2012 – 2013
B.TECH. AUTUMN (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
MATHEMATICS – III
(AM-211)
Credits: 04

Maximum Marks : 60
Duration : Three Hours

Note: Answer all questions.

1. (a) Find the constants a, b and c so that the directional derivative of
\( \psi = ax^2 + by^2 + cz^3 \) at \((1, 2, -1)\) has a maximum magnitude 64 in the direction
parallel to z-axis.
(b) Prove that the div grad \( \mathbf{r}^n = n(n+1) \mathbf{r}^{n-2} \).
(c) A vector field \( \mathbf{F} \) is given by \( \mathbf{F} = (y\sin z - \sin x)i + (x\sin z + 2yz)j + (xy\cos z + y^2)k \).
Prove that it is irrotational and hence find its scalar potential.

OR

(c') Verify the identity:
\[ \text{Curl curl } \mathbf{F} + \nabla^2 \mathbf{F} = \text{grad div } \mathbf{F} \]
with \( \mathbf{F} = x^2yi + y^2zj + z^2xk \).

2. (a) If \( \mathbf{F} = 4xzi - y^2j + yzK \), evaluate \( \int \mathbf{F} \cdot \mathbf{A} \) ds, where \( S \) is the surface of the cube
bounded by \( x = 0, x = 1, y = 0, y = 1 \) and \( z = 0, z = 1 \).
(b) Apply Green's theorem to evaluate
\[ \int_C \left[ (2x^2 - y^2) \, dx + (x^2 - y^2) \, dy \right], \]
where \( C \) is the boundary of the area enclosed by
the x-axis and upper half of circle \( x^2 + y^2 = a^2 \).

OR

(b') Verify Stoke's theorem for the function \( \mathbf{F} = x^2i + xyj \) integrated round the square
in the \( z = 0 \) plane whose sides are along the line \( x = 0, y = 0, x = a, y = a \).

3. (a) Show that the function \( e^x(\cos y + i \sin y) \) is an analytic function, find its
derivative.
(b) If \( f(z) = u + iv \), is any analytical function of a complex variable \( z \) and
\( u - v - e^z (\cos y + \sin y) \), find \( f(z) \) in terms of \( z \).

OR

(b') Prove that
\[ \left( \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) |f(z)|^2 - 4 |f'(z)|^2. \]

Contd.....2
(c) Evaluate

\[ \int_C \frac{e^z}{(z-1)(z-4)} \, dz \] where C is the circle with centre at origin and radius 2.

4. (a) From a partial differential equation by eliminating a, b, c from

\[ \frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1. \]

(b) A tightly stretched string with fixed end points \( x = 0 \) and \( x = \ell \) is initially at rest in its equilibrium position. If it is set vibrating by giving to each of its points on initial velocity \( \lambda x (\ell - x) \). Find the displacement of the string at any distance \( x \) from one end at any time \( t \).

OR

(b') A rod of length \( \ell \) with insulated sides is initially at a uniform temperature \( u_0 \). Its ends are suddenly cooled to 0°C and are kept at that temperature. Prove that the temperature function \( u(x, t) \) is given by

\[ u(x, t) = \sum_{n=1}^{\infty} b_n \sin \frac{n\pi x}{\ell} \ e^{-\frac{n^2\pi^2 c t}{\ell^2}} \]

where

\[ b_n = \frac{2}{\ell} \int_0^\ell u_0(x) \sin \frac{n\pi x}{\ell} \, dx. \]
2012–2013
R.TECH. AUTUMN (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
CIVIL ENGINEERING MATERIALS

Maximum Marks : 60
Credits: 04
Duration: Three Hours

Note: (i) Answer all questions.
(ii) Each question carry equal marks.

1. (a) What are the essential constituents of good brick earth? How the quality of brick is affected by the excess of one or other of the constituents? [06]
(b) With the help of sketch explain the burning of bricks in “clemp”. [06]

OR

1'. (a) Discuss different types of masonry mortar in detail. [06]
(b) Explain the following
(i) Quick lime  (ii) Fat lime  (iii) Slaked lime
(c) Write short notes on stop moulding bricks and sand moulding bricks. [03]

2. (a) Explain the following
(i) Soda lime or crown glass  (ii) Flint glass
(iii) Pyrex or Heat resistant glass  (iv) Bullet-proof glass
(b) What do you mean by plastic? Discuss various constituents of plastic in detail. [04]

3. Discuss various defects in timber in detail with sketches. [12]

OR

3'. (a) (i) Write carbon content in different forms of steel. [02]
(ii) Enumerate the methods of protection of steel against rusting and corrosion and explain any two of them. [04]
(b) Discuss different stages involved in the production of wrought-iron from iron ores. [06]

4. (a) What do you mean by ‘workability’? Discuss the factors effecting workability of fresh concrete. [06]
(b) What is modulus of rupture? How it is determined in the laboratory? Explain. [06]
5. (a) Giving percentages of important cement compounds in the cement, discuss their properties.
(b) Discuss classification of aggregates based on their shapes.

