Time: 3hours **Max. Marks: 80**

Note: Q1 is compulsory. Attempt any three out of the remaining questions.

Q1. Solve any One out of Two **20 marks each**

A Draw the Plans of a Residential Bungalow, as (G+1) storied RCC Framed structure with following facilities.

(i) Living Room = 22Sq.m.
(ii) Master's Bedroom (with A.T) = 20 Sq.m.
(iii) Bed Room = 15 Sq.m.
(iv) Guest Room = 15 Sq.m.
(v) Kitchen = 12 Sq.m.
(vi) Store Room = 12 Sq.m.
(vii) Drawing Room = 22 Sq.m.

Provide Toilets, Passages as per Bye-laws. Assume Floor to Floor height as 3.3 m.
Show position of Columns, Doors, Windows & Ventilators in the proposed PLANS.
Draw

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

B Draw the Plans of a Residential Bungalow, as RCC_(G+1) Framed structure with following facilities. Floor to Floor height is 3.03m.

(i) Living-cum-Dining = 24 Sq.m.
(ii) Master's Bedroom (with A.T) = 20 Sq.m.
(iii) Bed Room = 15 Sq.m.
(iv) Kitchen = 12 Sq.m.
(v) Pooja Room = 10 Sq.m.

Provide Toilets, Passages as per Bye-laws.
Show position of Columns, Doors, Windows & Ventilators in the proposed PLAN.
Draw

(a) GROUND FLOOR PLAN (with wall thickness) – 15 Marks
(b) First Floor LINE PLAN (Single Line) --05 Marks

Q2. Solve the following **10 marks each**

B Draw the Sectional Elevation of the building as designed and drawn in Q.1. passing through at least one staircase and one sanitary unit.

C Explain all Principles of Town Planning in detail.(with all sketches)

Q3. Solve any Two out of Three **10 marks each**

A Draw the **G.F Plan** of a **PHC**(Primary Health Center) in a Taluka place in your district , with following facilities:(**Floor to Floor Height- 3.6 m.)**
Consultancy Rooms – 2 No.(Each 5x3 m.)
O.T(Operation Theater)- (10mx12m.)
Ward-1 no.(40 Sq,.m.)
Pathology & X-Ray = 25 Sq.m.
Doctor's Room-20 Sq.m.
Nurses's Room= 15 Sq.m.
Medical shop= 12 Sq.m.
Provide Toilets, Passages as per Bye-laws.
Show position of Columns, Doors, Windows & Ventilators in the proposed PLAN**.**
Draw:
Ground Floor Plan (with walls) – 10 Marks

B Draw the Sectional Elevation for building in Q.No.3-A

C Draw the Front Elevation for building in Q.No.3-A

Q4. Solve the following **10 marks each**

A **Draw** the **One-Point perspective** of a Small Single House of size (20x 15) m. Take floor to floor height as 3.3 m, plinth height at 600 mm, height of parapet wall at roof level as 1.0 m and height of observer as 1.5 m, above G.L.. Assume suitable station point , provide & draw perspectives for doors, windows, chajjas, steps etc. also.

B Plan & Design a Dog-Legged Staircase for Floor-Floor height of 3.3 m. (Residential Building)
Assume the data as per bye-laws. (Consider Ground Floor structure only)
Draw Plan &Section of Staircase.

Q5. Solve the following **10 marks each**

A Explain & Draw different types of Staircases used in Residential buildings, with proper Sketches & Diagrams.

B Draw the Front Elevation of the building as designed and drawn in Q.1

Q6. Write Short Notes , with proper explanation on any Four **(4x5=20)**

A Principles of Planning for Residential buildings
B Types of pitched roofs, with sketches
C Types of Doors & Windows for Residential purpose
D Slum Clearance & Re-development of buildings
E Green building
F Computer aided drawing

(3Hours) **Max Marks=80**

Note 1. Question **1** is compulsory
2. Attempt any **4** out of six questions
3. Assume any suitable data where ever required

Q.1 Attempt any **four**

a. What is capillarity? Derive expression for height of capillary rise. **05**

b. State and prove Pascal's law. (Prove that the pressure is same in all directions at a point in static fluid.) **05**

c. What is orifice and mouthpiece? Explain classification of orifices and mouthpieces. **05**

d. A projectile is travelling in air having pressure and temperature as 10.1043 N/cm^2 and -10^{o}C at a speed of 1500 km/hour. Find Mach number and the Mach angle. Take k=1.4 and R= 287 J/kg^{o}K **05**

e. Short note : condition of stability of floating and submerged bodies **05**

Q.2 **a.** Write short note on : Types of fluid flow **05**

b. Define following terms: **05**
a) Bulk modulus
b) Surface tension
c) Specific weight
d) Specific gravity
e) Mass density

c. A horizontal Venturimeter with inlet diameter 300 mm and throat diameter 150 mm is employed to measure the flow of water. The reading of the differential manometer connected to the inlet is 200 mm of mercury. If the Cd=0.98. Determine the rate of flow. **10**

