to an excellent finish.

Select your answer according to the coding system given below :

- a) Both A and R are true and R is the correct explanation of A
- b) Both A and R are true but R is not the correct explanation of A
- c) A is true but R is false
- d) A is false but R is true

**Ans: a**

31. The disease of dry rot in timber is caused by

- a) lack of ventilation
- b) alternate wet and dry conditions
- c) complete submergence in water
- d) none of the above

**Ans: a**

32. Plywood has the advantage of

- a) greater tensile strength in longer direction
- b) greater tensile strength in shorter direction
- c) same tensile strength in all directions
- d) none of the above

**Ans: c**

33. In which of the following directions, the strength of timber is maximum ?

- a) parallel to grains
- b) 45° to grains
- c) perpendicular to grains
- d) same in all directions

**Ans: a**

34. The moisture content in a well seasoned timber is

- a) 4% to 6%
- b) 10% to 12%
- c) 15% to 20%
- d) 100%

**Ans: b**

35. The trunk of tree left after cutting all the branches is known as

- a) log
- b) batten
- c) plank
- d) baulk

**Ans: a**

36. The age of a tree can be known by examining

- a) cambium layer
- b) annular rings
- c) medullary rays
- d) heart wood

**Ans: b**

37. Plywood is made by bonding together thin layers of wood in such a way that the angle between grains of any layer to grains of adjacent layers is

- a) 0°
- b) 30°
- c) 45°
- d) 90°

**Ans: d**

38. The plywood

- a) has good strength along the panel only
- b) can be spilt in the plane of the panel
- c) has greater impact resistance to blows than ordinary wood
- d) cannot be bent more easily than ordinary wood of same thickness

**Ans: c**

39. The practical limit of moisture content achieved in air drying of timber is

- a) 5%
- b) 15%
- c) 25%
- d) 35%

**Ans: b**

40. First class timber has an average life of

- a) less than one year
- b) 1 to 5 years
- c) 5 to 10 years
- d) more than 10 years

**Ans: d**

41. A first class brick when immersed in cold water for 24 hours should not absorb water more than

- a) 15%
- b) 20%
- c) 22%
- d) 25%

**Ans: b**

42. Crushing strength of a first class brick should not be less than

- a) 3.5 N/mm<sup>2</sup>
- b) 7.0 N/mm<sup>2</sup>
- c) 10.5 N/mm<sup>2</sup>
- d) 14.0 N/mm<sup>2</sup>

**Ans: c**

43. The main function of alumina in brick earth is

- a) to impart plasticity
- b) to make the brick durable
- c) to prevent shrinkage
- d) to make the brick impermeable

**Ans: a**

44. The percentage of alumina in a good brick earth lies between

- a) 5 to 10%
- b) 20 to 30%
- c) 50 to 60%
- d) 70 to 80%

**Ans: b**

45. Excess of alumina in brick earth makes the brick

- a) impermeable
- b) brittle and weak
- c) to lose cohesion
- d) to crack and warp on drying

**Ans: d**

46. The nominal size of the modular brick is

- a) 190 mm x 90mmx 80 mm
- b) 190 mm x 190 mm x 90 mm
- c) 200 mm x 100 mm x 100 mm
- d) 200 mm x 200 mm x 100 mm

**Ans: c**

47. Percentage of silica in a good brick earth lies between

- a) 5 to 10%
- b) 20 to 30%
- c) 50 to 60%
- d) 70 to 80%

**Ans: c**

48. Excess of silica in brick earth results in

- a) cracking and warping of bricks
- b) loss of cohesion
- c) enhancing the impermeability of bricks
- d) none of the above

**Ans: b**

49. Which of the following ingredients of the brick earth enables the brick to retain its shape ?

- a) alumina
- b) silica
- c) iron
- d) magnesia

**Ans: b**

50. Which of the following pairs gives a correct combination of the useful and harmful constituents respectively of a good brick earth ?