OR

5'. (a) Explain the method used to determine compressive strength of cement in laboratory.
(b) What do you mean by I.S. Sand? Write properties of I.S. Sand.
(c) Write note on bulking of sand.
B. TECH. AUTUMN (III-SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
FLUID MECHANICS
(CE-213)
CREDIT – 04

Maximum Marks: 60
Duration: Three Hours

Answer all the questions.
Each question carries equal marks.
Symbols used bear usual meanings.
Assume suitable data if not supplied.

1(a) Differentiate between Newtonian and Non-Newtonian Fluids. Give two examples of dilatants and Bingham plastic fluids.

A conical thrust bearing idealised as a cone of semi angle 30 degrees, maximum cone diameter 20 cm rests and revolve over a uniform fluid of thickness 0.1 cm at 600 r.p.m.. If the fluid has a viscosity of 0.10 N-Sec/m², calculate the power required to rotate the cone. (8)

1(b) What are $\phi$ and $\psi$ lines? The stream function is given by $\psi = Ax + B Y^2$, find the velocity potential $\phi$. (7)

1'(a) With suitable examples differentiate among:
(i) Rotational and irrotational flows
(ii) Circulation and vorticity
(iii) Local and convective accelerations
(iv) Stream lines and stream tubes (8)

1'(b) Oil with specific gravity 0.86 is flowing at a uniform rate of 100 l/s in a 2m long conical reducer 100 cm diameter at inlet and 50 cm diameter at
outlet. At a particular instant it was found that discharge is increasing at a rate of 20 l/s. Find the convective acceleration at mid point of the reducer.

2(a) Where will you prefer vertical and inclined piezometers? For a gauge pressure at A of $-1.5 \text{ N/m}^2$, determine the specific gravity of the gauge liquid B in the Fig. 2.

2(b) What are meta centre and metacentric height? A wooden cylinder of diameter $d$ and length $2d$ floats in water with its axis vertical. Is the equilibrium stable? Locate the metacentre with reference to water surface. Specific gravity of wood is 0.6.

OR

2' Explain total hydrostatic pressure and centre of pressure. Give their significances. A cylinder 2.4 m diameter weighs 2 KN and rests on the bottom of a tank which is 1 m long shown in Fig. 3. Find the magnitude of the horizontal and vertical components of the force which will keep the cylinder touching the tank at B.

3.(a) State Bernoulli's theorem. Write its various forms. A 20 KW pump with efficiency as 85% is discharging oil of specific gravity 0.85 to the overhead tank as shown in Fig. 4. If losses in the whole system are 2.2 m of flowing fluid, find the discharge.

OR

3(a') Explain momentum correction factor. What are its values for laminar and turbulent flows?

A 8.5 cm diameter jet of water impinges on a series of hemispherical cups and is deflected through 180 degrees as shown in Fig. 5. If the velocity of the jet is 20 m/s and that of the cup is 10m/s, find the workdone per second by the water striking the cups.
3(b) Where sprinklers are used? For a frictionless shaft in the rotating sprinkler as shown in Fig. 6, and equal flow in each nozzle (relative velocity = 10 m/s), find the speed of rotation.

4(a) Classify the orifices based on their shapes, size and submergence.

4(b) A circular tank 2 m diameter has its axis vertical and contains a 10 cm diameter orifice at its bottom. If the coefficient of discharge of the orifice is 0.53, estimate the time required to lower the water surface from 3 m to 2 m height above the bottom.

OR

4(b') Classify the mouthpieces based on any two criteria. Develop expression for discharge through a triangular weir taking usual notations. Where will you prefer U-shaped and V-shaped weirs?
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B. TECH. AUTUMN (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
ENVIRONMENTAL SCIENCE
(CE-214 N)
Credits 04

Maximum Marks: 60  Duration: Three Hours

Important Notes:
I. Answer all the questions.
II. Assume any suitable data, if required.

