ASSISTANT PROFESSOR IN CIVIL ENGG.
Technical Education Department (Engineering Colleges)

Sl.No	Subject	Marks
1	Technical Mathematics	10
2	Basic Civil Engineering	5
3	Basic Mechanical Engineering	6
4	Basic Electrical Engineering	5
5	Basic Electronics Engineering	4
6	Building Materials	7
7	Building Construction	4
8	Construction Management	2
9	Surveying	3
10	Estimation	9

Sl.No	Subject	Marks
11	Engineering Mechanics	1
12	Mechanics of Solids	9
13	Structural Analysis	1
14	Reinforced Cement concrete	1
15	Steel Structures	2
16	Water Resources Engineering	4
17	Fluid Mechanics	2
18	Environmental Engineering	8
19	Transportation Engineering	9
20	Geotechnical Engineering	8

ISRO BOOK CIVIL

1. If $\begin{bmatrix} 5 & 4 \\ 1 & 1 \end{bmatrix} x = \begin{bmatrix} 1 & -2 \\ 1 & 3 \end{bmatrix}$, then x equals

A. $\begin{bmatrix} -3 & -14 \\ 4 & 17 \end{bmatrix}$

B. $\begin{bmatrix} -3 & 14 \\ 4 & 17 \end{bmatrix}$

C. $\begin{bmatrix} 3 & -14 \\ 4 & 17 \end{bmatrix}$

D. $\begin{bmatrix} 3 & 14 \\ 4 & 17 \end{bmatrix}$

$$\begin{bmatrix} 5 & 4 \\ 1 & 1 \end{bmatrix} = x \begin{bmatrix} 1 & -2 \\ 1 & 3 \end{bmatrix}$$

$$x = \begin{bmatrix} 1 & -2 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} 5 & 4 \\ 1 & 1 \end{bmatrix}^{-1}$$

$$= \begin{bmatrix} 3 & -14 \\ 4 & 14 \end{bmatrix}$$

1st RANKERS

വിവിധ സിവിൽ എഞ്ചിനീയറിംഗ് മത്സരപരീക്ഷകളിലെ സിവിലിയൻസിൽ നിന്നുള്ള ഒന്നാം റാങ്കുകാരാണിവർ

Sravan S
AE-**PWD**

Greeshma S
AE-**Irrigation**(DC)

Chithra C
AE-**PWD** (DC)

Prijil P T
AE-**LSGD** (DC)

Pouthramanu V
AE-**PCB**

NIkhil Soman
Junior Instructor
Draftsman Civil

Hannath N M
Work Superintendent
SS&SC Dept.

Answara S
Lecturer Gr. I
Rural Egg.

Gargi S
Work Superintendent
SS&SC Dept.

Sithara T P
FACT Technician-
CIVIL

Jesin Rajan
Training Instructor-
CIVIL - SCDD

Nanda M S
PWD/IRRIGATION
OVERSEER GR.I

Sidharth A
PWD/IRRIGATION
OVERSEER GR.II

Nithin A
Training Instructor-
SURVEY - SCDD

Anjali S
KAMC Draftsman-

Kavya K S
Tradesman (Survey)-

Anand V
Tracer-
Soil Conservation

Amrutha S
Work Supervisor-
KSFCL

AE-PWD	**6** RANKS **IN FIRST 10**
AE-Irrigation	Two in every **5** CANDIDATES IN RANKLIST IS FROM **CIVILIANZ.**
AE-LSGD	One in every **3** CANDIDATES IN RANKLIST IS FROM **CIVILIANZ.**
AE-PCB	**56** RANKS **IN FIRST 100**
Junior Instructor	**7** RANKS **IN FIRST 10**
Overseer	**50%** OF

2. The value of $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}$ is

A. $(a-b)(b-c)(c-a)$

B. $-(a-b)(b-c)(c-a)$

C. $2(a-b)(b-c)(c-a)$

D. $-2(a-b)(b-c)(c-a)$

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} \quad (a)$$

$$C_2 \longrightarrow C_2 - C_1$$

$$C_3 \longrightarrow C_3 - C_1$$

$$\begin{vmatrix} 1 & 0 & 0 \\ a & b-a & c-a \\ a^2 & b^2-a^2 & c^2-a^2 \end{vmatrix}$$

$$\Rightarrow 1 \left[(b-a)(c^2-a^2) - (c-a)(b^2-a^2) \right]$$

$$\Rightarrow (b-a)(c-a)(c+a) - (c-a)(b-a)(b+a)$$

$$\Rightarrow (b-a)(c-a) \left[(c+a) - (b+a) \right]$$

$$\Rightarrow (b-a)(c-a)(c-b)$$

$$\Rightarrow (a-b)(b-c)(c-a)$$

3. If $\cos \theta = \dfrac{2}{3}$ and $0 < \theta < \dfrac{\pi}{2}$, then the value of $\cos 2\theta$ is

    A. -9

    B.   9

    C. $-\dfrac{1}{9}$

    D. $\dfrac{1}{9}$

$$\cos\theta = 2/3$$

$$\cos 2\theta = 2\cos^2\theta - 1$$

$$= 2\left(2/3\right)^2 - 1$$

$$= 2\left(4/9\right) - 1$$

$$= \frac{8}{9} - 1$$

$$= -1/9$$

4. The equation of a straight line through (2, -5) and perpendicular to the line y = 3x - 11 is

A. $y = -(\frac{x+13}{3})$

B. $y = (\frac{x+13}{3})$

C. $Y = -(\frac{x-13}{3})$

D. $Y = (\frac{x-13}{3})$

(c)

$(2, -5)$ and $y = 3x - 11$

$$\Rightarrow 3x - y - 11 = 0$$
$$ax - by + c = 0$$

$a = 3$
$b = -1$
$c = -11$

Eqn $\Rightarrow bx - ay + ba_1 - av = 0$

$\Rightarrow -x - 3y + (-1 \times 2) - (3x - 5) = 0$

$\Rightarrow -x - 3y - 2 + 15 = 0 \Rightarrow -x - 3y + 13 = 0$

$$\Rightarrow 3y = -x + 13$$
$$y = \frac{-(x - 13)}{3}$$

5. The value of $\lim\limits_{x \to +\infty} x \sin\left(\frac{1}{x}\right)$ is

A. **1**

B. -1

C. 0

D. ∞

5. (a)

$$\operatorname*{lt}_{x \to \alpha} x \cdot \sin\left(1/x\right)$$

$$= \operatorname*{lt}_{x \to \alpha} \frac{\sin\left(1/x\right)}{\left(1/x\right)}$$

by identify $\operatorname*{lt}_{x \to \alpha} \frac{\sin \theta}{\theta} = 1$

We get,

$$\operatorname*{lt}_{x \to \alpha} \frac{\sin\left(1/x\right)}{1/x} = 1$$

6. The equation of normal to the curve 2y = 3 - x^2, at the point (1, 1) is

A.   x+y = 0

B.   ×+y =1

C.   x-y = 0

D.   x-y= 1

$$2y = 3 - x^2 \qquad at \quad (1,1)$$

Slope of equation,

$$2y = 3 - x^2$$

diff w.r.t x

$$2 \cdot \frac{dy}{dx} = -2x$$

At $(1,1)$

$$\frac{dy}{dx} = -1$$

$$\frac{dy}{dx} = -m \implies \begin{array}{l} -m = -1 \\ \therefore \quad m = 1 \end{array}$$

