1.(a) Find the directional derivative of \( P = 4e^{2x-y+z} \) at the point \((1,1,-1)\) in a direction:

(i) towards the point \((-3,5,6)\)

(ii) parallel to the line \( \frac{x}{1} = \frac{y}{2} = \frac{z}{3} \).

(a') A field is generated by certain distribution of charge given by

\[ \vec{F} = (x + 2y + az)\hat{i} + (bx - 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}. \]

Find the values of \( a, b, c \) so that \( \vec{F} \) is irrotational. Hence find the scalar potential function \( \varphi \) such that \( \vec{F} = \nabla \varphi \).

(b) Find \( n \) such that \( \vec{F} = \frac{\vec{r}}{r^n} \) is solenoidal, (where \( \vec{r} = x\hat{i} + y\hat{j} + z\hat{k},\ r = |\vec{r}| \)).

2.(a) Use divergence theorem to evaluate the surface integral \( \int_S \vec{F} \cdot d\vec{s} \), [CO-2]

where \( \vec{F} = x^2\hat{i} + y^2\hat{j} + z^2\hat{k} \) and \( S \) is the surface of the sphere \( x^2 + y^2 + z^2 = 1 \)

(b) Verify Green's theorem in a plane for \( \int_C [(2x^2 - y^2)dx + (x^2 + y^2)dy] \), where \( C \) is the boundary of the surface in the \( xy \)-Plane enclosed by the \( x \)-axis and the semi-circle \( y = \sqrt{(1 - x^2)} \).
OR

(b') Verify Stoke's theorem for the function \( \mathbf{F} = x^2 \mathbf{i} + xy \mathbf{j} \) integrated round the square in the plane \( z = 0 \) and bounded by the lines \( x = 0, y = 0, x = a \) and \( y = a \).

[7, 8]

3. (a) Find the polar form of Cauchy–Riemann equations and use it to show that \( \log z \) is analytic.

OR

(a') If \( f(z) = u + iv \) is an analytic function of \( z \) and \( u + v = \frac{2 \sin 2x}{e^{2y} + e^{-2y} - 2 \cos 2x} \), find \( f(z) \) in terms of \( z \).

(b) Evaluate, using Cauchy integral formula, the integral \( \int_C \frac{\cos \pi z + \sin \pi z}{(z-1)(z-2)} \, dz \), where \( C \) is a circle (i) \( |z| = \frac{3}{2} \) (ii) \( |z| = 3 \).

[7, 8]

4. (a) Form the partial differential equations by eliminating the arbitrary constants and arbitrary functions from the following relations:

(i) \( ax^2 + by^2 + z^2 = 1 \)
(ii) \( z = f\left(\frac{xy}{z}\right) \)

(b) A tightly stretched string with fixed end points \( x = 0 \) and \( x = l \) is initially in a position given by \( y(x, 0) = y_0 \sin^2\left(\frac{nx}{l}\right) \). It is released from rest from this position. Find the displacement \( y(x, t) \).

OR

(b') Show that the solution of the partial differential equation \( \frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2} \) subject to the condition

(i) \( u \) is not infinite for \( t \to \infty \), (ii) \( \frac{\partial u}{\partial x} = 0 \) for \( x = 0 \) and \( x = l \),
(iii) \( u = lx - x^2 \) for \( t = 0 \), and between \( x = 0 \) and \( x = l \), is

\[
    u = \frac{l^2}{6} - \frac{l^2}{\pi^2} \sum_{n=1}^{\infty} \frac{1}{n^2} e^{-\frac{(4n^2\pi^2 kt)}{l^2}} \cos \frac{2\pi nx}{l}.
\]

[6, 9]
2017-18
B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
FLUID MECHANICS (CE-213)

Maximum Marks: 60 Credits: 04 Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q. No. Question Marks

1(a) Two containers with same volume as 200 ml are filled up to brim with water and ccl₄ respectively. These two fluids are mixed together and filled in another container having capacity as 500ml. Find specific weight and specific volume of the mixture [3]

1(b) Calculate the angle of the meniscus at its perimeter if the capillary depression of mercury in a 2mm glass is 0.5mm. Assume the surface tension of mercury as 0.51N/m. Assume any other data if required. [4]

1(c) If stream function ψ is defined as ψ = 3 (y² - x²) /2, determine the x and y components of velocity at (1,3) and (3,3). Also determine the discharge passing between stream lines through these lines. [8]

Q1'(a) Differentiate between tangential and normal accelerations. Water is flowing at a rate of 250 l/s in a 2 m long enlarger having 25 cm diameter at inlet and 50 cm diameter at outlet. It is found that the discharge is decreasing at a rate of 20 l/s. Find the value of convective tangential acceleration at mid of the enlarger at 5³ seconds. [9]

1'(b) If velocity vector is defined as V = xy i + yz j - (yz+z²) k, Find:
   (i) Magnitude of velocity at point P(1,1,3)
   (ii) Vorticity along Z – direction at P(1,2,3) [6]

2(a) Water is flowing in the pipeline from A towards B as shown in Fig.1. Calculate the pressure difference (p_B - p_A) in kPa. [4]

2(b) A flash board is held in place by two stops as shown in Fig. 2. Determine the distance y between them so that the flash board will tumble when water reaches to 3m depth. [3]

2(c) The tank shown in Fig. 3 contains water and is pressurized to 200 kPa (gage) in the air gap. Determine the vertical hydrostatic force on circular-arc section AB [2]
and its line of action.

OR

2'(a) List the various forces that temporarily cause heeling of floating bodies.

2'(b) A wooden cylinder having specific gravity $S$, diameter $D$ and height $H$ floats in water with its axis vertical. Determine $D/H$ ratio for the cylinder to float in stable equilibrium.

