

01. Which one the following remedial measures are taken to avoid negative head and air binding in a rapid sand filter?

1. Avoiding the occurrence of excessive negative head
2. Pumping in air
3. Avoiding increase in water temperature
4. Control of algae growth

Select the correct answer using the codes given below

- (a) 1, 3 and 4 (b) 2, 3 and 4
(c) 1 and 2 (d) 1, 2, 3 and 4

02. Match List-I (Equation/Law) with List-II (Related Applications) and select the correct answer using the codes given below the lists:

- | List - I | List - II |
|----------------------------|-------------------------------|
| A. Chick's Law | 1. Discrete particle settling |
| B. Darcy-Weisbach equation | 2. Head loss in a pipe |
| C. Stoke's equation | 3. Head loss in filters |
| D. Carmen-Kozeny equation | 4. Rate of bacterial kill |

Codes :

- A. A-4, B-2, C-1, D-3
B. A-3, B-1, C-2, D-4
C. A-4, B-1, C-2, D-3
D. A-3, B-2, C-1, D-4

03. A flash mixer of 2.0 m^3 , with a velocity gradient of mixing mechanism equal to $600/\text{s}$, and fluid absolute viscosity of $1.0 \cdot 10^{-3} \text{ Ns/m}^2$ is continuously operated. What is the power input per unit volume?

- (a) 360 W
(b) 720 W
(c) 1440 W
(d) 300 W

04. Match List-I (Treatment Process) with List-II (Removed Matter) and select the correct answer using the code given below the lists:

- | List - I | List - II |
|---------------------------|---|
| A. Plain Sedimentation | 1. Dissolved gases |
| B. Chemical Precipitation | 2. Dissolved solids |
| C. Slow Sand Filtration | 3. Suspended solids with specific gravity more than 1.0 |
| D. Aeration | 4. Floating solids |
| | 5. Bacterial cells |

Codes :

- A. A-5, B-1, C-4, D-2
B. A-3, B-2, C-5, D-1
C. A-5, B-2, C-4, D-1
D. A-3, B-1, C-5, D-2

05. According to the theory of filtration in water treatment, which of the following mechanisms come into play when water is filtered through a filter bed?

1. Mechanical straining
2. Capillary action
3. Centrifugal force
4. Electro kinetic phenomenon
5. Osmotic force
6. Bacteriological action

Select the correct answer using the code given below

- (a) 1, 2, 4 and 6
(b) 2, 3 and 5
(c) 3, 4, 5 and 6
(d) 1, 3, 4 and 6

06. Which of the following are associated with alum coagulation?

1. A decrease of alkalinity in treated water
2. Formation of hydroxide flocs of aluminium
3. A slight decrease of pH in treated water
4. An increase of permanent hardness

Select the correct answer using the code given below:

- (a) 1, 2 and 3
(b) 1, 3 and 4
(c) 1, 2, 3 and 4
(d) 2 and 4

07. Chlorides from water are removed by

- (a) Lime soda process
(b) Reverse osmosis
(c) Cation exchange process
(d) Chemical coagulation

08. Which one of the following chemicals is employed for dechlorination of water?

- (a) Sodium sulphite
(b) Sodium bicarbonate
(c) Calcium carbonate
(d) Hydrogen peroxide

09. Which one of the following is the correct sequence of slow sand filter (SSF), rapid sand filter (RSF), dual media filter (DMF) and mixed media filter (MMF) in the decreasing order of their filtration rates?

- (a) MMF ~ DMF > RSF > SSF
(b) DMF > RSF > SSF > MMF
(c) RSF > SSF > MMF ~ DMF
(d) SSF > MMF ~ DMF > RSF

10. If total hardness and alkalinity of a water sample are 200 mg/l as CaCO_3 and 260 mg/l as CaCO_3 respectively, what are the values of carbonate hardness and non-carbonate hardness?

