2013 – 2014
B. TECH. AUTUMN (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
MATHMATICS - III
(AM-211)
Credits: 04

Max. Marks: 60

Duration: Three Hours

Note: Answer all questions.

1. (a) Show that \( Vr^n = nr^{n-2} \), and hence evaluate \( V\frac{1}{r} \) where \( \mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k} \).

OR

(a') Show that the vector field \( \mathbf{F} = \frac{\mathbf{r}}{r^3} \) is irrotational as well as solenoidal. Find the scalar potential.

(b) Find the directional derivative of \( \psi = 5x^2y - 5y^2z + \frac{5}{2}z^2x \) at the point \((1,1,1)\) in the direction of the line \( \frac{x-1}{2} = \frac{y-3}{2} = \frac{z}{1} \).

(c) If \( \theta \) is the acute angle between the surfaces \( xy^2z = 3x + 2z \) and \( 3x^2 - y^2 + 2z = 1 \) at the point \((1,2,4)\), show that \( \cos \theta = \frac{3}{7\sqrt{6}} \).

2. (a) Evaluate \( \int \mathbf{A} \cdot d\mathbf{s} \), where \( \mathbf{A} = 2\mathbf{i} + x\mathbf{j} - 3y^2z\mathbf{k} \) and \( s \) is the surface of the cylinder \( x^2 + y^2 = 16 \) included in first octant between \( z = 0 \) to \( z = 5 \).

(b) Apply Green's theorem to evaluate \( \int \left[ (xy^2 - 2xy) \, dx + (x^2y + 3) \, dy \right] \) around the boundary \( C \) of the region enclosed by \( y^2 = 8x, 4x = 2 \).

(b') Use Stokes' theorem to prove that \( \int \left[ (x^2 - y^2) + 2xy \right] \cdot d\mathbf{r} - 2ab^2 \) where \( c \) is the boundary of the rectangle bounded by the lines \( x = 0, x = a, y = 0, y = b \).

3. (a) Verify Cauchy-Riemann equations in polar form. Hence or otherwise show that \( \log z \) is analytic function.

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

OR

(b') If \( f(z_0) = \int_C \frac{4z^2 + z + 5}{(z - z_0)} \, dz \)

where \( C \) is the ellipse \( \frac{x^2}{4} + \frac{y^2}{9} = 1 \), find the values of \( f(1), f(i), f(-1) \) and \( f''(-i) \).
4. (a) Form the partial differential equation by eliminating $c$ and $\alpha$ from $x^2 + y^2 = (z-\phi)^2 \tan^2 \alpha$.

(b) A tightly stretched string with fixed end points $x=0$ and $x=L$ is initially in a position given by $y(x,0) = y_0 \sin \left( \frac{\pi x}{L} \right)$. If it is released from rest from this position, find the displacement $y$ at any distance $x$ from one end at any time $t$.

OR

(b') A long rectangular plate of width $a$ cm with insulated surfaces has its temperature $v$ equal to zero on both the long sides and one of the short sides so that $v(0,y) = 0$, $v(a,y) = 0$, $v(x,\infty) = 0$, $v(x,0) = kx$. Show that the steady-state temperature within the plate is

$$v(x,y) = \frac{2ak}{\pi} \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} e^{-\frac{n\pi a}{a}} \sin \left( \frac{n\pi x}{a} \right)$$
2013-2014
B. TECH. AUTUMN (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
CIVIL ENGINEERING MATERIALS
(CE-212)
Credit: 04

Maximum Marks: 60
Duration: 3 hrs

Note: Attempt all questions.

