1(a) Find the values of the constants $a, b, c$ so that the directional derivatives of $f = axy^2 + byz + cz^2x^3$ at $(1, 2, -1)$ has a maximum magnitude 64 in the direction parallel to z-axis.

(b) Show that the vector field $\vec{A}$ where $\vec{A} = (2xy + z^2)\hat{i} + (2yz + x^2)\hat{j} + (2zx + y^2)\hat{k}$ is irrotational. Find the scalar function $\varphi$ such that $\vec{A} = \text{grad} \varphi$. 

OR

(b') Find the value of $\nabla (r^n)$ and show that $\nabla^2 \left( \frac{1}{r} \right) = 0$

(where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, $r = |\vec{r}| = \sqrt{x^2 + y^2 + z^2}$).

2.(a) Use divergence theorem to evaluate the surface integral $\iint_S (x^3 dydz + x^2y dzdx + x^2z dx dy)$, where $S$ is the sphere $x^2 + y^2 + z^2 = 1$.

OR

(a') Verify Green’s theorem in a plane to evaluate $\int_c [(2x^2 - y^3)dx + (x^2 + y^2)dy]$, where $C$ is the boundary of the surface in xy-plane between $x^2 = y$ and $y^2 = x$. 

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

\[
3. (a) \text{Verify that the function } f(z) = \begin{cases} 
\frac{x^3 y(y-i \alpha)}{x^6 + y^2}, & z \neq 0 \\
0, & z = 0 
\end{cases} \text{ is analytic at } z = 0.
\]

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) Use Cauchy’s integral formula to evaluate \( \int_C \frac{\cos zn^2 + \sin zn^2}{(z-1)(z-2)} \, dz \), where \( C \) is a circle \( |z| = 3 \).

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

(i) \( z = ae^{-b^2 t} \cos bx \)

(ii) \( f(x^2 + y^2, z - xy) = 0 \)

(b) A tightly stretched flexible string has its ends fixed at \( x = 0 \) and \( x = l \). At time \( t = 0 \) the string is given a shape defined by \( F(x) = \mu x(l-x) \), where \( \mu \) is a constant, and then released. Find the displacement of any point \( x \) of the string at any time \( t > 0 \).

OR

(b') A rod of length \( L \) has its ends \( A \) and \( B \) kept at \( 0^0C \) and \( 100^0C \), respectively, until steady state conditions prevail. If the temperature of \( B \) is then reduced suddenly to \( 0^0C \) and kept so, while that of \( A \) is maintained, find the temperature \( u(x, t) \) at distance \( x \) from \( A \) at time \( t \).
Maximum Marks: 60

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

Q. No.  Question  M.M.  Duration: Two Hours
1(a)  An oil (specific gravity = 0.85) is flowing in a 10cm pipe line with velocity of 1.2 m/s. Find volume flow rate, mass flow rate and weight flow rate.  03

1(b)  Derive the expression for surface tension of a water droplet taking suitable parameters.  04

1(c)  If velocity vector is defined as \( \vec{V} = 3x^3 \hat{i} - 3x^2 y \hat{j} \), obtain the equation of stream line passing through point P (1,1). Also sketch this line taking the values of x from 0.5 to 5.  08

OR

Q1'(a)  Differentiate between local and convective accelerations. Water is flowing at a rate of 100 l/s in a 2-m long reducer having 50 cm diameter at inlet and 30 cm diameter at outlet. It is found that the discharge is increasing at a rate of 10 l/s/s. Find the value of local and convective tangential accelerations at mid of the reducer at 6th seconds.  09

1'(b)  If velocity vector is defined as \( \vec{V} = x^2 y \hat{i} + y z^2 \hat{j} - (y z + z^3) \hat{k} \), Find:  06

(i) Rotation along Y - direction at point P (1, 2, 2) and
(ii) Vorticity along Z - direction at Point Q (1, 2, 3)

2(a)  Find the components of hydrostatic pressure on the 6.0 m long, 2.0 m diameter cylindrical gate. Water is held by the gate only on one side up to the top of the gate.  [10]

(b)  Discuss various types of equilibrium of floating bodies with suitable examples.  [5]

OR

2'(a)  Derive the expression for centre of pressure and total pressure for an inclined plane surface immersed in water such that its one end is touching the water level.  [08]
Show that a cylindrical buoy 1.2m diameter and 2m high weighing 12 kN will not float vertically in water. Assume other suitable data.

Q3(a) What is energy correction factor? Mention its values for laminar and turbulent flows in closed conduit.

Water is flowing in a penstock with a velocity of 1.06 m/s. The penstock feeds water to the turbine as shown in Fig.1. If the pressures at points A and B are 120 kN/m² and –30 kN/m², find the flow rate and power developed by the turbine if its efficiency is 85%. The head lost in the draft tube is 0.02 m.

