1. (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.
   [8]

   (b) Find the directional derivatives at \((1, -2, 1)\) on the sphere
   \[ x^2 + y^2 + z^2 = 6 \]
   in the direction normal to the surface
   \[ z = 2x^2 + y^2 - 5 \]
   at the same point.

   **OR**

   (b') Show that the \( \text{div}(r^n\vec{r}) = (n + 3)r^n, \) \[ \text{where } \vec{r} = x\hat{i} + y\hat{j} + z\hat{k}, r = |\vec{r}| = \sqrt{x^2 + y^2 + z^2}. \] [7]

2. (a) Use divergence theorem to evaluate the surface integral \( \iint_S \vec{F} \cdot \vec{N} \, ds \), where
   \[ \vec{F} = x^2\hat{i} + x^2y\hat{j} + x^2z\hat{k} \]
   and \( S \) is the surface of the cylinder
   \[ x^2 + y^2 = a^2, z = 0, z = b. \]
   [7]

   (b) 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 the \( XY \)-Plane between \( x^2 = y \) and \( y^2 = x. \)
3.(a) If \( f(z) \) is an analytic function of \( z \), prove that
\[
\left( \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) |f(z)|^2 = 4|f'(z)|^2.
\]
OR

(a') If \( f(z) = u + iv \) is an analytic function of \( z \) and
\[
u = \frac{25\sin 2x}{e^{2y} + e^{-2y} - 2\cos 2y}
\]
find \( f(z) \) in terms of \( z \).

(b) Evaluate, using Cauchy integral formula, the integral \( \int_c \frac{\cos \pi z^2}{(z-1)(z-2)} \, dz \),
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) \( (x - h)^2 + (y - k)^2 + z^2 = c^2 \)
(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 \( 0^\circ C \) and \( 100^\circ C \), respectively, until steady state conditions prevail. If the temperature of \( B \) is then reduced suddenly to \( 0^\circ C \) and kept so, while that of \( A \) is maintained, find the temperature \( u(x, t) \) at distance \( x \) from \( A \) at time \( t \).
Standard Normal Probabilities

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2016-17
B. TECH. III SEMESTER (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
CIVIL ENGINEERING MATERIALS
CE 212

Maximum Marks: 60  Credits: 04  Duration: Two Hours

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

Q. No.  Question  M.M.
1(a)  Write the reaction of hydration of cement and describe the characteristics of constituents of cement. [06]
1(b)  Describe the characteristics of any two of the following:
(i) Rapid hardening cement
(ii) Oil-well cement
(iii) Effect of alkali-aggregate reaction on concrete
(iv) Absorption and moisture content of aggregates [06]
2(a)  Describe any two of the following:
(i) Measurement of workability of concrete with the help of slump test
(ii) Plastic shrinkage of concrete
(iii) Use of objectionable water in concrete [06]
2(b)  Describe any two of the following:
(i) Fibre reinforced concrete
(ii) Self compacting concrete
(iii) High strength and high performance concrete [06]
3  What is the object and purpose of bond in brick masonry unit? Draw and describe different types of brick masonry bond. [12]
4(a)  Discuss the various defects developed during the growth of timber. [06]
4(b)  What are the objects of seasoning of timber? Describe the natural method of seasoning of timber. [06]

OR

4'(a)  What do you mean by preservation of timber? Describe creosoting and ascu treatment in the preservation of timber. [06]

Contd... 2.
4'(b) Describe the characteristics of cold twisted deformed bars and thermo-mechanically treated bars.

5(a) Describe the characteristics of any two of the following:
(i) Sheet glass
(ii) Laminated glass
(iii) Insulating glass
(iv) Heat absorbing glass

5(b) Define plastics. Describe the functions of constituents of plastics.
Maximum Marks = 60

Q. No.  Question  Marks

1(a)  If velocity field is define as \( \vec{V} = 2 \times y \hat{i} + (a^2 + x^2 - y^2)\hat{j} \), answer the following:

(i) Show that flow is potential and steady

(ii) Find the magnitude of acceleration along \( X \) - direction at P (1,1,2) and

(iii) Find rotation along \( Y \) - direction at Q (2,1,3)

1(b) Develop an expression for power required to rotate a conical shaft at angular speed \( \omega \) in a conical bearing. The vertex angle of the cone is \( \alpha \) and the clearance between bearing and the shaft is \( b \). Assume other parameters suitably.

OR

1’(a) Differentiate among the following:

(i) Convective and local accelerations

(ii) Stream line and streak line

(iii) Free vortex and forced vortex motions

(iv) Circulation and vorticity

1’(b) Develop expression for surface tension of a soap bubble taking usual symbols.

1’© Show that \( \Phi \) and \( \psi \) lines always intersect orthogonally.

contd...
2(a) Define manometer. Where will you prefer U-tube manometer? Explain the working of Micro-manometer.

2(b) Define meta-centre. A wooden block of specific gravity 0.75 floats in water. If the size of the block is 1m x 0.5m x 0.4 m, find its meta centric height.