Eq. of normal $\implies (y - y_0) = m(x - x_0)$

$$y - 1 = 1(x-1)$$

$$y - 1 = x - 1$$

$$x - y = 0$$

7. For the function $f(x) = x^4 - 2x^2$, which of the following is correct?

A. Relative maximum occurs at $x = 1$ and relative minimum occurs at $x = 0$ and $x = -1$

B. Relative minimum occurs at $x = 0$ and relative maximum occurs at $x = 1$ and $x = -1$

C. Relative minimum occurs at $x = 1$ and relative maximum occurs at $x = 0$ and $X = -1$

D. Relative maximum occurs at $x = 0$ and relative minimum occurs at $x = 1$ and $X = -1$

$$f(x) = x^2 - 2x^2$$

$$f'(x) = 0$$

$$4x^3 - 4x = 0$$

$$4x(x^2 - 1) = 0$$

$$x = 0, \quad x = \pm 1$$

$$f''(x) = 12x^2 - 4 = 0$$

at $x = 0$, $f''(x) = -4 < 0$, max, occurs.

at $x = 1$, $f''(x) = 8 > 0$ } min occurs.

at $x = -1$, $f''(x) = 8 > 0$ }

8. The value of $\int \dfrac{dx}{25-9x^2}$ =

A. $\dfrac{1}{30} \log \dfrac{3x+5}{3x-5}$

B. $\dfrac{1}{30} \log \dfrac{5+3x}{5-3x}$

C. $-\dfrac{1}{30} \log \dfrac{3x+5}{3x-5}$

D. $-\dfrac{1}{30} \log \dfrac{5+3x}{5-3x}$

8 (b)

$$\int \frac{dx}{25 - 9x^2}$$

In the form,

$$\int \frac{dx}{a^2 - x^2} = \frac{1}{2a} \log\left(\frac{a+x}{a-x}\right) + C$$

$$\therefore \int \frac{dx}{25 - 9x^2} = \frac{1}{10} \log\left\{\frac{5+3x}{5-3x}\right\} \times \frac{1}{3} + C$$

$$= \frac{1}{30} \log\left\{\frac{5+3x}{5-3x}\right\} + C$$

9. The area bounded by the curve $y = 4x - x^2$ and the x - axis is

A. $\dfrac{4}{3}$

B. $\dfrac{16}{3}$

C. $\dfrac{32}{3}$

D. $\dfrac{64}{3}$

9. (c)

$$y = 4x - x^2$$

x axis

at $y = 0$, $\quad 4x - x^2 = 0$

$$x(4-x) = 0$$

$$x = 0, \quad x = 4$$

Area $= \displaystyle\int_0^4 y \cdot dx$

$\qquad = \displaystyle\int_0^4 4x - x^2 \cdot dx$

$\qquad = \overset{2}{\cancel{4}} \left[\dfrac{x^2}{\cancel{2}} \right]_0^4 - \left[\dfrac{x^3}{3} \right]_0^4$

$\qquad = 32 - \dfrac{64}{3}$

$\qquad = \dfrac{32}{3}$ //
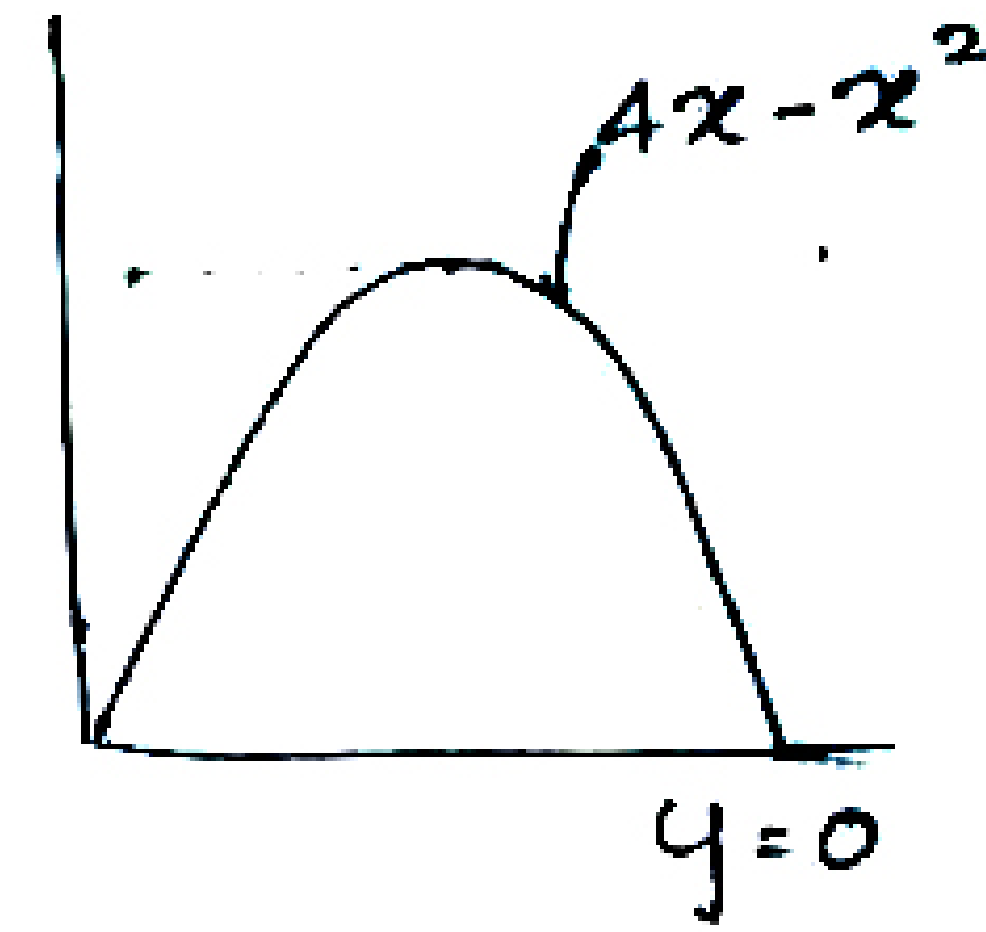
10. The solution of the initial value problem $y' + y \tan x = \sin 2x$, $y(0) = 1$ is