- (a) 200 mg/l & zero
(b) Zero & 60 mg/l
(c) Zero & 200 mg/l
(d) 60 mg/l & zero

11. In which treatment unit is "Schmutzdecke" formed?

- (a) Sedimentation tank
(b) Rapid sand filter
(c) Coagulation tank
(d) Slow sand filter

12. Match List-I (Disinfectant) with List-II (Property) and select the correct answer using the code given below the lists:

- | List - I | List - II |
|----------------------|--|
| A. Chlorine | 1. No carcinogenic result |
| B. Ozone | 2. Ineffective in the presence of suspended solids |
| C. Iodine | 3. Not affected by the Ammonium ion |
| D. Ultra-violet rays | 4. Feasible residual content |

Codes :

- A. A-4, B-3, C-1, D-2
B. A-1, B-2, C-4, D-3
C. A-4, B-2, C-1, D-3
D. A-1, B-3, C-4, D-2

13. What is the predominating coagulation mechanism for raw water having high turbidity and high alkalinity?

- (a) Ionic layer compression
(b) Adsorption and charge neutralization
(c) Sweep coagulation
(d) Inter particle bridging

14. Match List-I (Type of impurity) with List-II (Harm caused) and select the correct answer using the codes given below the lists:

- | List - I | List - II |
|------------------------|-------------------|
| A. Excess of nitrates | 1. Brackish water |
| B. Excess of fluorides | 2. Goitre |
| C. Lack of iodides | 3. Fragile bones |
| D. Excess of chlorides | 4. Blue babies |

Codes :

- A. A-4, B-2, C-3, D-1
B. A-1, B-2, C-3, D-4
C. A-4, B-3, C-2, D-1
D. A-1, B-3, C-2, D-4

15. Which combination of surface water quality parameters will indicate sweep coagulation as the preferred mechanism of coagulation?

- (a) High turbidity - low alkalinity
(b) High turbidity - high alkalinity
(c) Low turbidity - high alkalinity
(d) Low turbidity - low alkalinity

16. Which one of the following processes of water softening requires recarbonation?

- (a) Lime-soda ash process
(b) Hydrogen - cation exchanger process
(c) Sodium - cation exchanger process
(d) Demineralization

17. Consider the following treatment process units in a water treatment plant :

1. Coagulation
2. Disinfection
3. Sedimentation
4. Filtration

Which is the correct sequence of the process units in the water treatment plant?

- (a) 2 - 4 - 3 - 1
- (b) 1 - 4 - 3 - 2
- (c) 2 - 3 - 4 - 1
- (d) 1 - 3 - 4 - 2

18. The correct sequence of treatment of typical turbid surface water is

- (a) Flocculation, Coagulation, Sedimentation, Filtration
- (b) Flocculation, Coagulation, Filtration, Sedimentation
- (c) Coagulation, Flocculation, Filtration, Sedi mentation
- (d) Coagulation, Flocculation, Sedimentation, Filtration

19. Consider the following statements: The appropriate method(s) for removal of fluorides from water comprise:

1. Addition of alum and lime followed by clarification.
2. Passing through beds of activated alumina.

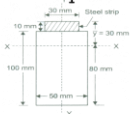
Which of the above statements is/are correct?

- (a) Neither 1 nor 2
- (b) Both 1 and 2
- (c) 1 only
- (d) 2 only

20. If the specific gravity of a suspended particle is increased from 2 to 3, the settling velocity will

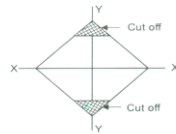
- (a) not change
- (b) get doubled
- (c) get increased by 1.5 times
- (d) get increased by 2.25 times

01. the cross section of a timber beam with a steel strip is shown in the given figure, it is subjected to a sagging bending moment of 1000 Nm, $I_{xx} = 1250 \times 10^4 \text{ mm}^2$ and modulus ratio $m = 20$. The stresses at the lower surfaces of timer σ_1 and steel σ_2 will be respectively



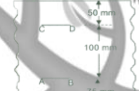
- a. + 6.4 MN / m² and - 6.4 MN / m²
- b. - 6.4 MN / m² and - 32 MN / m²
- c. + 6.4 MN / m² and - 32 MN / m²
- d. + 32 MN / m² and - 6.4 MN / m²

02. In the case of a square beam subjected couples acting about x-x axis, it is advisable to cut off the edges and keep the sections as shown in the given figure because it increases



- a. Stresses in the beam
- b. Stresses and reduced the weight of the beam
- c. The moment of inertia of the beam
- d. The section modulus

03. A test is conducted on a beam loaded by end couples. The fibres at layer CD are found to lengthen by 0.03 m and fibres at layers AB shorten by 0.9 mm in given figure. Taking $E = 2 \times 10^5 \text{ N/mm}^2$, the flexural stress at top fibres would be



- a. 900 N/mm² tensile
- b. 1000 N/mm² tensile
- c. 1200 N/mm² tensile
- d. 1200 N/mm² compressive