- a) lime stone and alumina
- b) silica and alkalies
- c) alumina and iron
- d) alkalies and magnesium

**Ans: b**

51. The process of mixing clay, water and other ingredients to make brick is known as

- a) kneading
- b) moulding
- c) pugging
- d) drying

**Ans: a**

52. Advantage of a clamp compared to a kiln for burning bricks is that

- a) it takes less time for burning
- b) it gives more output of first class bricks
- c) it has less initial cost

d) it is suitable when bricks are required in large numbers

**Ans: c**

53. The internal size of mould used in brick preparation is

- a) equal to the size of a fully burnt brick
- b) smaller than the size of a fully burnt brick
- c) greater than the size of a fully burnt brick
- d) none of the above

**Ans: c**

54. Pug mill is used for

- a) preparation of clay
- b) moulding of clay
- c) drying of bricks
- d) burning of bricks

**Ans: a**

55. Which of the following bricks are used for lining of furnaces ?

- a) overburnt bricks
- b) underburnt bricks
- c) refractory bricks
- d) first class bricks

**Ans: c**

56. The frog of the brick in a brick masonry is generally kept on

- a) bottom face
- b) top face
- c) shorter side
- d) longer side

**Ans: b**

57. Number of bricks required for one cubic metre of brick masonry is

- a) 400
- b) 450
- c) 500
- d) 550

**Ans: c**

58. Glazing is used to make earthenware

- a) hard
- b) soft
- c) porous
- d) impervious

**Ans: d**

59. Quick lime is

- a) calcium carbonate
- b) calcium oxide
- c) calcium hydroxide



d) none of the above

**Ans: b**

60. Quick lime is

i) slow in setting

ii) rapid in slacking

iii) good in strength The correct answer is

a) only (i)

b) only (ii)

c) both (i) and (ii)

d) both (ii) and (iii)

**Ans: c**

61. Assertion A : Pure lime takes a long time to develop adequate strength.

Reason R : Pure lime has slow hardening characteristics.

Select your answer according to the coding system given below :

a) Both A and R are true and R is correct explanation of A.

b) Both A and R are true and R is not a correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

**Ans: a**

62. Hydraulic lime is obtained by

a) burning of lime stone

b) burning of kankar

c) adding water to quick lime

d) calcination of pure clay

**Ans: b**

63. The main constituent which imparts hydraulicity to hydraulic lime is

a) calcium oxide

b) silica

c) clay

d) water

**Ans: c**

64. Study the following statements.

i) Hydraulic lime is suitable for white washing,

ii) Fat lime is suitable for whitewashing,

iii) Hydraulic lime is suitable for making mortar,

iv) Fat lime is suitable for making mortar.

The correct answer is

a) (i) and (iv)

b) (ii) and (iii)

c) (i) and (ii)

d) (iii) and (iv)

**Ans: b**

65. The main ingredients of Portland cement are

- a) lime and silica
- b) lime and alumina
- c) silica and alumina
- d) lime and iron

**Ans: a**

66. The constituent of cement which is responsible for all the undesirable properties of cement is

- a) dicalcium silicate
- b) tricalcium silicate
- c) tricalcium aluminate
- d) tetra calcium alumino ferrite

**Ans: c**

67. Le Chatelier's device is used for determining the

- a) setting time of cement
- b) soundness of cement
- c) tensile strength of cement
- d) compressive strength of cement

**Ans: b**

68. The main constituent of cement which is responsible for initial setting of cement is

- a) dicalcium silicate
- b) tricalcium silicate
- c) tricalcium aluminate
- d) all of the above

**Ans: c**

69. The initial setting time for ordinary Portland cement as per IS specifications should not be less than

- a) 10 minutes
- b) 30 minutes
- c) 60 minutes
- d) 600 minutes

**Ans: b**

70. As per IS specifications, the maximum final setting time for ordinary Portland cement should be

- a) 30 minutes
- b) 1 hour
- c) 6 hours
- d) 10 hours

**Ans: d**

71. For testing compressive strength of cement, the size of cube used is

- a) 50 mm
- b) 70.6 mm
- c) 100 mm
- d) 150 mm

**Ans: a**

72. The normal consistency of ordinary Portland cement is about

- a) 10%
- b) 20%
- c) 30%
- d) 40%

**Ans: c**

73. Early attainment of strength in rapid hardening cement is mainly due to

- a) gypsum
- b) finer grinding
- c) tricalcium silicate
- d) tricalcium aluminate