OR

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

Water is flowing at the rate of 0.15 m³/s in a 20cm uniform diameter pipe. If the pipe is bent by 135°, find the magnitude of the resultant force. The pressure everywhere in the pipe is 300 kPa.

3(b) Explain the torque principle. How this principle is applied in rotating a sprinkler?

4(a) How orifices are classified based on their shapes?

(b) Derive the discharge equation for a sharp edged triangular notch.

(c) A Borda’s mouthpiece is 50 mm in diameter and run free under a head of 2 m. What would be the discharge and the size of the jet?
B. E. (AUTUMN), IIIrd SEMESTER EXAMINATION, 2017-18
(CIVIL ENGINEERING)
ENGINEERING GEOLOGY (ECE – 215)

MAXIMUM MARKS: 60

Note: Answer all questions.

1. Give a short account of origin and physical properties of minerals. (15)

OR

1’a. Give a brief classification of igneous rocks, what factors control their mineral composition and texture. (15)

2. What are folds? Give their classification scheme and significance in mega civil engineering construction projects. (15)

3. Write short notes on any two of the followings:
(a). Geotectonic Divisions of India and its importance (7.5)
(b). Geological control on occurrence and movement of Groundwater (7.5)
(c). Parameters Used in Rock Mass Rating (7.5)

4. Enumerate different geological and geophysical ground investigations for a major dam site. (15)

OR

4’. Give a short account of earthquake occurrence in Indian Sub-Continent and remedial measures for minimizing the effect of earthquakes. (15)
2017-18
B.E. (AUTUMN SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
ECE-220
QUANTITY SURVEY
Credits: 04
Duration: Two Hours

Maximum Marks: 60
Note: Attempt all questions, Assume any date required.

Q1(a) What do you understand by estimate? Enumerate different methods for estimate and explain any one of them in detail.

Q1(b) Calculate the total no. of bricks to be used in the super-structure of a room of size 4.5m × 3.5m and 3.6m height, having one door and one window opening of standard sizes. Take the thickness of super-structure as 300mm.

OR

Q1'(b) Draw a neat sketch of the wall section and write the dimensions of its components.

Q2(a) Prepare the analysis of rates for any ONE of the following items:
   (a) 1:1.5:3 R.C.C. work in beams
   (b) First class brickwork with 1:6 cement mortar in foundation and plinth.

Q2(b) Discuss the purpose and requirements of rate analysis.

Q3(a) Prepare the detailed specification for cement mortar plastering on walls.

Q3(b) Prepare the list of materials in tabular form for the following items:
   (a) DPC (1:1.5:3) - 30 m²
   (b) RCC work (1:1:2) - 25 m³

Q4(a) Define a contract. What do you understand by free consent of parties?

OR

Q4'(a) Differentiate between Earnest money and Security money.

Q4(b) What is the departmental procedure for execution of a civil engineering project?
Department of Civil Engineering
B.E. (Civil) End – Semester Examination, Autumn 2017-18
ECE 221: Civil Engineering Materials and Construction Practice

Attempt all questions

Q 1a Enlist various types of the cement. Write approximate oxide composition of the raw materials suitable for production of OPC. Discuss the role of Bogue’s compounds in the strength and rate of hydration in cement with the help of graph. [2+2+4]

Q 1b What are different types of aggregates? Discuss various characteristics of the aggregates. [3+4]

Q 1b’ What do you mean by workability? Discuss various factors that affect workability. Also, explain slump test for its measurement. [1+3+3]

Q 2a Write short notes on any two of the following:
(i) Burning of clay bricks involving the three stages of dehydration, oxidation and vitrification.
(ii) Defects in timber during the growth of the tree and after the tree has been fallen.
(iii) Structure of exogenous timber tree with neat sketch.
(iv) Preservation of timber through ASCU treatment and chemical salts. [4+4]

Q 2b Enlist the different types of steel based on their chemical compositions according to American Iron and Steel Institute. Discuss the classification of stainless-steel in to three groups based on their crystalline structure. [2+5]

Q 3a Describe various components of a residential building and enlist their types. Draw neat sketches of different types of foundations. [4+4]

Q 3b What do you mean by the term ‘Dampness’? Mention various causes and effects of dampness. Enumerate the methods of damp-proofing and explain any two of them. [1+3+3]

Q 3b’ What are the measures of limiting the spread of fire? Discuss fire resisting properties of common building materials. [3+4]

Q 4a Differentiate between the following:
(i) Wales and struts
(ii) Earth dike and rock dike [1+1]

Q 4b What is deep excavation and what are its problems? Mention the different methods of timbering along with their sketches. [2+5]

Q 4b’ What do you mean by dewatering? What are the purposes of dewatering during construction and post construction stages? Enlist the different ground water pumping methods. [1+3+3]

Q 4c Define a cofferdam. How is it different from Caisson? Enumerate the factors which influence the choice of a particular type of cofferdam. Also mention the uses of the cofferdam. [1+1+2+2]