Max. Marks : 60. Duration : Three Hours

NOTE: Answer all questions.

1(a) Find the rate of change of $\phi = xyz$ in the direction normal to the surface $x^2y + y^2x + yz^2 - 3 = 0$ at the point $(1, 1, 1)$.

(b) Find the value of $n$ for which the vector $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ is solenoidal, where $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$.

OR

(b') Show that $\text{div} (\text{grad} n) = n(n+1)r^n$, where $r = |\mathbf{r}|$ and $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$.

(c) Prove that $\mathbf{F} = (y^2\cos x + x^3)\mathbf{i} + (2y\sin x - 4)\mathbf{j} + (3x^2 + 2)\mathbf{k}$ is (i) Conservative field.

(ii) Find the scalar potential of $\mathbf{F}$.

(iii) Find the work done in moving an object in this field from $P(0, 0, -1)$ to $P(\pi/2, 1, 2)$.

2(a) Evaluate $\int \int S \mathbf{A} \cdot d\mathbf{S}$, where $\mathbf{A} = x\mathbf{i} + y\mathbf{j} - z\mathbf{k}$ and $S$ is the surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between $x = 0$ to $z = 5$.

OR

(a') Find the flux of the vector field $\mathbf{A} = (x - 2z)\mathbf{i} + (x + 3y + z)\mathbf{j} + (tx + y)\mathbf{k}$ through the upper side of the triangle ABC with vertices at the point $A(1, 0, 0)$, $B(0, 1, 0)$, $C(0, 0, 1)$.

(b) Verify Stokes 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 $y = a$.

3(a) If $f(z) = u + iv$ is an analytic function of $z = x + iy$ and

$u + v = (x - y)(2 - 4xy + x^2 + y^2)$,

then find $u, v$ and the analytic function $f(z)$. 2 marks
(b) Evaluate \( \oint_C \frac{2z}{z^4+5} \) where \( C \) is

(i) \( |z - 3i| = 4 \)

(ii) \( |z + 3i| = 2 \)

(iii) \( |z| = 5 \).

(c) If \( f(z) = u + iv \) is an analytic function of \( z \), show that the curve \( u = \text{constant} \) and \( v = \text{constant} \) cut orthogonally.

[5, 10]

4(a) Form the partial differential equation by eliminating the arbitrary function from the relation \( f(xy + z^2, x + y + z) = 0 \).

(b) A rod of length \( l \) has its ends \( A \) and \( B \) kept at \( 0^\circ \) and \( 100^\circ \) respectively, until steady state conditions prevail. If the temperature at \( B \) is reduced suddenly to \( 0^\circ \) and kept so, while that of \( A \) is maintained find the temperature \( u(x, t) \) at a distance \( x \) from \( A \) and at a time \( t \).

(b') An infinitely long plane uniform plate is bounded by two parallel edges and an end at right angles to them. The breadth is \( \pi \); this end is maintained at a temperature \( u_o \) at all points and the other edges are at zero temperature. Show that in the steady state, the temperature is given by

\[
u = \frac{4u_o}{\pi} [e^{-v} \sin x + \frac{1}{3} e^{-2v} \sin 3x + \ldots]\]
2014-15
B.TECH. III SEMESTER (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
CIVIL ENGINEERING MATERIALS
CE-212
CREDIT: 04

Maximum Marks: 60

Duration: Three Hours

Answer all the questions.

1. (a) Define setting time of cement. Explain, how it is determined in the laboratory?
   (b) Discuss classification of aggregates based on their shapes.
   OR

1'. (a) Explain High Alumina, Super sulphate and Portland slag cement.
   (b) What do you mean by consistency of cement? How the tensile strength of cement
   is determined? Explain.

2. (a) Discuss compaction factor test to determine workability of fresh concrete.
   (b) What are various methods of mix design? Explain any one of them.

3. (a) Explain the various stages involved in the production of wrought iron from ore.
   (b) What do you mean by rusting and corrosion of steel? What are different methods
   of preservation of steel against rusting and corrosion? Explain.
   OR

3'. What are various defects in timber? Discuss them in detail.

