

Time: 3 hours

Max. Marks: 80

Note:

1. Q1 is compulsory.
2. Attempt any three (03) out of the remaining questions.
3. All questions carry equal marks.
4. Draw neat Sketches/Diagrams, wherever necessary.

Q1. Solve the following :

20 marks

Draw the Plans of a Residential Bungalow, as (G+1) storied RCC Framed structure with following facilities. (Plot size is 50 mx40 m.)

- (i) Living _Cum _Dining Room = 24Sq.m.
- (ii) Master's Bedroom (with A.T) = 22 Sq.m.
- (iii) Bed Room = 18 Sq.m.
- (iv) Guest Room = 18 Sq.m.
- (v) Kitchen = 12 Sq.m.
- (vi) Drawing Room = 24 Sq.m.
- (vii) Puja Room = 10 Sq.m.

Provide Toilets, Passages as per Bye-laws. Assume Floor to Floor height as 3.0 m. Show position of Columns, Doors, Windows & Ventilators in the proposed PLANS.

Draw

- (a) **Ground Floor PLAN (with Walls) - 15Marks**
- (b) **First Floor LINE PLAN (Single Line Plan) -05 Marks**

Q2. Solve the following :

10 marks each

- A Draw the Front Elevation of the building as designed and drawn in Q.1. (G+1 Storied)
- B Draw the Foundation Plan & Section of one Footing of the building, as designed and drawn in Q.1.

Q3. Solve the following :

20 Marks

Draw the Plans of a Small Hospital in a District place in your district , as (G+1) storied, with following facilities:(Floor to Floor Height- 3.6 m.): (Plot = 40 m. X 40 m.)

Consultancy Rooms – 6 No.(Each 15 Sq. m.)

O.T(Operation Theater)- (80 Sq.m)(with A.T)

Ward-2 no. _(Each 80 Sq.,m.)

Pathology & X-Ray = 30 Sq.m.

Doctor's Room-20 Sq.m.

- A Nurse's Room = 20 Sq.m

Medical shop= 15 Sq.m.

Provide Toilets, Passages as per Bye-laws.

Show position of Columns, Doors, Windows & Ventilators in the proposed PLAN.

All the above facilities on Ground & First Floor only

Draw:

- (i) **Ground Floor Plan (with walls) – 15 Marks**
- (ii) **Line Plan of First Floor (Single Line Plan) – 05 Marks**

Q4. Solve the following :

10 marks each

A **Draw the One-Point perspective** of a Small Single House of size (35x 15) m.(Overall Dimensions of Building).

Take floor to floor height as 3.6 m, Plinth height at 600 mm, height of parapet wall at roof level as 1.0 m and height of observer as 1.6 m, above G.L... Assume all the remaining data.

B Plan & Design a Dog-Legged Staircase for Floor-Floor height of 3.6 m. (Residential Building)

Draw Plan & Sectional Elevation of Staircase.

Q5. Answer the Following.

(2x10=20)

A Explain & Draw different types of all PITCHED Roofs, with proper Sketches & Diagrams

B Explain all types of STAIRCASES used for Residential & Public buildings, with neat sketches.

Q6. Write Short Notes on any FOUR, with proper sketches.

(4x5=20)

A Green building Concept & Built Environment

B Computer aided drawing(CAD) concepts & detailed features

C Principles of Planning for Residential buildings

D Principles of TOWN Planning

E All types of Flooring used for Residential & Public buildings

Time: 3Hours

Marks:80

N.B. 1) Question No.1 is Compulsory.

2) Attempt any Three questions from remaining questions.

3) Assume suitable data where required and clearly state the same.

4) Figures to the right indicate full marks.

Q.1 Attempt any Four

(20)

- a) What is difference between dynamic viscosity and kinematic viscosity? State their units of measurement.
- b) An oil of specific gravity 0.85 is contained in a vessel. at a point the height of the oil is 37m. Find the corresponding height of water at the point.
- c) Explain equipotential lines and flow net.
- d) Explain the principle of venturimeter with a neat sketch.
- e) Explain Hydraulic coefficients.
- f) Derive an expression for Stagnation density and temperature.