2'(c) A U - tube has a liquid of relative density 0.85 in its limbs to a height of 50 cm above the horizontal limb as shown in Fig. 4. What will the difference in elevation between A and B when the tube is rotated about a vertical axis 10 cm from left limb at 180 rpm?

Q3(a) Derive the expression for momentum correction factor.

Water is pumped from a sump through a 100-mm diameter pipe line at a rate of 40l/s up to a point A situated at 3.2 m above the ground. The pump is kept at the ground in horizontal plane. The suction pipe is 1.5 m below the ground. Assuming overall efficiency as 65%, calculate the power of the pump.

OR

3'(a) List out all assumptions in the derivation of Bernoulli’s equation.

Derive the $x$ and $y$ components of the hydro-dynamic force on a U- shaped (hairpin) pipe bend taking suitable parameters. Water is entering in the bend at inlet where diameter of pipe is $D$ and leaving through a nozzle having diameter $d$.

3(b) What is torque principle? For a lawn sprinkler having two unequal arms develop the expression for hydraulic torque taking suitable physical variables

4(a) Derive the formula for $C_t$ using trajectory method.

4(b) A tank in the form of hemisphere having radius 3m is full of water. It is to be emptied using an orifice of diameter 5cm fitted at its bottom. Determine the time of emptying if $C_d$ is 0.62.

4(c) Water is flowing over a 4m long Cippoletti weir under ahead of 1m. Compute the discharge if $C_d = 0.68$. 

Contd...
MAXIMUM MARKS: 60 Credits: 04 Duration: Two Hours

Note: Answer all questions. Marks are given in parenthesis.

1. Give a short account of origin and classification of rocks. What are the factors controlling strength of rocks? (12)

2. Define endogenous and exogenous processes. What are their roles in evolution of land forms and importance in civil engineering? (12)

OR

2'. Give basic classification of joints, fault and folds. Why are they important in engineering geological applications? (12)

3a. Give a short account of occurrence and movement of groundwater. (06)

3b. Enumerate geotectonic units and their presence in India. (06)

4a. Give a brief account of parts of tunnels and geological aspects taken into consideration for the construction of tunnels. (12)

OR

4a. Give a brief classification of dam and important geological investigations for their construction. (12)

4b. Write short notes on any two of the followings:
   (i) Rock Quality Designation (06)
   (ii) Shear Zones and its treatment (06)
   (iii) Stopping sand dune migration. (06)
2017-18
B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
QUANTITY SURVEY
CE – 220

Maximum Marks: 60 Credits: 04 Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.
1. (a) Define the following terms: [03]
   (i) Plan (ii) Elevation (iii) Section of a Building
   (b) Write the least dimensions of the following [06]
       (i) Bed Room (ii) Drawing Room (iii) Kitchen (iv) Store (v) Wash Room
       (vi) Internal and External Verandah
   (c) Write the Least Width of Front, Side and Rear Setback for a residential building in a [03]
       plot size of:
       (i) Upto 250 m² Area (ii) 251 m² to 500 m² (iii) 501 to 1000 m²
   (d) (i) What is a Dog Legged Stair Case? Write the size of Flight, Landing, Tread and [02]
       Riser.
       (ii) What is the purpose of Air Gap? [01]

2 Determine the total number of bricks in superstructure in a set of two rooms shown [15]
in figure and as per the following data.
   (i) Height of room = 3500 mm
   (ii) Height of plinth = 1000 mm
   (iii) Thickness of superstructure wall = One and a half Brick
   (iv) Size of Brick = 229 mm x 115 mm x 76 mm
   (v) Door = 1200 mm x 2100 mm
   (vi) Window = 1000 mm x 1200 mm (vii) Ventilator = 600 mm x 450 mm

Contd...
2'(a) Draw a neat sketch of the wall section and write the dimensions of its components.  
(b) What is DPC? Write its purpose and dimensions.  
3(a) What is the purpose of rate analysis?  
3(b) Analyse the rates for 25 cubic metre of Reinforced Cement Concrete in beams and slabs in the ratio of 1:2:4  

OR

3' Write short notes on any two of the following:  
(a) Different areas in a Building  
(b) Administrative Approval and Technical Sanction  
(c) Quantity Survey and its Requirement  
4 What is a contract? Discuss in detail the essential requirements of contract.
Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

Answer all the questions.
Sketch neat figures, if necessary.

Q. No.  
**Question**  
M.M.  
1(a) With the help of the flow chart, describe the manufacture of ordinary Portland cement by wet process. Also write the advantages of wet process.  
[05]  
1(b) Write short notes on expansive cement and hydrophobic cement.  
OR  
[05]  
1(b)' Discuss the classification of aggregates based on their size and shape.  
[05]  
1(e) What do you mean by curing of concrete? Describe various methods of curing of concrete.  
[05]  
2(a) What are the three types of classifications of bricks? Describe in detail.  
[05]  
2(b) What do you mean by brick masonry unit? Differentiate between English garden wall bond and Flemish garden wall bond.  
[05]  
2(c) Describe the defects in timber developed during the growth of tree.  
OR  
[05]  
2(c)' Write the objects of seasoning of timber. Write also the comparison between air seasoning and kiln seasoning methods.  
[05]  
3  
Explain the following with the help of neat sketches.  
(a) Combined Footing  
[05]  
(b) Advantages of Pre-cast Concrete Piles  
[05]  
(c) Well Foundation  
OR  
3'  
Explain the following with the help of neat sketches.  
(a) Thermal Insulation of Roofs  
[05]  
(b) Dormer Window  
[05]  
(c) Collapsible Steel Door  
[05]  
4  
Explain the following with the help of neat sketches.  
(a) Double Flying Shores  
[05]  
(b) Box Sheeting  
[05]  
(c) Well Point System  
[05]