4. (a) What are essential constituent of good brick earth? Discuss them in detail.
   (b) Discuss the characteristics of different kinds of bricks in detail.
   OR

4'. (a) With the help of sketches, explain the burning of brick in clamp.
   (b) Discuss different types of mortar in detail.

5. (a) What are constituent of glass and discuss their functions in detail.
   (b) Discuss the following in detail:
      (i) Soda line or Crown glass
      (ii) Flint glass
      (iii) Pyrex or Heat resistant glass
      (iv) Bullet proof glass.
B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
FLUID MECHANICS CE-213

Maximum Marks: 60
Credits: 04
Duration: Three Hours

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

Q.No. Question M.M.
1(a) With aid of stress-strain diagram, explain any three types of Non-Newtonian fluids. [04]
Give one example of each.

1(b) The velocity vector is defined as \( \mathbf{V} = x^2 y^2 x^2 y + x y \), find rotation component along \( x \)-direction at point \( P(1,2,1) \) at time \( t = 3 \) seconds. [05]

1(c) Given velocity potential \( \phi = x^2/3 - x^2 + xy^2 + y^2 \), find stream function \( \psi \). [06]

OR

Q1(a) Explain

(i) Steady flow
(ii) Potential Flow
(iii) Circulation
(iv) Stream Function
(v) Vorticity

1(b) A 2 m long reducer 40 cm dia. at the inlet and 20 cm dia. at the outlet carries water at a rate of 100 l/s. It is found that the discharge is increasing at the uniform rate of 10 l/s/s at the centre. Find the convective acceleration at a distance 0.5 m and 0.8 m from the inlet at 5th second. [10]

2(a) Define absolute pressure, gauge pressure and vacuum pressure. [2]

2(b) Check the stability of dam section shown in Fig. 1 against overturning. Take specific weight of concrete as 24 kN/m^3. Neglect uplift pressure. [6]

2(c) A sector gate in the form of a circular arc of radius 6 m retains water to a height of 6 m above its sill as shown in Fig. 2. Calculate the magnitude and direction of the resultant force per unit length of the gate. [7]

Contd. 2. 
2' (a) Explain the terms centre of pressure, centre of buoyancy and metacentre.

2' (b) A block of wood of rectangular cross section of sides $b$ and $d$, and length $l$ has specific gravity $S$. If the block is to float with its longitudinal axis horizontal and the length $d$ vertical, find the ratio $b/d$ to have stable equilibrium.

2' (c) A closed tank 6 m long 2 m wide and 1.8 m deep contains water to a depth of 1.2 m. The top has an opening in the front part to have air space at atmospheric pressure. If the tank is given a horizontal acceleration of 2.45 m/s$^2$ along its length, calculate the total force on the top of the tank.

3' (a) Explain energy and momentum correction factors. Mention their values for laminar flows in closed conduits. A venturimeter is to be fixed in a 150 mm diameter pipeline horizontally at section where the pressure is 100 kN/m$^2$. If the maximum flow of water is 150 l/s, find the diameter of the throat so that the pressure at the throat does not fall below 75 kN/m$^2$ (vacuum). Assume that 3% of the differential head is lost between the inlet and the throat.

OR

3' (a) The angle of a reducing bend is 60° (that is deviation from initial direction to final direction). Its initial diameter is 30 cm and final diameter 15 cm and is fitted in a pipeline, carrying a discharge of 360 l/s. The pressure at the commencement of the bend is 2943 bar. The friction losses in the pipe bend may be assumed as 10% of the kinetic energy at exit of the bend. Determine the force exerted by the reducing bend.

3' (b) For a lawn sprinkler as shown in Fig. 3 has 1 cm diameter nozzle at the end of a rotating arm and discharges water at the rate of 8 m/s velocity. Determine the torque to hold the rotating arm stationary. Neglecting friction, find the speed of rotation in R.P.M. Equal discharge is entering into all arms of the sprinkler.
4(a) Classify mouthpieces based on location.