1. (a) What do you mean by soundness of cement? Explain laboratory test to determine setting time of cement. (8)
   (b) Enumerate various type of cement and explain any two of them. (4)

   OR

   1'. Explain the following: (3x4)
   (i) I.S. Sand
   (ii) Flash and False Set
   (iii) Bulking of Sand
   (iv) Natural and Artificial Aggregates

2. (a) Differentiate between flexural tensile strength and tensile strength of concrete. Explain splitting test to determine tensile strength of concrete. (8)
   (b) Write a note on concrete, mentioning main drawback of plain concrete and also ways and means used to overcome the drawback. (4)

   OR

2'. (a) Explain factors affecting workability. (6)
   (b) Explain the following: (2x3)
   (i) Water Cement Ratio
   (ii) Curing of Concrete

3. Describe various steps involved in the manufacturing of bricks in detail. (12)

   OR

3'. (a) What are the tests usually carried out on bricks? Explain them in detail. (8)
   (b) Describe different types of mortar in detail. (4)

4. (a) Discuss various properties and uses of asbestos and asphalt in detail. (6)
   (b) What are the constituents of glass and discuss their function in detail. (4)
   (c) Describe various properties of glass. (2)

5. What do you mean by seasoning of timber? Discuss various methods of seasoning in detail. (12)
<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>What is Newton's law of viscosity? A rectangular block with size 0.6m x 0.6m slides down on an inclined fixed bed as shown in Fig.1 with terminal velocity 1m/s. The gap between block and the bed is 2 mm and is filled by a viscous fluid with viscosity 0.8 Ns/m². Find the weight of the plate.</td>
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<tr>
<td>1(b)</td>
<td>The velocity vector is defined as ( \mathbf{V} = x \mathbf{i} + y \mathbf{j} + z \mathbf{k} )</td>
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<td></td>
<td>(i) Find rotation component along z-direction at point ( P(1,1,1) )</td>
<td>[05]</td>
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<tr>
<td></td>
<td>(ii) Find value of acceleration along -y direction at point ( Q(1,2,1) ).</td>
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<tr>
<td>1(c)</td>
<td>Given velocity potential ( \varphi = xy^2 + 2xy ), find stream function ( \psi ).</td>
<td>[06]</td>
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<td>OR</td>
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<tr>
<td>1’(a)</td>
<td>Explain</td>
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<td></td>
<td>(i) Vorticity</td>
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<td>(ii) Mach Number</td>
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<td></td>
<td>(iii) Potential Flow and</td>
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<td>(iv) Stream Function</td>
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<td>1’(b)</td>
<td>A water droplet of radius ( R ) breaks into ( n ) numbers of smaller droplets. The work done in this process is ( W = 12\pi R n^2 ). Find the value of ( n ).</td>
<td>[05]</td>
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<tr>
<td>1’(c)</td>
<td>Given stream function ( \psi = -xy^2 + 4yxy^2 ), obtain expression for velocity potential ( \varphi ).</td>
<td>[06]</td>
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<tr>
<td>2(a)</td>
<td>Show an inverted U - tube manometer fitted in a pipe line.</td>
<td>[02]</td>
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<tr>
<td>(b)</td>
<td>An equilateral triangular plate of side 1.2 m is vertically immersed in water in such a manner that its base is parallel to free surface and its vertex lies on the free surface. Find hydrostatic force on the plate.</td>
<td>[04]</td>
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<tr>
<td>Qn</td>
<td>Question</td>
<td>Marks</td>
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<td>(e)</td>
<td>A cylindrical object hinged at the bottom and tied at the top with a wire retains water at one side as shown in Fig. 2. If the length of the object 1 m and radius is also 1 m compute the tension in wire.</td>
<td>[09]</td>
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<td>OR</td>
<td>Acknowledge the type of equilibrium of a floating body.</td>
<td>[03]</td>
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<tr>
<td>(b)</td>
<td>A cylinder of diameter 0.4 m having specific gravity 0.9 floats in water.</td>
<td>[05]</td>
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<td>What is the maximum permissible length of the cylinder in order that it may float in stable equilibrium with its axis vertical?</td>
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<td>(c)</td>
<td>An open cylindrical tank of height 1 m and diameter 0.2 m is half filled with water.</td>
<td>[07]</td>
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<td>Determine the maximum speed of rotation to expose (i) centre of the bottom, (ii) one fourth of the bottom area.</td>
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<td>Q3(a)</td>
<td>List out various assumptions made in the derivation of Bernoulli's Equation.</td>
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<td>What are the values of energy and momentum correction factors for laminar flow?</td>
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<td>Calculate the head ‘H’ in Fig. 3 above which cavitation at throat of the tube is to be expected. Barometric pressure is 1.013 bars and vapour pressure of water at 20°C is 2.348 KN/m².</td>
<td>[09]</td>
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<td>OR</td>
<td>3(a) Find the component of the hydrodynamic force on the pipe bend as shown in Fig. 4. The bend is kept on the ground in such a way that point 2 is 0.15 m above point 1. The inlet and outlet diameters of the bend are 20 cm and 10 cm respectively. Pressure at section 1 is 20 kPa and 10 Kg/s mass is entering into the bend. The head loss is 0.05 m of water.</td>
<td>[09]</td>
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<td>What are the practical utilities of momentum and torque equations?</td>
<td>[06]</td>
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<tr>
<td>3(b)</td>
<td>For a lawn sprinkler as shown in Fig. 5, find the speed of rotation in R.P.M. Assume frictionless system. Equal discharge is entering into all arms of the sprinkler.</td>
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<td>What is it necessary to ventilate the region below lower nappe of suppressed weir?</td>
<td>[02]</td>
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<tr>
<td>4(a)</td>
<td>A conical tank of diameter 2 m and height 2 m is completely filled with water. It is to be emptied using an orifice of diameter 5 cm fitted at its vertex. Determine the time of emptying if Cd is 0.62. Centre of the orifice may be assumed as the vertex of cone.</td>
<td>[06]</td>
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<tr>
<td></td>
<td>A weir 36 m long is divided into 12 equal bays by vertical posts of thickness 50 cm. Determine the discharge over the weir if the head over the crest is 1.2 m and velocity of approach is 2 m/s.</td>
<td>[07]</td>
</tr>
</tbody>
</table>