Q.2.a) A vertical gap 24.5 mm wide of infinite extent contain a oil of specific gravity 0.96 and viscosity $2.45 \text{ N}_s/\text{m}^2$ A metal plate $1.5\text{m} \times 1.5\text{m}$. 1.5mm thickness Weighting 48 N is to be lifted through the gap at a Great constant speed of 0.1m/s Estimate the force required. **(10)**

b) A square surface $3\text{m} \times 3\text{m}$ lies in a vertical Plane Determine the position of the centre of pressure and the total pressure force on the Square when its Upper edge is a) in water b) 15m below the water surface. **(10)**

Q.3. a) Define the equation of continuity; obtain an expression for continuity equation for three-dimensional flow. **(10)**

b) If $\phi = 3xy$, find x and y components of velocity at (1,3) and (3,4) Determine the discharge passing between streamlines passing Through these points. **(10)**

Q.4.a) Derive the discharge through orifice meter. **(10)**

b) A horizontal venturimeter, with inlet and throat diameters of 300 mm and 100mm respectively is used to measure the rate of flow of water. The pressure intensity at inlet is $130 \text{ KN}/\text{m}^2$ while the vacuum pressure head at the throat is 35cm. of mercury. Assuming that 3%. of head is lost in between inlet and throat, find the coefficient of the discharge of the venturimeter and the rate of flow. **(10)**

- Q.5.a)** An external cylindrical mouth piece of diameter discharge 100mm is discharging water (10) under a constant head of gm. Determine the discharge and absolute pressure and head of water at vena-contracta take $C_d = 0.853$ and $C_c = 0.62$ for vena-contracta. Take atmospheric Pressure head = 10.3 m of water.
- b)** Suppressed rectangular water is used to measure rate of flow and a stream 2m wide. The (10) head of water above the weir is 25cm. The sill of the notch is 50cm above the stream bed. Assuming $C_d=0.62$ find the discharge consider velocity approach.
- Q.6.a)** Derive an equation for discharge over a triangular notch. (10)
- b)** find the mach number when an aero Plane is flying at 800 km/hr through still air having (10) a pressure of 9 N/cm^2 and temperature of 15°C . Take $K=1.4$ and $R = 287\text{J/kg k}$, calculate the Pressure, density and temperature of air at the Stagnation point on the nose of plane.
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(3 Hours)

Total Marks : 80

- Note: (1) Question No. 1 is Compulsory.
 (2) Answer any three questions from Q.2 to Q.6
 (3) Figures to the right indicate full marks.

- Q1. a) Find $L[te^{3t} \sin t]$ 5
 b) Find a, b, c, d if $f(z) = x^2 + 2axy + by^2 + i(cx^2 + 2dxy + y^2)$ is analytic. 5
 c) Find the Fourier expansion of $f(x) = x^2, -\pi \leq x \leq \pi$ 5
 d) Find the eigen values of $A^2 - 5A + 4I$ if $A = \begin{bmatrix} -1 & 0 & 0 \\ 2 & -3 & 0 \\ 1 & 4 & 2 \end{bmatrix}$ 5
- Q2. a) i) If $L\{f(t)\} = \frac{s}{s^2 + s + 4}$, find $L\{e^{-2t} f(2t)\}$ 3
 ii) Find $L(t^2 \sin at)$ 3
 b) Determine the Half Range Sine Series for $f(x) = \frac{x(\pi^2 - x^2)}{12}$, where $0 < x < \pi$. 6
 c) Find analytic function $f(z)$ whose imaginary part is $e^x \cos y + x^3 - 3xy^2$ 8
- Q3. a) Solve $\frac{\partial^2 u}{\partial x^2} - 32 \frac{\partial u}{\partial t} = 0$ by Bender-Schmidt method subjected to the conditions $u(0, t) = 0, u(x, 0) = 0, u(1, t) = t$, taking $h = 0.25, 0 < x < 1$, upto $t = 5$. 6
 b) Determine the Harmonic Conjugate of u if $u + iv$ is analytic $3x^2y - y^3 = u$ 6
 c) Determine the Fourier Series $f(x) = \left(\frac{\pi - x}{2}\right)^2$ over $[0, 2\pi]$. Hence show that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$ 8
- Q4. a) Evaluate the following Integral using Laplace Transforms. 6

$$I = \int_0^\infty e^{-t} \left(\int_0^t u \cos^2 u \, du \right) dt$$

 b) Determine inverse Laplace Transform of $\frac{s}{(s^2+1)(s^2+4)}$, using Convolution theorem. 6
 c) Is the matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$ diagonalizable? If so find the diagonal form of A and transforming matrix of A. 8