**Ans: b**

74. After storage, the strength of cement

- a) decreases
- b) increases
- c) remains same
- d) may increase or decrease

**Ans: a**

75. According to IS specifications, the compressive strength of ordinary portland cement after three days should not be less than

- a) 7 MPa
- b) 11.5 MPa
- c) 16 MPa
- d) 21 MPa

**Ans: c**

76. Addition of pozzolana to ordinary Portland cement increases

- a) bleeding
- b) shrinkage
- c) permeability
- d) heat of hydration

**Ans: b**

77. Gypsum consists of

- a)  $H_2S$  and  $CO_2$
- b)  $CaSO_4$  and  $H_2O$
- c) Lime and  $H_2O$
- d)  $CO_2$  and calcium

**Ans: b**

78. For testing compressive and tensile strength of cement, the cement mortar is made by mixing cement and standard sand in the proportions of

- a) 1:2
- b) 1:3

- c) 1:4
- d) 1:6

**Ans: b**

79. The slump recommended for mass concrete is about

- a) 25 mm to 50 mm
- b) 50 mm to 100 mm
- c) 100 mm to 125 mm
- d) 125 mm to 150 mm

**Ans: a**

80. With increase in moisture content, the bulking of sand

- a) increases
- b) decreases
- c) first increases to a certain maximum value and then decreases
- d) first decreases to a certain minimum value and then increases

**Ans: c**

81. Which of the following cements is suitable for use in massive concrete structures such as large dams ?

- a) ordinary Portland cement
- b) low heat cement
- c) rapid hardening cement
- d) sulphate resisting cement

**Ans: b**

82. Proper amount of entrained air in concrete results in

- i) better workability
  - ii) better resistance to freezing and thawing
  - iii) lesser workability
  - iv) less resistance to freezing and thawing
- The correct answer is
- a) (i) and (ii)
  - b) (i) and (iv)
  - c) (ii) and (iii)
  - d) (iii) and (iv)

**Ans: a**

83. The most common admixture which is used to accelerate the initial set of concrete is

- a) gypsum
- b) calcium chloride
- c) calcium carbonate
- d) none of the above

**Ans: b**

84. The maximum quantity of calcium chloride used as an accelerator in cement in percentage by weight of cement is

- a) 1
- b) 2
- c) 3

d) 4

**Ans: b**

85. The basic purpose of a retarder in concrete is

- a) to increase the initial setting time of cement paste in concrete
- b) to decrease the initial setting time of cement paste in concrete
- c) to render the concrete more water tight
- d) to improve the workability of concrete mix

**Ans: a**

86. Which of the following cements contains maximum percentage of dicalcium silicate?

- a) ordinary Portland cement
- b) low heat cement
- c) rapid hardening cement
- d) sulphate resisting cement

**Ans: b**

87. The most commonly used retarder in cement is

- a) gypsum
- b) calcium chloride
- c) calcium carbonate
- d) none of the above

**Ans: a**

88. Three basic raw materials which are needed in large quantities for production of steel are

- a) iron ore, coal and sulphur
- b) iron ore, carbon and sulphur
- c) iron ore, coal and lime stone
- d) iron ore, carbon and lime stone

**Ans: c**

89. Compared to mild steel, cast iron has

- i) high compressive strength
- ii) high tensile strength
- iii) low compressive strength
- iv) low tensile strength

The correct answer is

- a) (i) and (ii)
- b) (ii) and (iii)
- c) (iii) and (iv)
- d) (i)and(iv)