Q.3 **a.** A broad crested weir of 50 m length has 50cm height of water above its crest. (a) Find the maximum discharge. Take Cd=0.60. Neglect velocity of approach. (b) If the velocity of approach is to be taken into consideration, find the maximum discharge when the channel has a cross-section area of 50 m^2 on the upstream side. **10**

b. A circular tank of diameter 4 m contains water up to a height of 5 m. the tank is provided with an orifice of diameter 0.5 m at the bottom. Find the time taken by water (i) to fall from 4 m to 2 m (ii) for completely emptying the tank. Take Cd =0.6 **10**

Q.4 **a.** Determine the total pressure and center of pressure on an isosceles triangular plate of base 4 m and altitude 4 m when it is immersed vertically in an oil of sp.gr. 0.9. The plate coincides with the free surface of oil. **10**

b. Describe Archimedes principle. Determine meta-centric height by experimental method and analytical method. **10**

Q.5 **a.** The velocity components in a two-dimensional flow field for an incompressible fluid are as follow: $u = y^3 + 6x - 3x^2y$ and $v = 3xy^2 - 6y - x^3$. Obtain expression for stream function Ψ **10**

b. Differentiate between: **10**

(i) Stream function and velocity potential function

(ii) Stream line and streak line

Q.6 **a.** An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauge fitted upstream and downstream of the orifice meter gives reading of 19.62 N/cm2 and 9.81 N/cm2 respectively. Co-efficient of discharge for the orifice meter is given as 0.60. Find the discharge of water through pipe. **10**

b. Explain Lagrangian method and Eulerian method **10**

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(3 Hours) **Total Marks : 80**

N.B. 1. Question No. **1** is **compulsory**
2. Attempt any **Three** questions out of remaining **Five** questions.
3. Draw neat labeled **diagrams** wherever necessary.
4. All the parts of a question should be **grouped together**.
5. Figures to the **right** indicate marks

Q.1 a Answer the following- **5**

(i) Give characteristic properties and use of the following minerals-
Quart
Orthoclase
Diamond
Talc
Galena

Q.1 b Define the following terms- **5**

(i) Geological Survey of India (GSI)
(ii) Creep
(iii) Central eruption
(iv) Mohorovicic Discontinuity
(v) Seismograph

Q.1c Name the following- **5**

(i) Which two tectonic plates collided to form Himalaya?
(ii) A coarse grained clastic sedimentary rock in which rounded pebbles are cemented together
(iii) Fine grained Igneous rocks formed by solidification of magma at the surface of the earth.
(iv) A Part of Dam which is used to release excess water from the reservoir
(v) A point exactly above the focus of an earthquake

Q.1d Draw a neat sketch of the following- **5**

(i) Alluvial fan
(ii) Recumbent fold
(iii) Axial Plane
(iv) U shaped valley
(v) Laccolith

Q.2(a) What is plate Tectonic Theory? What are the different types of Plate boundaries , Explain Convergent Plate boundary in detail, giving example. **10**

(b) Describe following landforms in short- **6**
Ox bow lakes
Mushroom rock

(c) Briefly describe the layered structure of Earth. **4**

Q.3(a) Describe agents of Metamorphism and correlate the agents of Metamorphism with different types of metamorphism. **5**

(b) Give classification of sedimentary rocks. **5**

(c) What is texture? Describe textures of igneous rocks with neat sketches and comment on the suitability of igneous rocks for foundation. **10**

Q.4(a) What are faults, give terminology of faults? Describe various types of faults in the rocks and give their engineering considerations. **10**

(b) An ore body is exposed on horizontal ground. It dips 30° eastward and the width of the outcrop is 300 m. Determine its True Thickness and vertical thickness. **6**

(C) Explain unconformity, Describe angular unconformity in detail. **4**

Q.5(a) Explain in detail the water bearing properties of rocks giving examples. Comment on the suitability of sandstone as water bearing strata. **10**

(b) Define RQD and Core Recovery, Calculate RQD and Core Recovery from the given data and comment on the suitability of rocks for foundation purpose. **10**

Total run 2m.