- Q5. a) Find the Eigen value and the eigen vector of $\begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & -6 \\ 2 & 2 & 2 \end{bmatrix}$ **6**
- b) Determine the Inverse Laplace Transform of $\log \left[\frac{s^2+a^2}{(s+b)^2} \right]$ **6**
- c) Solve $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$, by Crank-Nicholson simplified formula, where $u(0, t) = 0, u(4, t) = 0, u(x, 0) = \frac{x}{3}(16 - x^2)$, find u_{ij} , for $i = 0, 1, 2, 3, 4$ and $j = 0, 1, 2$ taking $h = 1$. **8**
- Q6. a) Find the Laplace Transform of $f(t) = \frac{\cos at - \cos bt}{t}$ **6**
- b) A tightly stretched string with fixed end points $x = 0$, and $x = l$, in the shape defined by $y = kx(l - x)$, where k is a constant, is released from this position of rest. Find $y(x, t)$ the vertical displacement if $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ **6**
- c) Determine the Inverse Laplace Transform of i) $\frac{s+2}{s^2-4s+13}$ **4**
 ii) $\tan^{-1}(s)$ **4**

(03 Hours)

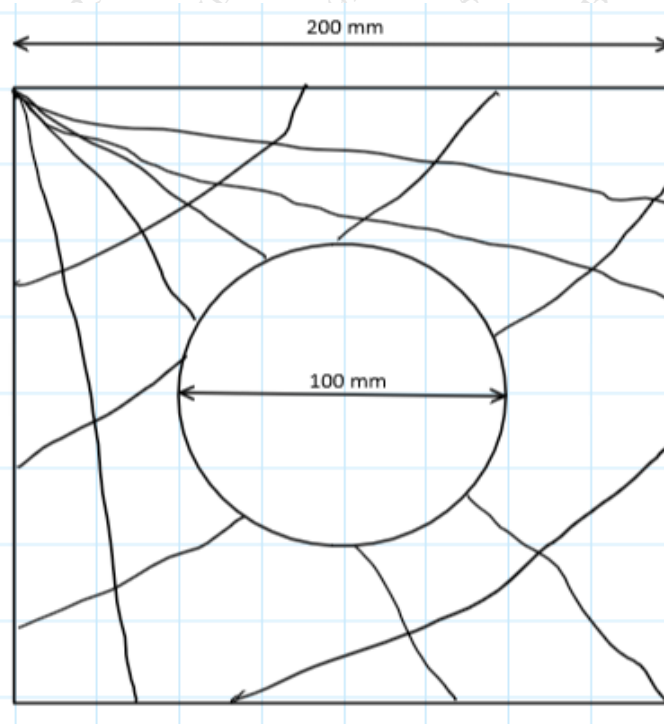
Total Marks: 80

Instructions:

1. Question No. 1 is **compulsory**
2. Answer **any three** from the remaining.
3. Each full question carries **20 marks**.
4. **Assume** suitable data, if needed and state it clearly.

Q. 1 Attempt any **four**

- | | Marks |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| a Establish relationship between Young's Modulus, Bulk Modulus and Shear Modulus. | 5 |
| b Draw Shear force diagram and Bending moment diagram for a simply supported beam carrying a UVL of intensity zero and 20 kN/m at left support and right support respectively. | 5 |
| c Define core or kernel of a section, Locate the Core of the solid rectangular section having a width of 300 mm and a depth of 400 mm. | 5 |
| d Define strain energy. Derive the expression for strain energy due to suddenly applied axial load. | 5 |
| e A timber beam has a square cross section (200 mm x 200 mm). A 100 mm diameter hole is punched at the centre of the beam. Calculate Moment of inertia along both the axes. | 5 |



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|------------------------------------------------------------|----------|
| f Discuss virtual work theorem and Castigliano's theorems. | 5 |
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Q. 2

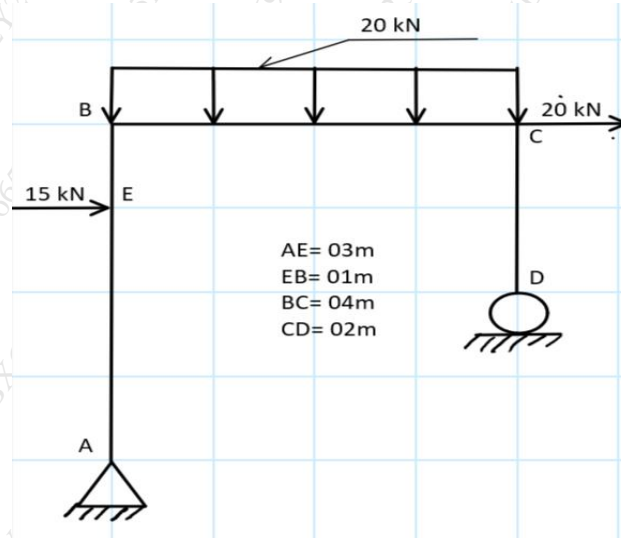
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|-----------------------------------------------------------------------------------|-----------|
| a A T-beam of span 5 m is simply supported. Flange is (200 mm X 20 mm) and web is | 10 |
|-----------------------------------------------------------------------------------|-----------|

(20 mm X 180 mm). Maximum permissible bending stress is 200 MPa. Determine the maximum UDL which the beam can carry safely.