    A. $y = 3\cos x + 2\cos^2 x$

    B. $y = 3\cos x - 2\cos^2 x$

    C. $y = 3\sin x + 2\sin^2 x$

    D. $y = 3\sin x - 2\sin^2 x$

10. (B)

$$y' + y\tan x = \sin 2x. \qquad y(0) = 1$$

$$\frac{dy}{dx} + y\tan x = \sin 2x \Rightarrow \frac{dy}{dx} + Py = Q$$

I.F $= e^{\int P \cdot dx}$

$= e^{\int \tan x \cdot dx}$

$= e^{\ln \sec x}$

$\therefore \int \tan x = \ln(\sec x)$

$= \sec x$

$\therefore \left[e^{\log x} = x \right]$

$\therefore$ Solution is:

$$y \cdot I.F = \int Q \cdot I.F \, dx + c$$

$\Rightarrow y \sec x = \int \sin 2x \cdot \sec x \, dx + c$

$\Rightarrow y \sec x = -2\cos x + c$

Given, $y(0) = 1$

$\Rightarrow \quad 1 \cdot \sec 0 = -2\cos 0 + c$

$\qquad 1 = -2 + c$

$\qquad c = 3$

$\therefore$ Solution is

$$y \cdot \sec x = -2\cos x + 3$$

$\Rightarrow y = -2\cos^2 x + 3\cos x \qquad \left[\therefore \sec x = \frac{1}{\cos x} \right]$

$\Rightarrow y = 3\cos x - 2\cos^2 x$

[By Simplification:

$\cdot \int \sin 2x \cdot \frac{1}{\cos x} \cdot dx$

$\cdot \int 2\sin x \cdot \frac{\cos x}{\cos x}$

$\cdot \int 2\sin x$.

11.In chain survey, the area of land is divided into

     A. rectangles

     B.   triangles

     C. circles

     D. semicircles

12. Sensitivity of a level tube is expressed by

    A.   length of bubble tube

    B.   length of level tube

    C. radius of level tube

    D. height of level tube

13.The rocks having clay as main constituent are known as

      A. metamorphic rocks

      B. igneous rocks

      C. argillaceous rocks

      D. calcareous rocks

14. Unit weight of plain concrete is

    A.   14 kN/m^3

    B.   20 kN/m^3

    C.   24 kN/m^3

    D.   30 kN/m^3

15. Piles are usually not made of

        A. Timber

        B. R.C.C.

        C. Steel

        D. Stainless steel

16. Which type of engine of the same specification need higher compression ratio?

       A. Petrol engine

       B. **Diesel Engine**

       C. Gas Turbine

       D. All run with same ratio

17. Which component is used to smoothen the output energy of an automobile engine?

A.   Flywheel

B.   Governor

C.   Carburetor

D.   Both A) and B)

18. Draft tube is compulsory for

    A. Impulse turbines

    B.   Reaction turbines

    C. Both A) and B)

    D. None

19. In a reverted gear train, gear A drives a pinion gear C, co-axial with gear D, which meshes with gear B. Gear B and A are along the same axis. All gears are of module 8 mm. If the gear A contain 40 teeth and gear C contain 32 teeth, then how many teeth the gear D will have, if B contains 60 teeth ?

A. 8 teeth

B. 40 teeth

C. 12 teeth

D. 24 teeth

$$Z_A + Z_C = Z_B + Z_D$$

$$40 + 32 = 60 + Z_D$$

$$Z_D = 12$$

20. Boiled water reactors will yield more than they consume - Is it right?

A. Yes

B. Don't know

C. No

D. Sometimes

21. Thermodynamic steam trap is used to

      A.   Release super heat from a main line

      B.   Release the pressure in steam pipeline

      C.   Release the moisture in pipeline

      D.   **All the above**

22. The property of a coil, which opposes any change of current or flux through the coil is called

A. Mutual inductance

B.   Lenz's laws

C. Magnetizing force

D.   Self-Inductance

23. A series RLC circuit consists of a resistor of 45 Ω, an inductor of 80 mH and a capacitor of 30 μF connected on an AC supply voltage of 230 V, 60 Hz. Then the current in the circuit is given by

A. 3.122 A

B. 3.0 A

C. 5.11 A

D. 5.0 A

23(A.)

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$= 73.62$$

$$i = \frac{230}{73.62} = 3.12$$

24. An LC circuit stores a total energy of E and the maximum charge on the capacitor is assumed as Q. What will be the energy stored in the inductor while the charge on the capacitor is Q/2?

    A. 2E/3

    B. E/3

    C. E

    D. 3E/4

24. (D)

Total Energy $= \dfrac{Q^2}{2C} + \frac{1}{2} L I^2 =$ Constant

When charge is maximum, $i = 0$

$$\text{Total energy} = \dfrac{Q^2}{2C}$$

$$\therefore \ \tfrac{1}{2} L I^2 = 0$$

When $q = Q/2$

$$\dfrac{\left(Q/2\right)^2}{2C} + \tfrac{1}{2} L i^2 = \dfrac{Q^2}{2C}$$

$$\tfrac{1}{2} L I^2 = \dfrac{Q^2}{2C} - \dfrac{Q^2}{8C}$$

$$= \dfrac{3Q^2}{8C}$$

$$= \dfrac{3}{4} \times \dfrac{Q^2}{2C}$$

$$= \dfrac{3}{4} E$$

25. If footing resistance of transmission tower is 50Ω and the lightning current from tower to ground is 50 kA, then the degree of rise in tower potential is

    A. 1000 kV

    B. 2500 kV

    C. 1500 kV

    D. None of the above

26. The energy stored as static electricity on an object depends on

        A. Size of the object

        B. Capacitance of the object

        C. Both A and B

        D. None of these

27. The minimum data rate for stationary users in 3G is

A. 0.02 Mbit/s

B. 2 Mbit/s

D. 200 Mbit/s

C. 20 Mbit/s

28. The number of _____ on switches defines how many separate circuits the switch can control.

A. poles

B. throws

C. terminals

D. none of these

29. A full-wave rectifier circuit delivers 3W to a load resistance of 300Ω. If ripple factor is given 1%, then the ac ripple voltage across the load is