Q.1(a) List essential parameters for water and wastewater quality assessment and discuss the significance of each parameter in brief. 7

Q.1(b) For a BOD test, 15mL of sample from a wastewater drain is taken and used without seeding. The initial DO in three BOD bottles of 300 ml each read 8.7, 8.54 and 8.63 mg/l respectively. The final DO levels after 5 days are 5.3, 5.2 and 5.5 mg/l respectively. Find the BOD of the drain water. 5

Q.1(b') An industry discharges flow of 20.00 m3/hour with a concentration of boron @ 7.3 mg/l to a small water channel flowing @19000 m3/hr having upstream concentration of boron as 1.4 mg/l. Compute the boron concentration in the stream after completely mixing. 5

Q.2(a) What are the harmful effects of Air Pollution on human health, property and environment? List some common air pollutants according to their source generation (natural and anthropogenic). 5

Q.2(b) Determine the effective height of a stack for a given data:
   a) Physical stack height = 108m
   b) Diameter of stack = 1.5 m
   c) Wind velocity = 3.12 m/s
   d) Air temperature = 12.5°C
   e) Barometric pressure = 1000 milli bars
   f) Stack gas velocity = 9.14 m/s
   g) Stack gas temperature = 154°C 7
Q.2(b) Discuss primary and secondary sources of air pollution. Give two examples of each. Discuss any case study (disaster) that caused serious air pollution problem due to industrial mishap including mass causalities in the Indian history.

Q.3 A water treatment plant of capacity 10,000 m$^3$ per day receiving water from a nearby river is to be treated for domestic supply. The average values for raw water data is as under:

- pH: 7.9
- Alkalinity: 275 mg/L as CaCO$_3$
- TS: 4500 mg/L
- Total Hardness: 325 mg/L as CaCO$_3$
- Turbidity: 650 NTU

Suggest the scheme or units required to make this raw water as 'potable' and briefly describe the function of each unit.

Q.4 (a) Briefly explain with the help of schematic the following processes/technologies:
   a) Activated Sludge Process
   b) Trickling Filter
   c) Waste Stabilization Pond
   d) UASB

OR

Q.4(a)' Design a single stage trickling filter to treat 45000 m$^3$/day of wastewater having BOD of 250 mg/l and TSS of 400 mg/l. Outlet BOD and TSS should be less than 30 and 50 mg/l respectively.

Q.5 Write explanatory notes on any four of the following:
   i. Sloughing Action and Bio-film
   ii. Elements of Solid Waste Management System
   iii. Noise Pollution
   iv. Disposal Techniques of Municipal Solid Waste
   v. Disinfection Methods (for Pathogens)
   vi. Control devices for Air Pollution

3 each
MAXIMUM MARKS: 60                  Credits: 04                  Duration: Three Hours

1. Give a pictorial account of internal structure of the earth and relate it to the theory of plate tectonics.  (12)

2. What do you understand by deterioration and deformation of rocks? How these processes affect rock masses?  (12)

**OR**

2' Write a short account of folding process. How folding affects rocks of an area?  (12)

3. Define stratigraphy and enumerate its fundamental concepts.  (12)

4. Give a brief account of landslides. What are the methods and measures to mitigate the problems of landslides?  (12)

**OR**

4'. Give a classification scheme for dams. Discuss important geomorphological and geological factors taken into consideration in deciding the location of dams.  (12)

5. Write short notes on any two of the followings:
   a. Physico - mechanical properties of building stones  (06)
   b. Rock Quality Designation  (06)
   c. Rock Mass Properties  (06)
   d. Strike and dip of rocks  (06)
1. Determine forces in members BC, CD and DE of the plane pin jointed frame shown in figure 1.

2. (a) A masonry retaining wall of trapezoidal section, 2m wide at top and 4m at bottom is 10m high and subjected to earth with leveled at top surface. The earth face of wall is vertical. Check stability of dam in overturning and calculate extreme stresses at base assuming unit weight of masonry and soil as 10 kN/m³ and 17kN/m³ respectively and angle of repose for soil as 28°. Coefficient of friction at base may be assumed as 0.55.

(b) A cylindrical shell 4 m long, 1 m in diameter, thickness of metal 10 mm is subjected to an internal pressure of 1.5 N/mm². Calculate the change in the dimensions of the shell and the maximum intensity of shear stress induced. Given $E = 2 \times 10^6$ N/mm²; Poisson’s ratio = 0.3.