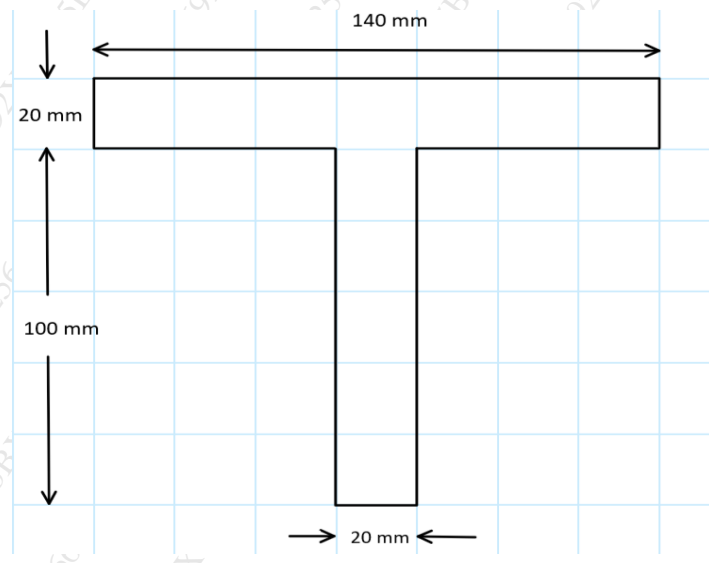
- b A cylindrical vessel of 1.6 m diameter and 3.5 m long is closed at ends by a rigid plate. It is subjected to an internal pressure of 2.5 N/mm^2 . If maximum circumferential stress is not to exceed 150 N/mm^2 , find the thickness of shell. Find change in diameter, length and volume of the shell. Assume: $E = 2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio = 0.25. **10**

Q. 3

- a Draw AFD, SFD & BMD for the frame shown below. UDL on beam BC is **12**
20 kN/m.



- b A beam cross-section shown below, is subjected to a shear force of 140 kN. Draw shear stress distribution diagram across the c/s. **8**

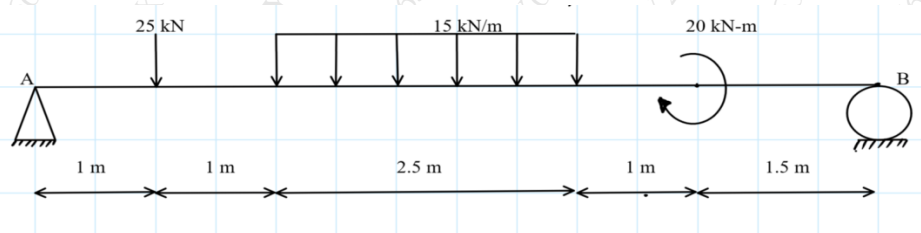


Q. 4

- a In an experiment, a bar of 40 mm diameter and 200 mm in length is subjected to a pull of 85 kN. Change in length and diameter is 0.09 mm and 0.0039 mm respectively. Calculate the Poisson's ratio, Modulus of Elasticity, Shear Modulus and Bulk Modulus. **10**
- b A hollow circular shaft has external diameter of 200 mm and internal diameter of 160 mm. Find the safe power that can be transmitted if allowable shear stress is 130 MPa and maximum angle of twist is 4° for 3.8 m length. Take speed of shaft as 4 revolutions per second. Maximum torque exceeds mean torque by 25 %. Take $G = 85 \text{ GPa}$. **10**

Q. 5

- a The principal stresses at a point across two perpendicular planes are 135 MPa horizontal (Tensile) and 95 MPa vertical (Tensile). Find the normal stress, tangential stress and resultant stress and its obliquity on a plane at 30 degrees with the major principal plane. **10**
- b Calculate slope at supports and maximum deflection by using Macaulay's method. Take EI constant **10**



Q. 6

- a A cantilever beam AB of span 4 m is fixed at left end A and is free at right end B. It carries a UDL of 25 kN/m all over the span and a couple of 50 kN.m clockwise at free end B. Draw SFD and BMD. **7**
- b A masonry pier (3m x 4m) supports a vertical load of 30 kN at an eccentricity of 0.5 m along y axis and an eccentricity of 1 m along x axis respectively. Width 3 m is parallel to x-axis. Find the stresses developed at each corner of the pier. **8**
- c A steel rod 28 mm in diameter is 3.5 m long. Find the maximum instantaneous stress induced and work done at maximum elongation when the load of 80 kN is suddenly applied. Take $E = 210 \text{ GPa}$. **5**