A. 0.03V

B. 0.3V

C. 3V

D. 30V

29. Given,

$$P_{DC} = 3W \qquad R_L = 300\,\Omega \qquad rf = 0.01$$

$$P_{DC} = \frac{V_{DC}^2}{R_L}$$

$$\therefore V_{DC} = \sqrt{P_{DC} \times R_L} = \sqrt{900} = 30V$$

The ripple factor is $1\% \, (= 0.01)$

$$\therefore rf = \frac{V_{AC}}{V_{DC}}$$

$$\Rightarrow 0.01 = \frac{V_{AC}}{V_{DC}} = \frac{V_{AC}}{30}$$

$$\Rightarrow V_{AC} = 30 \times 0.01$$

$$= 0.3V$$

30. The ac input voltage to a full wave bridge rectifier has an rms value of 230V, then the diode P/V rating is

A. $230\sqrt{2}$V

B. $\dfrac{230}{\sqrt{2}}$V

D. none of these

C. 230V

30. (D)

For full wave rectifier

$$PIV = 2V_m$$

Given,

$$V_{rms} = 230V$$

$$\therefore \ PIV = 2V_m = 2\left(\sqrt{2} \ V_{rms}\right)$$

$$= 2 \times \sqrt{2} \times 230$$

31. Basalt is a/an

A. Metamorphic rock

B. Sedimentary rock

C. Igneous rock

D. None of the above

32. 1S code for common burnt clay building bricks is

A. IS 1077 1992

B. 1S 456 1972

C. IS 2982 1981

D. IS 1825 1992

33. The modulus of rupture for tiles in N/mm² is calculated by the expression

A. $\dfrac{3Fb}{2Lh^3}$

B. $\dfrac{2FL}{3bh^3}$

C. $\dfrac{3FL}{2bh^3}$

D. $\dfrac{2Fb}{3Lh^3}$

34. Which constituent in lime is responsible for its hydraulicity?

A. Clay

B. Soluble Silica

C. Sulphates

D. Magnesium Carbonate

35. The needle used in Vicat apparatus is

A. 1 mm square

B. 1.13 mm square

C. 1 mm diameter

D. 1.25 mm diameter

36. The fineness modulus index of M sand compared to natural river sand is

A. Higher

B. Lower

C. Equal

D. None of the above

37. Hard fibrous tissue that usually found in the stems, branches and roots of a tree is called

A. Timber

B. Lumber

C. Wood

D. Core

38. A wedge-shaped stone/brick used in the construction of an arch is known as

A. Springer

B. Queen closer

C. Voussoir

D. Impost

39. The inclined slab of the staircase is known as

A. Baluster

B. String

C. Header

D. Spindle

40. Affordable delay in a task chain is known as

A. Event

B. Duration

C. Float

D. Constraint

41. The process by which bauxite is converted to aluminium is known as

      A. Hall-Heroult Process

      B. Bayer Process

      C. Clark's Process

      D. Brymer Process

42. The ratio of the volume of the soil displaced by the sampler tube in proportion to the volume of the sample

    A. Recovery ratio

    B. Area ratio

    C. Disturbance ratio

    D. Sampling ratio

43. The hierarchical order in PWD is

A. AXE, EE, SE, CE

B. EE, AXE, SE, CE

C. SE, EE, AXE, CE

D. AXE, SE, EE, CE

44. The method of supporting the structures for increasing the depth and width of an existing foundation is known as

A. Shoring

B. Scaffolding

C. Prestressing

D. Underpinning

45. The bearing measured in the direction of advancement of surveying is called

A. Back Bearing

B. Intermediate Bearing

C. First Bearing

D. Fore Bearing

46. Inclination of the magnetic needle of the compass with horizontal plane at a particular location on the planet is known as

A. Declination

B. Latitude

C. Dip

D. Longitude

47. The method of levelling in which only fore and back sights are taken to connect the bench mark to the starting point of the alignment is known as

A. Differential levelling

B. Simple levelling

C. Precise levelling

D. Reciprocal levelling

48. The gross rent according to a property is Rs. 20,000/- pa. Allowing 10% as deductions for repair and maintenance of the property. What is the rental value of the property at an interest of 10% ?

A. Rs. 2,00,000

B. Rs. 1,80,000

C. Rs. 1,90,000

D. Rs. 2,10,000

48. (b)

Given,

Gross rent = Rs. 20,000 per year

Deduction = 10% of the gross rent

= 10% of Rs. 20,000/-

= Rs. 2,000/-

Net Rent = Gross rent − Deduction

= (20000 − 2000)

= Rs. 18,000/-

Rental Value = $\dfrac{\text{Net Rent}}{\text{Interest Rate}}$

= $\dfrac{18000}{10\%}$

= Rs. 180,000/-

49. An amount of money put aside for emergency and expensive costs for repairs or renovations is called

A. Mutual fund

B. **Sinking fund**

C. Scrap value

D. Salvage

50. The flakiness Index of aggregate used for WBM road as per IS standard is

        A. Max 20%

        B. Max 50%

        C. Max 70%

        D. Max 10%

51. The book used to keep all accounts including quantities of work done, purchase made and other details of the work executed is called

A. Work Book

B. Measurement Book

C. Project Diary

D. Account Book

52. The financial limit for open tenders for superintending engineer is

A. Rs. 5 Lakhs

B. Rs. 10 Lakhs

C. Rs. 25 Lakhs

D. Rs. 100 Lakhs

53. The lateral earth pressure acting on a retaining wall is computed based on

A. Plane strain condition

B. Plane stress condition

C. Effective stress condition

D. None of the above

54. As per PWD schedule of rates for hilly areas the % increase over the scheduled rate is

A. 20

B. 30

C. 50

D. 15

54	Wireman	Do	**290**
55	Wireman- Assistant	Do	**270**
56	Wireman- Helper	Do	**225**
57	Wood cutter	Do	**300**
58	Moulder	Do	**325**
59	Tile paver	Do	**325**
60	Marble cutter	Do	**350**
61	Skilled Assistant (Engineering Degree Holder)	Do	**600**
62	Skilled Assistant (Diploma Holder)	Do	**475**
63	Skilled Assistant (I.T.I, I.T.C, etc,)	Do	**350**
64	Hardware Technician (Computer)	Do	**350**
65	Motor winder	Do	**350**
66	Technician- Electronic machinery	Do	**350**
67	Gardener	Do	**270**
68	Aluminium Fabricator	Do	**325**
Note:-	1. For Hilly areas 15 % increase in the rates may be allowed.		
	2. For difficult areas , restricted working hours etc. up to a 50 % increase in labour can be allowed subject to approval by the next higher authority.		
	3. This labour rate is applicable for Vol.II (Electrical schedule).		