2. (a) Following stress tensor is defined w.r.t. (x,y,z) axes. Transform this tensor w.r.t. new axes (x',y',z') obtained by rotating (y,z) axes in their own plane in anticlockwise direction by 30°.

$$[\sigma] = \begin{bmatrix} 25 & -5 & 3 \\ -5 & 10 & 0 \\ 3 & 0 & 15 \end{bmatrix}$$

(b) A hollow steel shaft of outer diameter 100 mm and internal diameter 70 mm is subjected to an axial load of 450 kN and a torque of 40 kN-m at a particular section. Calculate principal stresses and check safety of material against following failure theories.

(i) Maximum strain energy theory

(ii) Maximum principal strain theory

Assume yield stress of material as 200 N/mm² and Poisson’s ratio $\nu = 0.30$

3. A simply supported beam AB 8 m long has a uniformly distributed load of 20 kN/m over its entire length and a concentrated load of 40 kN at 3 m from the support A. Determine the maximum deflection in the beam. Also determine the slopes at ends A and B.

3'. (a) A cantilever of 4 m span and 400 mm depth carries a udl of 5 kN/m run. Find the magnitude of concentrated load W acting at the free end along with the udl so that the maximum deflection does not exceed 10 mm.

... 2
anywhere in the cantilever. Also find the maximum slope when both of these two loads are acting on the cantilever. Use \( E = 2 \times 10^8 \text{ N/mm}^2 \) and \( I = 2 \times 10^9 \text{ mm}^4 \).

(b) A simply supported beam, 4L long, has a moment of inertia twice that of the rest of the beam for the middle half of the beam and carries a point load \( W \) at the mid span. Determine the mid span deflection.

4. Calculate strain energy due to bending and shear separately for a simply supported beam as shown in Fig. 2. Assume \( E = 2 \times 10^4 \text{ N/mm}^2 \), \( I = 1 \times 10^6 \text{ mm}^4 \) and \( v = 0.3 \).

OR

4'. Using Castiglione's theorem, determine slope at free end and deflection at mid point of the cantilever beam shown in Fig. 3. Assume \( E = 2 \times 10^4 \text{ N/mm}^2 \), \( I = 2 \times 10^8 \text{ mm}^4 \).

5. (a) An alloy tube 5 m long elongates 6.4 mm under a tensile load of 60 kN. Calculate the Euler's buckling load for the tube when used as a strut with pin jointed ends. The tube internal and external diameters are 25 and 40 mm respectively.

5. (b) Determine the ratio of the buckling strengths of a solid steel column to that of a hollow column of the same material and having the same cross sectional area. The internal diameter of the hollow column is \( \frac{3}{4} \) of its external diameter. Both the columns are of same length and are pinned at both ends.
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B.TECH. AUTUMN (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
QUANTITY SURVEY

Maximum Marks : 60
Credits: 04
Duration : Three Hours

Note: Answer all questions.

1. (a) Define Plan, Elevation and Sectional elevation of a building. Also, write the standard size of a door, window and clerestory (ventilator).
(b) Define scale. Write its importance in drawing. Suggested suitable scale for plan and section of a residential building on a plot of about 240 sq. meter, if drawn on a full drawing sheet.
(c) What is orientation? Give its advantages.
(d) What is meant by D.P.C.? Where is it used?

OR

1'. Calculate the total no. of bricks to be used in the Super-structure and plinth of a room of size 4.5m × 3.5m and 3.6m height, having one door and one window openings of standard sizes. Take the thickness of the Super-structure = 200mm and total height of the plinth = 900mm.

2. (a) What is meant by the terms Tread and Riser, mentioning their range. Give a neat sketch of a Dog-legged staircase in a Stair-bell of 2.3m × 3.9m, taking the floor to floor height as 3.5m.
(b) Write the types of bricks according to their
   (i) size and
   (ii) quality

3. (a) What are the requirements and purpose of rate analysis?
(b) Prepare a list of materials required for the following items of work.
   (i) RCC work (1:2:4) = 25m³
   (ii) DPC (1:1:5:3) = 20m³.

OR

3'. Write short notes on the following:
(a) Necessity of specifications
(b) Capital Cost of a project.

Contd.... 2
4. (a) Write the units of measurement of the following items of work:
   (i) RCC Work
   (ii) Tower Bolts
   (iii) Steel Bars
   (iv) P-Traps
   (v) Readymade Points
   (vi) Ceramic Tiles
   (vii) Rain Water Pipes
   (viii) DPC

   (b) Write short notes on any TWO of the following:
       (i) Quantity Survey and its Requirement
       (ii) Types of Estimates
       (iii) Different areas in a building

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

   (b) Write short notes on the following
       (i) Contract Document
       (ii) Administrative Approval