**Ans: d**

90. Which of the following gradients exerts maximum influence on properties of steel?

- a) iron
- b) carbon
- c) manganese
- d) sulphur

**Ans: b**

91. Which of the following is the purest form of iron ?

- a) cast iron
- b) wrought iron
- c) mild steel
- d) high carbon steel

**Ans: b**

92. The ultimate tensile strength of structural mild steel is about

- a) 160N/mm<sup>2</sup>
- b) 260N/mm<sup>2</sup>
- c) 420 N/mm<sup>2</sup>
- d) 520 N/mm<sup>2</sup>

**Ans: c**

93. Percentage of carbon content in mild steel is

- a) less than 0.25
- b) between 0.25 and 0.7
- c) between 0.7 and 1.5
- d) greater than 1.5

**Ans: a**

94. Which of the following stresses is used for identifying the quality of structural steel ?

- a) ultimate stress
- b) yield stress
- c) proof stress
- d) none of the above

**Ans: b**

95. The ratio of the thickness of web to that of flange of steel rolled structural beams and channels is

- a) less than 1
- b) equal to 1
- c) greater than 1
- d) less than 1 in beams but greater than 1 in channels

**Ans: a**

96. Paints with white lead base are suitable for painting of

- a) wood work
- b) iron work
- c) both wood work and iron work
- d) none of the above

**Ans: a**

97. Assertion A : Paints with white lead base are not recommended for painting of iron works.

Reason R : Paints with white lead base do not check rusting of iron.

Select your answer according to the coding system given below :

- a) Both A and R are true and, R is the correct explanation of A.
- b) Both A and R are true but R is not the correct explanation of A

- c) A is true but R is false
- d) A is false but R is true

**Ans: a**

98. The amount of water used for one kg of distemper is

- a) 0.2 litre
- b) 0.4 litre
- c) 0.6 litre
- d) 0.8 litre

**Ans: c**

99. The vehicle used in case of enamel paints is usually

- a) linseed oil
- b) water
- c) varnish
- d) none of the above

**Ans: c**

100. Assertion A : Normally turpentine oil is recommended as thinner for indoor painting.

Reason R : Turpentine oil is costlier than other thinners.

Select your answer according to the coding system given below :

- a) Both A and R are true and R is the correct explanation of A.
- b) Both A and R are true but R is not the correct explanation of A.
- c) A is true but R is false.
- d) A is false but R is true.

**Ans: b**

101. In brick masonry the bond produced by laying alternate headers and stretchers in each course is known as

- a) English bond
- b) double flemish bond
- c) zigzag bond
- d) single flemish bond

**Ans: b**

102. The stretcher bond in brick masonry can be used only when the thickness of wall is

- a) 90 mm
- b) 180 mm
- c) 190 mm
- d) 280 mm

**Ans: a**

103. The pressure acting on the stones in stone masonry construction should be

- a) along the direction of bedding planes
- b) at  $45^\circ$  to the direction of bedding planes
- c) at  $60^\circ$  to the direction of bedding planes
- d) perpendicular to the direction of bedding planes

**Ans: d**

104. Which of the following should be used for hearting of thicker walls ?

- a) headers
- b) stretchers
- c) brick bats
- d) queen closer

**Ans: a**

105. A queen closer is a

- a) brick laid with its length parallel to the face or direction of wall
- b) brick laid with its breadth parallel to the face or direction of wall
- c) brick having the same length and depth as the other bricks but half the breadth
- d) brick with half the width at one end and full width at the other

**Ans: c**

106. Minimum thickness of wall where single flemish bond can be used is

- a) half brick thick
- b) one brick thick
- c) one and a half bricks thick
- d) two bricks thick

**Ans: c**

107. The most important tool in brick laying for lifting and spreading mortar and for forming joints is

- a) trowel
- b) square
- c) bolster
- d) scutch

**Ans: a**

108. Expansion Joints in masonry walls are provided in wall lengths usater than

- a) 10 m
- b) 20 m
- c) 30 m
- d) 40 m

**Ans: d**

109. The type of bond provided in brick masonry for carrying heavy loads is

- a) single flemish bond
- b) double flemish bond
- c) English bond
- d) zigzag bond