55. Approximate estimate is calculated based on which of the following method?

A. Plinth Area Method

B. Cubical Content Method

C. Unit Base Method

D. All the above

56. The total quantity of TMT bars required for construction of a project can be obtained from

A. Critical path method

B. Project evaluation schedule

C. Bar bending schedule

D. None of the above

57. The workers platform provided around the building to work at heights is called

A. Form work

B. Frame work

C. Scaffolding

D. Underpinning

58. The loading and unloading charges for per ton of steel bars as on 2018-20 is

A. 562.75

B. 675.00

C. 462.50

D. 325.42

59. The forces which cannot be solved by the equations of equilibrium are called

A. Collinear forces

B. Redundant forces

C. Body forces

D. Concurrent forces

60. The value of Poisson's ratio can be

        A. Only positive

        B. Only negative

        C. Can either be positive or negative

        D. None of the above

61. The relation between elastic constants can be given by the expression

A. $E = \dfrac{9KG}{G+3K}$

B. $E = \dfrac{3KG}{6K+2G}$

C. $E = \dfrac{9KG}{3G+2K}$

D. $E = \dfrac{3KG}{3K+2G}$

62. Two materials are having moduli of elasticity, moduli of rigidity and bulk modulus as (E1.E2). (N1.N2) and (K1,K2). The modulus ratio is given by

A. E1/C2

B. E1/K2

C. E1/E2

D. C1/K2

63. The elongation produced in a rod (by its own weight) of length (l) and diameter (d) rigidly fixed at the upper end and hanging freely is equal to

A. $\dfrac{wl}{2E}$

B. $\dfrac{wl^2}{2E}$

C. $\dfrac{wl^3}{2E}$

D. $\dfrac{wl^4}{2E}$

64. The work done in producing strain on a material per unit volume is called

A. Resilience

B. Ductility

C. Elasticity

D. Plasticity

65. A simply supported beam carries a uniformly distributed load of w N per unit length over the whole span (l). The point of contra flexure is

A. At the supported end

B. At the middle of the beam

C. A distance 1/4 from the supported end

D. None of the above

66. A solid circular shaft of diameter D carries an axial load W, if the same load is applied axially on a hollow circular shaft of inner diameter D/2, the ratio of stresses in a solid shaft to that of hollow shaft would be

A. 1/2

B. 1/4

C. 4/3

D. 3/4

66. Ratio of stresses in a solid shaft to that of hollow shaft

$$\neq \frac{P_i}{P}$$

$$= \frac{\dfrac{P}{\dfrac{\pi}{4} D^2}}{\dfrac{P}{\dfrac{\pi}{4}\left[D^2 - \left(\dfrac{D}{2}\right)^2\right]}}$$

$$= \frac{\dfrac{1}{D^2}}{\dfrac{1}{D^2 - \left(\dfrac{D}{2}\right)^2}}$$

$$= \frac{3}{4}$$

67. A simply supported beam carries a uniformly distributed load over the whole span. The deflection at the centre is 'y'. If the distributed load per unit length is doubled and also depth of the beam is doubled then the deflection at the centre would be

A. 2y

B. 4y

C. y/2

D. y/8

w/m
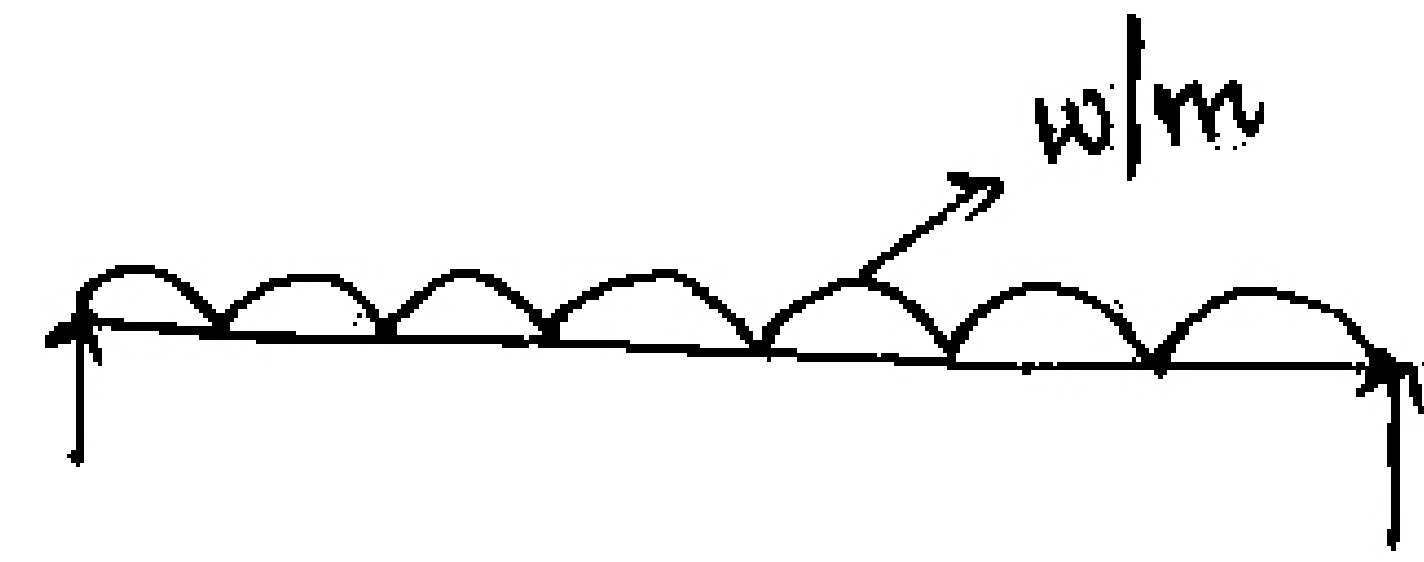
$W = wL$

Deflection at centre $y = \dfrac{5}{384} \dfrac{WL^3}{EI} = \dfrac{5}{384} \dfrac{wL^3}{E \times \dfrac{bd^3}{12}}$

Here, $W = 2W$

$d = 2d$

$\therefore$ Deflection $= \dfrac{5}{384} \left[\dfrac{(2w) L^3}{E \times \dfrac{b(2d)^3}{12}} \right]$

$\Rightarrow \dfrac{5}{384} \dfrac{wL^3}{E \times \dfrac{bd^3}{12}} \times \dfrac{2}{8}$