OR

2'(a) Explain total pressure and centre of pressure. A 1.0 m wide and 1.5 m deep rectangular plane surface lies in water in such a way that its plane makes an angle of 30° with the free surface. Determine the total pressure and position of centre of pressure when the upper edge is 0.75 m below the free water surface.

2'(b) A block of wood 6m long x 2.5m wide x 1 m thick is floating horizontally in water. The density of wood is 700 kg/m³. Find the volume of water displaced and position of centre of buoyancy.

3(a) Explain Bernoulli’s theorem. Write all its three forms for ideal and incompressible fluids. The liquid shown in Fig.1 has relative density 1.60 and vapour pressure 12 kN/m². Calculate the rate for incipient cavitation in the 7.5 cm section, assuming that tube flows full. Barometric pressure is 100 KPa.

OR

3'(a) Explain momentum correction factor β. Find the hydro-dynamic force on the vane as shown in Fig.2.

3(b) Explain momentum principle. For the sprinkler system as shown in Fig.3, find the speed of rotation.

4(a) What is an orifice? How orifices are classified based on submergence?

4(b) Water is flowing at a head of 1.2 m over a 5.0 m long rectangular weir. If the coefficient of discharge for the weir is 0.65, find the rate of flow.

4© Develop discharge equation for Borda’s mouth piece.
Fig. 1

Fig. 2

Fig. 3

Dia. of each nozzle = 10 cm
Total Q = 1.5 l/s
Arm length = equal
B. TECH. AUTUMN (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
ENGINEERING GEOLOGY
(CE – 215)

MAXIMUM MARKS: 60  Credits: 04  Duration: Two Hours

Note: Answer all questions.

1. Give a short account of classification of minerals. Write about physical properties of minerals with examples. (15)

OR

1'. Give a short account of internal structure of the earth linking it with the plate tectonic operation. (15)

2. What do you understand by deformation of rocks. Draw labeled diagrams of important deformation structures, list their characteristic features and importance in civil engineering. (15)

3a. Give a short account of hydrological cycle and its elements. (7.5)

3b. Define stratigraphy and enumerate fundamental concepts of stratigraphy. (7.5)

4. Give a brief account of landslide hazard and methods to mitigate the problems of slope failures. (15)

OR

4'. Write short notes on any two of the followings:

   Engineering classification of rock mass (7.5)
   Uses of rock material and properties (7.5)
   Construction problems of permafrost regions (7.5)
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)  What is Orientation? Discuss in detail.  [09]
(b)  Draw the Standard Door, Window and Ventilator in Section.  [06]

OR

1'  Determine the total number of bricks in superstructure in a set of two rooms shown in figure and as per the following data.

(i)  Height of room = 4000 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

[15]

contd. – 2.
2 Write the least dimensions of the following:
   (i) Front, Side and rear set backs in a residential building on a plot of areas 500 m² and 1000 m² [06]
   (ii) Bed room, Drawing-cum-dining room, Kitchen Store and Garage [05]
   (iii) External and internal verandahs [02]
   (iv) Plinth and parapet wall [01]
   (v) Tread and riser [01]

3(a) Determine the quantity of materials required for 75 m³ of cement concrete having a ratio of 1:1.5:3 [7]

3(b) Write short notes on:
   (a) Quantity Survey and its requirements [04]
   (b) Capital Cost of project [04]

   OR

3' What is meant by Specifications? Briefly describe the principles adopted for writing the specifications. [15]

4 Write short notes on any two of the following: [15]
   (i) Contract Document  (ii) Administrative Approval  (iii) Percentage rate Contract
2016-17
B. TECH. III SEMESTER (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
CIVIL ENGINEERING MATERIALS & CONSTRUCTION PRACTICE
CE 221

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 flow charts, describe the manufacturing of ordinary Portland cement by dry process. Also write the reaction of hydration of cement. [05]
1(b) Describe the characteristics of any two of the following:
(i) Portland Pozzolana cement
(ii) Absorption and moisture content of aggregates
(iii) Effect of alkali-aggregate reaction on concrete [05]
1(c) Describe any two of the following:
(i) Measurement of workability of concrete with the help of slump test
(ii) Fibre reinforced concrete
(iii) Self compacting concrete
(iv) Differentiate between plastic and drying shrinkage of concrete [05]
2(a) Enumerate different types of burnt clay bricks. Describe the purpose of cavity and paving brick in masonry construction. [05]
2(b) What is the object and purpose of bond in brick masonry unit? Draw and describe any two brick masonry bond.
(i) English bond
(ii) Double Flemish bond
(iii) Rat trap bond [05]
2(c) Draw the structure of timber and describe any two of the following:
(i) Characteristics of soft and hard wood
(ii) Defects in timber developed after the tree felled
(iii) Natural method of seasoning of timber
(iv) Ascu treatment in preservation of timber [05]
3 Explain the following with the help of neat sketches.
(a) Grillage Foundation [05]
(b) Under-reamed Pile
(c) Ill effects of Dampness

OR

3' Explain the following with the help of neat sketches.
(a) Design of a wall with the help of nomogram
(b) Framed and Panelled Door
(c) Post construction treatment of termites

4 Explain the following with the help of neat sketches.
(a) Raking shores
(b) Pit method of underpinning
(c) Double scaffolding