4(b) A tank in the form of pyramid having square base of side 2 m and height 3 m is kept with its axis vertical and apex downwards. The tank is completely filled with water. It is to be emptied using an orifice of diameter 5 cm fitted at its apex. Determine the time of emptying if $C_e$ is 0.62. Centre of the orifice may be assumed as the apex of pyramid.

5(c) Derive the relation for computing discharge over a triangular notch.
2014-15
B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
ENGINEERING GEOLOGY
CE - 215

Maximum Marks: 60
Credits: 04
Duration: Three Hours

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

Q.No. Question M.M.
1(a) Give a pictorial account of earth’s internal structure and its relation to plate tectonics. [06]
1(b) Give a brief classification scheme of rocks and their subgroups. [06]

2 Enumerate different geomorphological processes and features of a river system. [12]

OR

2* What do you understand by deformation of rocks? Show labelled diagram of a fold with its parts. [12]

3 Name different Geo-tectonic units with their characteristic features and give examples from Indian Subcontinent. [12]

4 What do you understand by mass wasting and movements? Suggest remedial measures and its basis. [12]

OR

4* Enumerate geomorphologic and geological factors in selection of site and type of dam and reservoir setup. [12]

5 Write Short Notes on any two of the followings:
(a) Core Recovery Percent and Rock Quality Designation [6]
(b) Factors involved in Rock Mass Classifications [6]
(c) Physico-chemical properties of rocks for aggregate [6]
2014-15  
B.TECH. (AUTUMN SEMESTER) EXAMINATION  
CIVIL ENGINEERING  
QUANTITY SURVEY  
CE – 220

Maximum Marks: 60  
Credits: 04  
Duration: Three Hours

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

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
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| 1(a)  | Write the minimum recommended dimensions for  
        (i) Living Room  
        (ii) Drawing cum dining room  
        (iii) Kitchen  
        (iv) Store  
        (v) Washroom  
        (vi) Internal Verandah  
        (vii) External Verandah | [7] |
| 1(b)  | Write the dimensions of:  
        (i) Modular Brick  
        (ii) Standard Brick | [2] |
| 1(c)  | What is Frog? Give its Purpose. | [3] |
| 2(a)  | Determine the total number of bricks in the parapet wall and plinth for a set of rooms shown in Figure 1. Assume one-brick wall in both cases. | [12] |
| 2'(a) | OR Draw a neat sketch of the foundation plan of the rooms as shown in Fig. 1. | [12] |
| 3(a)  | What is the purpose of cost analysis? | [04] |
| 3(b)  | Analyse the rates for 30-cubic metre of Reinforced Cement Concrete in beams and slabs in the ratio of 1:1\frac{1}{2}:3, at normal height. | [08] |
| 3"   | OR Write short notes on the following  
        (i) Administrative Approval  
        (ii) Technical Sanction  
        (iii) Expenditure Sanction | [12] |
| 4(a)  | What is DPC? Where and why it is provided? | [03] |
| 4(b)  | What are the different types of Stair Cases? Which one of them is the best Staircase? | [03] |
| 4(c)  | Write short notes on: | [06] |

Contd...2:
(i) Capital Cost of a project

(iii) Work Charged Establishments

Define a Contract. What do you understand by free consent of parties?

[12]

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**Figure 1**

- **Bed Room**: 4500 mm x 4500 mm
- **Guest Room**: 4000 mm x 4500 mm
- **Verandah**: 1600 mm wide

**Given:**

- \( D = 1200 \text{ mm} \times 2100 \text{ mm} \)
- \( D_1 = 1600 \text{ mm} \times 2000 \text{ mm} \)
- \( W = 800 \text{ mm} \times 1200 \text{ mm} \)
- \( W_1 = 800 \text{ mm} \times 1000 \text{ mm} \)
- \( V = 600 \text{ mm} \times 450 \text{ mm} \)
- Parapet Wall = 600 mm high
- Plinth = 1000 mm