$\Rightarrow \dfrac{y}{4}$

68. The hoop or circumferential stress in a riveted cylindrical shell, when subjected to an internal pressure (p) is equal to

A. $\dfrac{pD}{4t\eta}$

B. $\dfrac{pD}{4t}$

C. $\dfrac{pD}{2t\eta}$

D. $\dfrac{pD}{2t}$

69. The crippling load according to Euler's theory of long column when one end of the column is fixed and other end is free is equal to

A. $\dfrac{4\pi^2 EI}{l^2}$

B. $\dfrac{\pi^2 EI}{l^2}$

C. $\dfrac{\pi^2 EI}{4l^2}$

D. $\dfrac{2\pi^2 EI}{l^2}$

70. The property by virtue of which a metal can be heated into plates is called

A. Ductility

B. Malleability

C. Resilience

D. Plasticity

71. The base slab thickness for a gravity retaining wall of height 'H' is

A. H/10 to H/14

B. H/6 to H/8

C. H/15 to H/20

D. H/3 to H/5

72. In the case of a three-pinned parabolic arch carrying a uniformly distributed load on the entire span, then bending moment will be

A. Equal to that of a simply supported beam loaded in the same manner

B. Maximum at quarter span

C. Zero only at the centre

D. Zero throughout the span

73. In a pitot tube the rise of liquid in the tube above liquid surface is 45 m. Then the velocity of flow through it is

A. 20 m/s

B. 30 m/s

C. 40 m/s

D. 45 m/s

74. If the coefficient of contraction is 0.70 and the coefficient of discharge is 0.60, then the value of coefficient of velocity is

A. 0.67

B. 0.86

C. 0.93

D. 0.96

74. We know that

$$C_d = C_c \times C_v$$

$$C_v = \frac{C_d}{C_c} \Rightarrow \frac{0.60}{0.40}$$

$$= 0.86$$

75. The base period of a crop, having duty 8.64 hectares/cumecs and depth of water supplied 160 cm is

A. 1 day

B. 1.2 days

C. 1.4 days

D. 1.6 days

76. According to Dicken's formula the food discharge for a catchment basin of area 1 km² is (Take flood coefficient C = 10)

A. 0.1

B. 1.0

C. 10.0

D. 100.0

$$Q = CA^{3/4}$$

$$= 10$$

$$C = 10$$

$$A = 1 \text{ km}^2$$

77. A sewer of 4m diameter, laid at a gradient of 1 in 400 runs full. Using Manning's formula, the velocity of flow is (Take Manning's coefficient as 0.01)

    A.   1.25 m/s

    B.   2.5 m/s

    C.   5.0 m/s

    D.   10.0 m/S

78. The Permissible limit of Iron (in mg/L) (in the absence of alternate source) as per IS: 10500;2012 including the latest amendments is

A. 0.1

B. 0.3

C. 0.5

D. 1.0

79. The first watering before sowing the crop in a field is called

    A.   Capacity factor

    B.   Cumec day

    C.   Kor watering

    D.   Paleo

80. 5 mL of sewage was diluted and a standard BOD test was performed. The initial Dissolved Oxygen (DO) and the final DO of the tested sample were 8.2 mg/L and 6.2 mg/L respectively. Then the Biochemical Oxygen Demand of the tested sample is

A. 2 mg/L

B. 20 mg/L

C. 12 mg/L

D. 120 mg/L

81. 50 million litres of sewage per day is flowing into the aeration tank of an activated sludge processing unit having volume of 10,000 m³. Then the aeration period to be maintained in the aeration tank in hours Is

A. 4

B. 5

C. 6

D. 7

(b)

$$Q = 50 \text{ MLD}$$

$$V = 10000 \text{ m}^3$$

$$DT = \frac{10,000}{50 \times 10^3/\text{day}} = 0.2 \text{ days}$$

$$= 0.2 \times 24$$

$$\approx \cancel{5 \text{ days}}$$

$$\approx 5 \text{ hours.}$$

82. The maximum discharge in a circular sewer is obtained when

A. the sewer is running full

B. the depth of flow is 0.81 times full depth

C. the depth of flow is 0.90 times full depth

D. the depth of flow is 0.95 times full depth

83. What is the theoretical oxygen demand of 300 mg/L glucose solution?

    A.   300 mg/L

    B.   320 mg/L

    C.   340 mg/L

    D.   360 mg/L

Formula of Glucose $\longrightarrow$ $C_6H_{12}O_6$

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$$
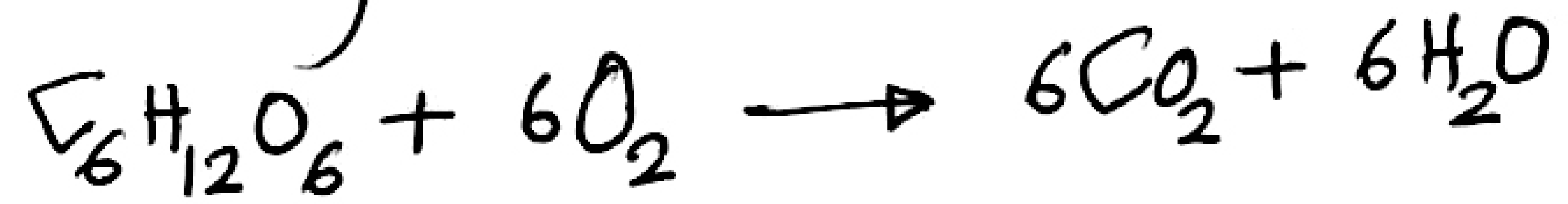
Mass weight of Glucose $= 180$

180 gm of glucose $\longrightarrow$ 192 gm of O_2

So,

300 mg/L of glucose requires,

$$\Rightarrow \quad 300 \times \frac{192}{180} = 320 \, mg/L$$

84. Symon's rain gauge is a

      A.   Tipping bucket gauge

      B.   Weighing type gauge

      C.   Float recording type gauge

      D.   Non recording gauge

85. The ratio of the mean supply (discharge) to the full supply (discharge) of a canal is

A. Time factor

B. **Capacity factor**

C. Kennedy factor

D. Lacey's factor

86. The normal detention periods maintained in a horizontal flow grit chamber (non-aerated) and detritus tank are respectively

A. 1 minute and 3.5 minutes

B. 10 minutes and 3.5 minutes

C. 1 minute and 30 minutes

D. 10 minutes and 30 minutes

87. What is coefficient of curvature it D_{60} = 3mm, D_{30} = 1.5mm, D_{10} = 0.75mm

A. 8

B. 1

C. 1.5

D. 4

88. The value of porosity of a soil sample in which the total volume of soil grains is equal to twice the total volume of voids would be

A. 75%

B. 66.66%

C. 50%

D. 33.33%

88. (D)

$$V_s = 2V_v$$

$$\eta = \frac{V_v}{V} = \frac{V_v}{V_s + V_v}$$

$$= \frac{V_v}{2V_v + V}$$

$$= \frac{1}{3}$$

$$= 0.33$$

89. Equation for a line in a plasticity chart is

A. $I_p = 0.007(w_L - 10)$

B. $I_p = 0.23(W_L - 20)$

C. $I_p = 0.73(W_L - 20)$

D. $I_p = 0.73(W_L - 10)$

90. If the OMC of a soil sample is 12.5%, maximum dry density is 19.6 kN/m^3 and G = 2.68, the degree of saturation of the sample is_____%.