Sample No.	Length of the core in cms	Nature of the lower end of the core sample		Sample No.	Length of the core in cms	Nature of the lower end of the core sample
a	12	N		i	32	N
b	10	N		j	14	N
c	08	N		k	8	N
d	06	M		l	14	N
e	22	M		m	8	M
f	07	N		n	02	N
g	21	N		o	03	M
h	13	M		p	05	N

Q.6 (a) Classify the rock according to Geomechanics (RMR) classification for a Rock having UCS of 180Mpa and RQD of 60% with average spacing of discontinuity of 900mm which is slightly rough in nature and highly weathered. The Strike is perpendicular to the tunnel axis and drive with dip is 40°. Also 8 lit/min groundwater inflows the tunnel length per 10m. Calculate the RMR value of the rock and state the condition of rock for tunnel construction. **10**

(b) Give a brief account of favourable and unfavourable geological structures at a Dam site. **10**

Time 3 Hours **Max. Marks: 80**

Note: (1) Question No. 1 is Compulsory.
(2) Answer any three questions from Q.2 to Q.6.
(3) Use of Statistical Tables permitted.
(4) Figures to the right indicate full marks.

1. (a) Find the constants a, b, c, d, e if
f(z)= $(ax^4+bx^2y^2+cy^4+dx^2-2y^2)$ +i $(4x^3y-exy^3+4xy)$ is analytic. (5)
(b) Find $L\{e^{-t}\sin 2t\cos 3t\}$. (5)
(c) Use Cayley Hamilton theorem for A= $\begin{bmatrix}1 & 4\\ 2 & 3\end{bmatrix}$ to find A^3 and A^{-1}. (5)
(d) Obtain the Fourier Series of $f(x) = x^4$, in (-1,1). (5)

2. (a) Find $L^{-1}\left(\frac{s^2}{(s^2+5)(s^2+4)}\right)$ (6)
(b) Find the analytic function f(z)=u + iv where u + v = e^x (cosy + sin y). (6)
(c) Find a Fourier series to represent the function

$$f(x) = \begin{cases} 0, & -\pi < x \le 0 \\ \frac{1}{4}\pi x, & 0 < x < \pi \end{cases}$$

Hence, deduce that $\frac{\pi^2}{8} = \frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\cdots$.... (8)

3 (a) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix}1 & 2 & 3\\ 0 & -1 & 1\\ 0 & 0 & 2\end{bmatrix}$ (6)
(b) Find the Laplace transform of $e^{-4t}\int_0^t u\ sin3u\ du$ (6)
(c) Solve $\frac{\partial^2 u}{\partial x^2}-\frac{\partial u}{\partial t}=0$ by Bender-Schmidt method, given
$u(0,t)=0, u(4,t)=0, u(x,0)=x^2(16-x^2)$
Assume h=1 upto t = 1 sec (8)

4 (a) Find the orthogonal trajectory of the family of curves given by $e^x cosy - xy = c$ (6)

(b) Find $L^{-1}\left[\frac{(s+3)^2}{(s^2+6s+18)^2}\right]$ using convolution theorem (6)

(c) Show that $A = \begin{pmatrix}2 & 2 & 1\\ 1 & 3 & 1\\ 1 & 2 & 2\end{pmatrix}$ is diagonalizable. Determine a transforming matrix and a diagonal matrix. (8)

5 (a) Find half range cosine series for $f(x) = \begin{cases} 1, & 0 \le x \le 1 \\ x, & 1 \le x \le 2 \end{cases}$ (6)

(b) By using Laplace transform, evaluate $\int_0^\infty \frac{sin2t+sin3t}{te^t} dt$ (6)

(c) Solve by Crank-Nicholson simplified formula $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0, 0 \le x \le 1$ subject to the condition

$u(0,t) = 0, u(1,t) = 0, u(x,0)$ =100 (x- x^2), h = 0.25 for one time step. (8)

6 (a) Find $L^{-1}\left[log \frac{(s^2+4)}{(s+2)^2}\right]$ (6)

(b) Find sin A where A = $\begin{bmatrix} \pi/2 & \pi \\ 0 & 3\pi/2 \end{bmatrix}$ (6)

(c) Find a Fourier series for $f(x)$ in $(0, 2\pi)$ Where

$$f(x) = \begin{cases} x, & 0 < x \le \pi \\ 2\pi - x, & \pi \le x < 2\pi \end{cases}$$

Hence, deduce that $\frac{\pi^2}{96} = \frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \cdots$ .... (8)

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(**03 Hours**) **Marks: 80**

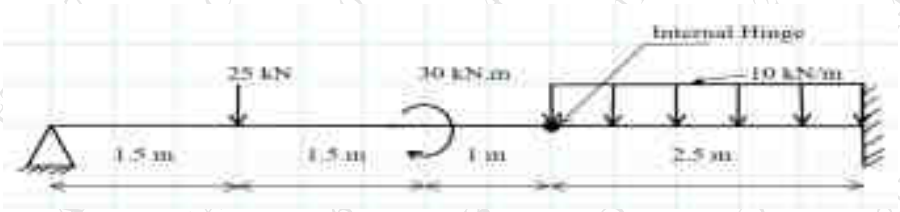
Instructions:

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

Q. 1	Answer **any four**	**Marks**
a	Draw SFD and BMD for a cantilever beam of span 5 m, loaded with a uniformly distributed load of 10 kN/m on entire span and a point load of 20 kN at 2 m from the fixed end.	5
b	A hollow steel pipe having yield stress = 270 MPa has to carry an axial compressive load of 1200 kN. A safety factor of 2 is to be used against yielding. If the thickness of pipe is 1/8th of its outer diameter, what will be the minimum required outer diameter?	5
c	Define core or kernel of the section. Locate Core of the solid Circular section having diameter of 300 mm.	5
d	State and explain Principle of Superposition and Principle of Virtual Work.	5
e	Determine the maximum stress and elongation of a solid circular bar 2 m long and 25 mm diameter when an axial pull of 50 kN is applied suddenly on it. Take E= 200 GPa.	5
f	Define Torsion or Twisting Moment. What are the assumptions made in theory of Pure torsion?	5

Q. 2

a Draw SFD and BMD for the beam shown below. Left end is roller and right end is fixed. 12



b A hollow cylindrical column is fixed at both the ends. The column length is 4.2 m and it carries an axial load of 260 kN. Design the column by Rankine's approach. Adopt a FOS of 4.5. Internal diameter = 0.8 times of external diameter. Take crushing stress for material = 560 MPa and Rankine's constant= (1/1600) 8

Q. 3

a A cantilever beam has hollow rectangular section with outer dimensions (300 mm wide x 600 mm deep) and inner dimensions (200 mm wide x 400 mm deep), symmetrical about both x and y axes. The beam has a span of 3 m and is loaded with a UDL of 20 kN/m on its entire span. Determine the maximum bending stress developed. 10

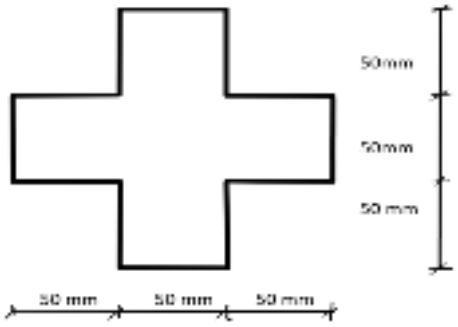
b A hollow circular steel shaft of 5.7 m length has to transmit 1900 kW power at 180 rpm. If internal diameter is 0.7 times the external diameter, total angle of twist is not to exceed 5 degrees and shear stress is limited to 64 N/mm^2, determine the diameters of the shaft. Take G = 92 kN/mm^2. 10

Q. 4

a Calculate slope at left support and maximum deflection by using Macaulay's double integration method. Take EI constant for the beam. 10

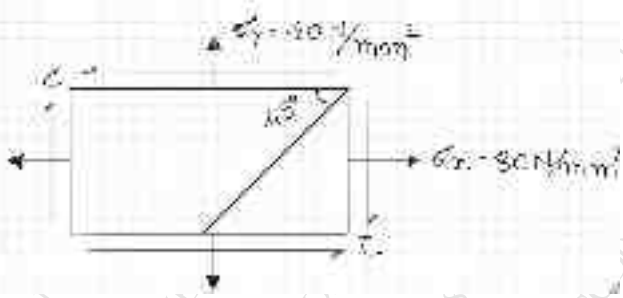
10

b Fig. below shows the cross-section of a beam. It is subjected to a shear force of 200 kN. Draw shear stress distribution diagram.



Q. 5

a Define Principal Plane and Principal Stresses. At a point in a two mutually perpendicular directions, stresses are 80 MPa and 40 MPa, both tensile in nature. Each of these stresses is accompanied by a shear stress of 60 MPa. Determine the normal stress, shear stress and the resultant stress and its obliquity on a plane at 45° with minor principal plane. 10



b A solid copper rod 12 mm in diameter and 400 mm long fits into a hollow aluminum tube of external diameter 20 mm and thickness 4 mm, of equal length. The assembly is held together by a rigid plate at the end and is stress-free at 20° C. Find the stresses in the two materials when it is heated to 60 ° C. 10

Material	Modulus of Elasticity (GPa)	Coefficient of Thermal Expansion /^{0} C
Copper	120	$18x10^{-6}$
Aluminum	70	$23x10^{-6}$

Q. 6

a A reinforced concrete column of size (230 mm x 400 mm) has 8 steel bars of 12 mm dia. The column is subjected to an axial compressive load of 600 kN. Find the stresses developed in steel and concrete. Take modular ratio= 18.67 08

b A steel rod 30 mm in diameter is 4 m long. Find the maximum instantaneous stress induced and the work done at maximum elongation when a load of 90 kN is suddenly applied. Take E= 210 GPa. 6

c A thin spherical shell of wall thickness 5 mm and diameter 300 mm is subjected to an internal pressure of 5 N/mm^2. Determine hoop stress, hoop Strain & volumetric Strain 6