04. A cantilever beam is 2m long. The cross section of the beam is hollow square with external sides 60 mm and the internal side is such that $I = 6 \times 10^5 \text{ mm}^4$. If the safe bending stress for the material is 100 N/mm², the concentrated load at the free end would be

- a. 400 N
- b. 500 N
- c. 1000 N
- d. 600 N

1. Type of material
2. Transverse shear force
3. The stresses in the remaining principal direction
4. $\sigma_v = \sigma_v = \tau_{xy} = \tau_{yx} = 0$
5. Linear variation of strain

Select the correct answer using the codes given below:

- a. 1, 2, and 4
- b. 2, 3, and 4
- c. 4 and 5
- d. 1 and 3

06. Out of the two beams of same material and same cross section area one is of circular cross section and other are is of square cross section . If these are subjected to bending moment of same magnitude , then

- a. Both sections would be equally strong
- b. Both sections would be equally economical
- c. Square section would be more economical than circular section
- d. Square section would be less economical than circular section

07. Match List I with List II and select correct answer

List I	List II
A. Assumption in the theory of simple bending	1. Neutral axis
B. The point at which the bending stress is max for any cross section.	2. Centroid
C. The point at which the bending stress is zero for any cross section.	3. The plane sections remain plain
D. The point in the cross section through which the N.A passes	4. Extreme fibre
	5. The cross section is circular

Codes :

- a. A - 5, B - 4, C - 1, D - 2
- b. A - 3, B - 1, C - 2, D - 4
- c. A - 5, B - 1, C - 2, D - 4
- d. A - 3, B - 4, C - 1, D - 2

08. Consider the following statements for a beam based on theory of bending.

1. Strain developed in any fibre is directly proportional to the distance of fibre from neutral surface
2. For flexural loading and linearly elastic action the neutral axis passes through the centroid of cross section.
3. The assumption of the plane cross sections remaining plane will not hold good centroid inelastic action
4. Instances in which the neutral axis does not pass through the centroid of a cross section include a homogenous symmetrical beam (with respect to neutral axis) and subjected to inelastic action.

Which of the statements given above are correct ?

- a. 1, 2, 3 and 4
- b. 1, 2 and 4
- c. 3 and 4
- d. 1 and 2

09. A beam has the same section throughout its length with $I = 1 \times 10^8 \text{ mm}^4$. It is subjected to uniform B.M = 40 kNm $E = 2 \times 10^5 \text{ N/mm}^2$ what is the radius of curvature of the fibre into which the beam will bend in the form of an arc of a circle ?

- a. 1000 m
- b. 500 m
- c. 400 m
- d. 350 m

10. A cantilever beam of T cross section carries uniformly distributed load. Where does the maximum magnitude of the bending stress occur ?

- a. At the top of cross section
- b. At the junction of flange and web
- c. At the mid-depth point
- d. At the bottom of the section

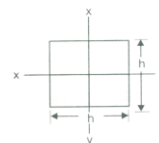
11. A structural beam subjected to sagging bending has a cross section which is an unsymmetrical I-section. The overall depth of the beam is 300 mm. the flange stresses in the beam are:

$$\sigma_{\text{top}} = 200 \text{ N/mm}^2 \quad \sigma_{\text{bottom}} = 50 \text{ n/mm}^2$$

What is the height in mm of the neutral axis above the bottom flange?

- a. 240 mm
- b. 60 mm
- c. 180 mm
- d. 120 mm

12. A square section as shown in the figure above is subjected to bending moment M. what is the maximum bending stress ?



- a. $\sigma_{bc} = \sigma_{bt} = 12 M/h^3$
- b. $\sigma_{bc} = \sigma_{bt} = 6 M/h^3$
- c. $\sigma_{bc} = \sigma_{bt} = 9 M/h^3$
- d. $\sigma_{bc} = \sigma_{bt} = 9 M/h^3$

13. A square beam laid flat is then rotated in such a way that one of its diagonal becomes horizontal. How is its moment capacity affected ?

- a. Increases by 41.4 %
- b. Increases by 29.27 %
- c. Decreases by 29.27 %
- d. Decreases by 41.4 %

14. beam of symmetrical I-section, made of structural steel has an overall depth of 300 mm. if the flange stresses developed at the top and bottom of the beam are 1200 kg/cm² and 300 kg /cm² respectively , then the depth of neutral axis from the top of the beam would be

- a. 250 mm
- b. 240 mm
- c. 200 mm
- d. 180 mm