A.   2

B.   34

C.   66

D.   98

$$r_d = \frac{G \gamma_w}{1+e}$$

$$19.6 = \frac{2.68 \times 10}{1+e}$$

$$e = \frac{2.68 \times 10}{19.6} - 1 = 0.34.$$

$$e \cdot S = w G$$

$$S = \frac{wG}{e} = \frac{0.125 \times 2.68}{0.34} = 0.98 = 98\%$$

91. Indirect method of geotechnical investigation is also termed as

A. Geo chemical method

B. Geo physical method

C. Borehole method

D. Pumping out method

92. Maximum net pressure intensity causing shear failure of soil is known as

    A. Safe bearing capacity

    B. Net safe bearing capacity

    C. **Net ultimate bearing capacity**

    D. Ultimate bearing capacity

93. The minimum value of camber provided for bituminous surface hill roads is

A. 2.3%

B. 2.5%

C. 3.0%

D. 3.5%

94. In pavements _____ forms the foundation layer.

A. **Base course**

B. Subbase

C. Subgrade

D. Wearing course

95. The number of vehicles moving in a specified direction on a roadway that pass a given point during specified unit of time is called

A. traffic density

B. traffic volume

C. traffic capacity

D. none of these

96. Size of ballast used in points and crossings under Indian railways is

A.   10 mm

B.   20 mm

C.   **25 mm**

D.   40 mm

97. Extra widening of pavements recommended by IRC for roads having radius of horizontal curve 120m is

<div>
A   1.5 m

B.   1.2 m

C.   0.9 m

D.   0.6 m
</div>

98. Slab bridges are used to a maximum span of

     A.   4 m

     B.   6 m

     C.   9 m

     D.   12 m

99. The most suitable soil for compressed air tunneling is

A. clay

B. Sand

C. Silt

D. gravel

100. What is the airport reference temperature if the monthly mean of average temperature for the hottest month of the year is 25°C and monthly mean of maximum daily temperature is 40°C ?
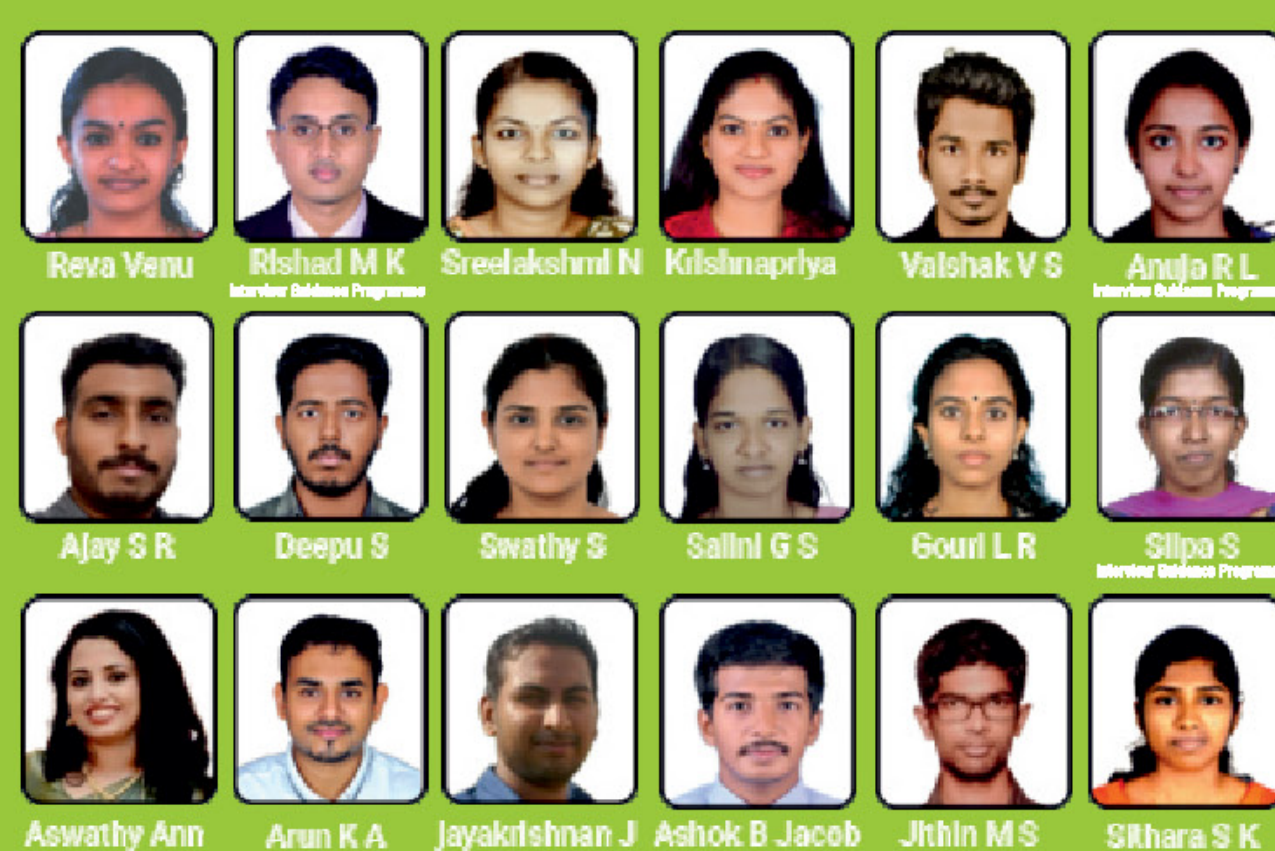
A. 20°C