**FIGURES ENCLOSED**

Contd...
1. Enumerate physical properties of minerals with examples. (06)

1'. How the three major rock groups differ in terms of form, structure, texture and mineral composition. (06)

2. Define and classify fault. How faults affect rocks of an area? (12)

OR

2'. What do you understand by endogenous and exogenous processes? How these processes are important in evolution of topography? (12)

3. Write a short account of groundwater system in unconsolidated and consolidated medium and its vertical distribution. (12)

4. Enumerate causes of earthquakes. Discuss the methods of classifying earthquakes and civil engineering measures to minimize its effects. (12)

OR

4'. Discuss the problems of hard and soft ground tunneling and importance of geological factors for safe construction of tunnels. (12)

5. Write short notes on any two of the followings:
   1. Unconformity (06)
   2. Uses and important properties of rocks in construction industry (06)
   3. Engineering Classification of Rock Mass (06)
1. Determine the number of bricks for the room as shown in Fig. 1, required in:
   (i) Superstructure of height 4000 mm and wall thickness of 220 mm
   (ii) Plinth of height 1000 mm
   (iii) Second footing of thickness equal to two bricks
   (iv) First footing of thickness equal to two bricks
   (v) The parapet wall of height 600 mm

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

2(b) What is DPC? Write its purpose and dimensions.

Damp proof course

Contd......2
2'(a) Draw a neat sketch of the foundation plan of the rooms as shown in Fig. 1.

2'(b) Write the standard sizes of:
(i) Door \((1200 \times 2100 \times 229)\) mm
(ii) Window \((900 \times 1200 \times 229)\) mm
(iii) Ventilator \((600 \times 450 \times 229)\) mm

3(a) What is the purpose of rate analysis?

3(b) Analyse the rates for 1st brickwork in foundation and plinth with 20x10x10 cm bricks per cubic metre with 1:6 cement sand mortar.

OR

3' Write short notes on the following
(i) Contract Document  (ii) Earnest Money and Security Deposit

4(a) Write the least dimensions of the front setback, side setbacks and courtyard in a residential building for a plot size of:
(i) 250 sq. m
(ii) 500 sq. m

4(b) Write the least dimensions of
(i) Bed Room  (ii) Drawing cum Dining Room  (iii) Kitchen
(iv) Wash Room  (v) Store  (vi) Width of Internal and External Verandah

4(c) Write short notes on:
(i) Quantity Survey and its Requirement  (iii) Different areas in a Building

5 What is a contract? Discuss in detail the essential requirements of contract.