**Ans: c**

110. A mortar joint in masonry which is normal to the face of wall is known as

- a) bed joint
- b) wall joint
- c) cross joint
- d) bonded joint

**Ans: c**



111. The slenderness ratio for masonry walls should not be more than

- a) 10
- b) 20
- c) 30
- d) 40

**Ans: b**

112. The proportions of lime and sand in the mortar normally used in brick construction are

- a) 1:2
- b) 1:4
- c) 1:6
- d) 1:8

**Ans: a**

113. Number of vertical joints in a stretcher course is  $x$  times the number of joints in the header course, where  $x$  is equal to

- a)  $1/2$
- b) 1
- c) 2
- d)  $1/4$

**Ans: a**

114. As compared to stretcher course, the thickness of joints in header course should be

- a) less
- b) more
- c) equal
- d) equal or more

**Ans: a**

115. As compared to English bond, double flemish bond is

- a) stronger
- b) more compact
- c) costly
- d) none of the above

**Ans: b**

116. Single flemish bond consists of

- a) double flemish bond facing and English bond backing in each course
- b) English bond facing and double flemish bond backing in each course
- c) stretcher bond facing and double flemish bond backing in each course
- d) double flemish bond facing and header bond backing in each course

**Ans: a**

117. The differential settlement in case of foundations on sandy soils should not exceed

- a) 25 mm
- b) 40 mm
- c) 65 mm
- d) 100 mm

**Ans: a**

118. In case of foundations on black cotton soils, the most suitable method to increase the bearing capacity of soils is to

- a) increase the depth of foundation
- b) drain the soil
- c) compact the soil
- d) replace the poor soil

**Ans: d**

119. The type of footing which is used to transmit heavy loads through steel columns is

- a) raft foundation
- b) grillage foundation
- c) well foundation
- d) isolated footing

**Ans: b**

120. The maximum total settlement for isolated foundations on clayey soils should be limited to

- a) 25 mm
- b) 40 mm
- c) 65 mm
- d) 100 mm

**Ans: c**

121. The type of pile which is driven at an inclination to resist inclined forces is known as

- a) friction pile
- b) sheet pile
- c) batter pile
- d) anchor pile

**Ans: c**

122. The minimum depth of foundation in clayey soils is

- a) 0.5 m
- b) 0.7 m
- c) 0.9 m
- d) 1.2 m

**Ans: c**

123. The maximum total settlement for raft foundation on clayey soils should be limited to

- a) 25 mm
- b) 25 to 40 mm
- c) 40 to 65 mm
- d) 65 to 100 mm

**Ans: d**

124. The bearing capacity of a water logged soil can be improved by

- a) compacting the soil
- b) draining the soil

- c) increasing the depth of foundation
- d) grouting

**Ans: b**

125. The type of flooring suitable for use in churches, theatres, public libraries and other places where noiseless floor covering is desired is

- a) cork flooring
- b) glass flooring
- c) wooden flooring
- d) linoleum flooring

**Ans: a**

126. The vertical distance between the springing line and highest point of the innercurve of an arch is known as

- a) intrados
- b) rise
- c) spandril
- d) extrados

**Ans: b**

127. Depth or height of the arch is the

- a) perpendicular distance between intra-dos and extrados
- b) vertical distance between springing line and intrados
- c) perpendicular distance between springing line and extrados
- d) none of the above

**Ans: a**

128. The triangular space formed between the extrados and the horizontal line drawn through the crown of an arch is known as

- a) haunch
- b) spandril
- c) voussoirs
- d) skewbacks

**Ans: b**

129. The lintels are preferred to arches because

- a) arches require more headroom to span the openings like doors, windows etc.
- b) arches require strong abutments to withstand arch thrust
- c) arches are difficult in construction
- d) all of the above

**Ans: d**

130. In the construction of arches, sand box method is used for

- a) centring
- b) actual laying of arch work
- c) striking of centring
- d) none of the above