B. 30°C

C. 35°C

D. 21.6°C

100. (B)

$$ART = T_1 + \frac{T_2 - T_1}{3}$$

$$T_1 = 25^\circ C, \ T_2 = 40^\circ C$$

$$\therefore \ ART = 25 + \frac{40 - 25}{3}$$

$$= 30^\circ C$$

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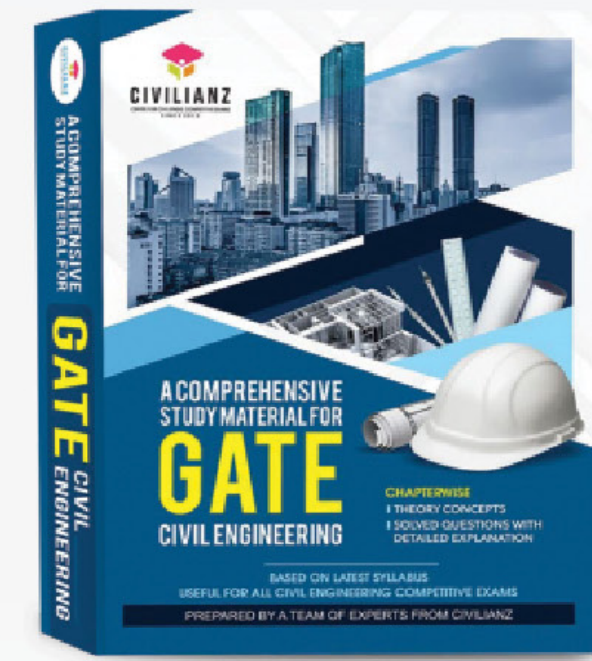
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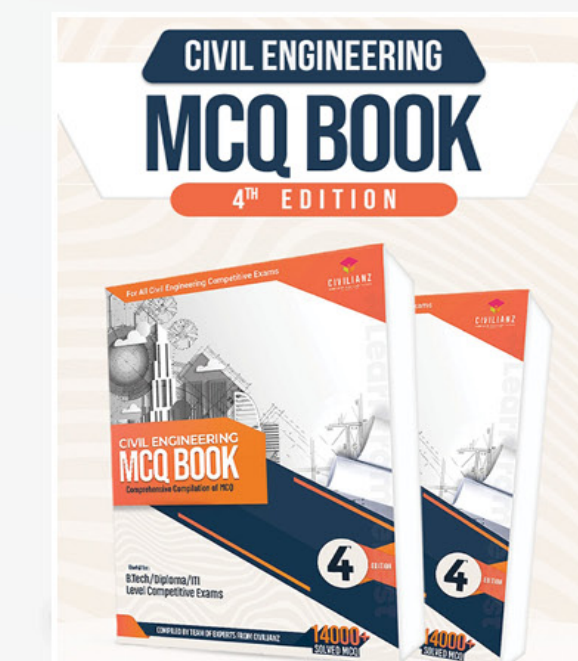
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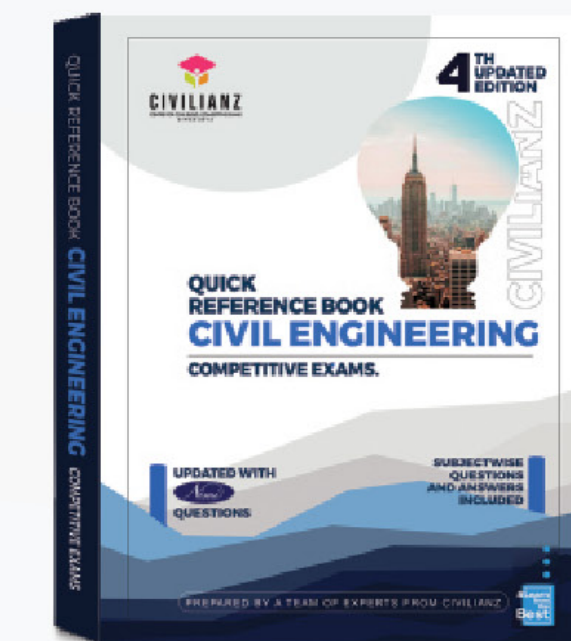
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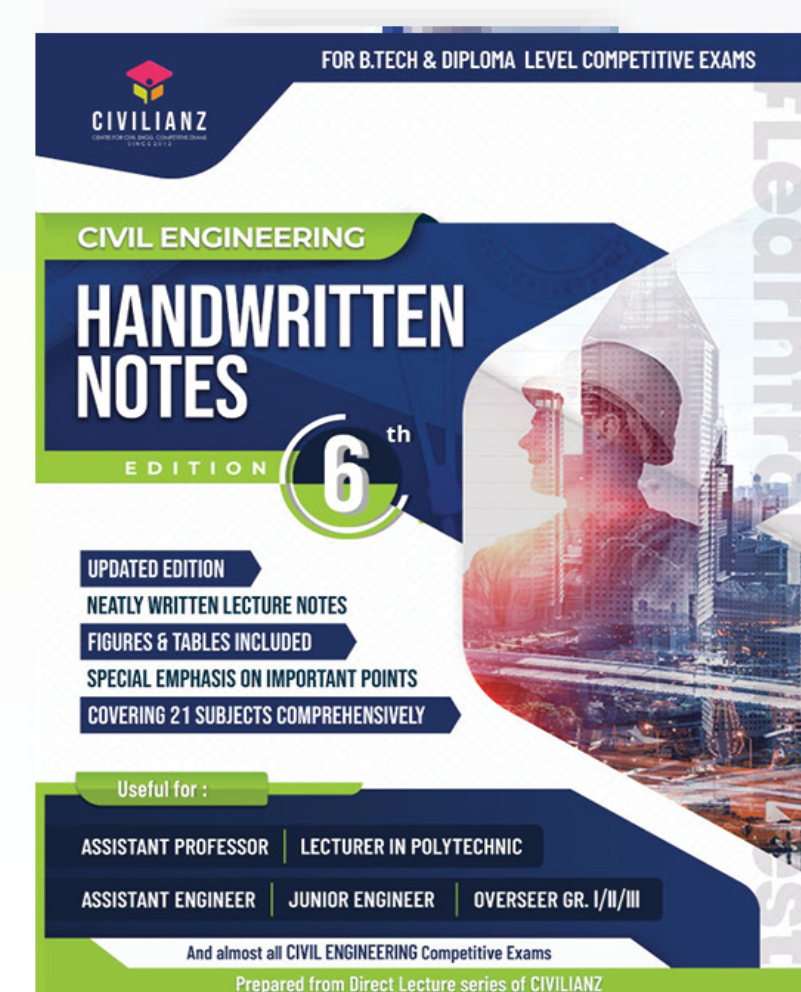
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