**Ans: c**

131. The type of arch generally constructed over a wooden lintel or over a flat arch for the purpose of carrying the load of the wall above is

- a) segmental arch
- b) pointed arch
- c) relieving arch
- d) flat arch

**Ans: c**

132. The type of joint commonly used at the junction of a principal rafter and tie beam in timber trusses is

- a) mortise and tennon joint
- b) oblique mortise and tennon joint
- c) butt joint
- d) mitred joint

**Ans: b**

133. The type of roof suitable in plains where rainfall is meagre and temperature is high is

- a) pitched and sloping roof
- b) flat roof
- c) shell roof
- d) none of the above

**Ans: b**

134. Pitched and sloping roofs are suitable for

- a) coastal regions
- b) plain regions
- c) covering large areas
- d) all of the above

**Ans: a**

135. The type of roof which slopes in two directions with a break in the slope on each side is known as

- a) gable roof
- b) hip roof
- c) gambrel roof
- d) mansard roof

**Ans: c**

136. Mansard roof is a roof which slopes in

- a) two directions without break in the slope on each side
- b) two directions with break in the slope on each side
- c) four directions without break in the slope on each side
- d) four directions with break in the slope on each side

**Ans: d**

137. The horizontal timber piece provided at the apex of a roof truss which supports the common rafter is called

- a) ridge board
- b) hip rafter

- c) eaves board
- d) valley rafter

**Ans: a**

138. The lower edge of the pitched roof, from where the rain water of the roof surface drops down, is known as

- a) hip
- b) gable
- c) ridge
- d) eaves

**Ans: d**

139. Higher pitch of the roof

- i) results in stronger roof
- ii) results in weaker roof
- iii) requires more covering material
- iv) requires less covering material

The correct answer is

- a) (i) and (iii)
- b) (i) and (iv)
- c) (ii) and (iii)
- d) (ii) and (iv)

**Ans: a**

140. Couple close roof is suitable for maximum span of

- a) 2.5 m
- b) 3.5 m
- c) 4.5 m
- d) 5.5 m

**Ans: c**

141. In a collar beam roof

- a) there is no horizontal tie beam
- b) there is a horizontal tie at the feet of rafters only
- c) there is a horizontal tie at almost the middle of rafters only
- d) there are two horizontal ties, one at the feet and other at the middle of the rafters

**Ans: c**

142. The function of king post in a king post roof truss is

- a) to support the frame work of the roof
- b) to receive the ends of principal rafter
- c) to prevent the walls from spreading outward
- d) to prevent the tie beam from sagging at its centre

**Ans: d**

143. The function of cleats in a roof truss is

- a) to support the common rafter
- b) to support purlins
- c) to prevent the purlins from tilting

d) all of the above

**Ans: c**

144. The term string is used for

- a) the underside of a stair
- b) outer projecting edge of a tread
- c) a sloping member which supports the steps in a stair
- d) a vertical member between two treads

**Ans: c**

145. The vertical posts placed at the top and bottom ends of a flight supporting the hand rail are known as

- a) balusters
- b) newal posts
- c) balustrades
- d) railings

**Ans: b**

146. The maximum number of steps in a flight should generally be restricted to

- a) 10
- b) 12
- c) 15
- d) no limit

**Ans: b**

147. The number of steps in a flight generally should not be less than

- a) 2
- b) 3
- c) 5
- d) no limit

**Ans: b**

148. Sum of tread and rise must lie between

- a) 300 to 350 mm
- b) 400 to 450 mm
- c) 500 to 550 mm
- d) 600 to 650 mm

**Ans: b**

149. Minimum width of landing should be

- a) equal to width of stairs
- b) half the width of stairs
- c) twice the width of stairs
- d) one fourth the width of stairs

**Ans: a**

150. In any good staircase, the maximum and minimum pitch respectively should be

- a)  $90^\circ$  and  $0^\circ$
- b)  $75^\circ$  and  $30^\circ$

c)  $60^\circ$  and  $10^\circ$

d)  $40^\circ$  and  $25^\circ$

**Ans: d**

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