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| **Q.NO.** | | **QUESTION** | **MARKS** | **YEAR** |
| **1** |  | A solid cylinder of 200 mm diameter and 800 mm length has its base 20 mm thick and of specific gravity 6. The remaining part of the cylinder is of specific gravity 0.6. Find the metacentric height and also state whether it can float or not in water. | **12** | **2016** |
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| **2** |  | If for a two-dimensional potential flow, the velocity potential is given by x(2y-1) determine the velocity at the point P (5,6). Find also the value of stream function at the same point | **12** | **2016** |
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| **3** | **(a)** | If Φ = 3xy, find x and y components of velocity at (2,4) and (3,4). Find the discharge passing between streamlines passing through these points. | **6** | **2015** |
|  | **(b)** | What is flow net? Explain. | **6** |
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| **4** | **(a)** | Define stream line, path line and streak line. | **6** | **2015** |
|  | **(b)** | A wooden block of width 1.25m, depth 0.75m and length 3m is floating in water. Specific weight of the wood is 6.4 KN/m3. Find volume of water displaced and position of centre of buoyancy. | **6** |
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| **5** |  | Each gate of a lock is 6m high and 5m wide, supported on one side by two hinges each 0.5 m from the top and from bottom. The angle between the gates in closed position is 120o. If the water levels are 5m and 1.25m on the upstream and downstream sides respectively, find the magnitude and position of the resultant water pressure on each gate and the magnitude of reaction between the gates. | **12** | **2014** |
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| **6** |  | A wooden block of specific gravity 0.75 floats in water. If the size of the block is 1m×0.5m×0.4m, find its metacentric height. | **12** |
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| **7** | **(a)** | What is continuity equation? Derive the same for two-dimensional flow. | **6** | **2014** |
|  | **(b)** | Define stream function and velocity potential function. Also give the relation between them. | **6** |
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| **8** | **(a)** | A 3m diameter and 3m high wooden cylinder of specific weight 5886 N/m3 is required to float in water with its axis vertical. State whether the body is in stable equilibrium. | **6** | **2013** |
|  | **(b)** | The velocity component in the x-direction in a two dimensional incompressible flow is given by u = 3x2+y2. Using continuity equation, find the velocity component in y-direction. Take the boundary conditions as v = 0 at y = 0. Also find the direction of stream line at a point (2,1) | **6** |
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| **9** |  | A circular plate 3 m in diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 1.5 m respectively. Determine the total pressure on one face of the plate and position of centre of pressure. | **6** | **2012** |
|  |  |  |  |  |
| **10** | **(a)** | Briefly explain various types of fluid flow with examples. | **6** | **2012** |
|  | **(b)** | If for a 2-dimensional potential flow the velocity potential Φ = x2y-1, determine the velocity at point (4,5) and determine Ψ at point (4,5). | **6** |
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| **11** | **(a)** | Show that centre of pressure of hydrostatic forces acting on a plane surface submerged in a homogeneous liquid is always below the centroid of a plane surface, by deriving the expression for the depth of the centre of pressure below the free surface of the liquid. | **6** | **2011** |
|  | **(b)** | Calculate the forces acting on two hinges and also at the clamp in a vertical rectangular door shown in figure, if the height of the water above the door is 5 meters. | **6** |
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| **12** |  | Calculate the unknown velocity components for the following flow field so that they satisfy continuity equation. Assume ρ is constant. u = 2x2 + 2xy and w = z3 - 4xz - 2yz. | **6** | **2011** |
|  |  |  |  |  |
| **13** | **(a)** | Define convective and local acceleration and express them in Cartesian coordinates. | **6** | **2011** |
|  | **(b)** | Two velocity components are given in the following case. Find the third component such that they satisfy the continuity equation. u = log (y2 +z2), v = log (x2 + z2). | **6** |
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| **14** | **(a)** | Explain any method of determination of metacentric height. | **6** | **2010** |
|  | **(b)** | Each gate of lock is 6 m high and 1.8 m wide and is supported on pivots situated 0.6 m from top and bottom. The angle between the gates when they are closed is 1400. If the depth of water on each side is 5 m and 1.5 m respectively, find the magnitude and direction of the resultant water pressure on each gate, the magnitude and direction of two reactions on each of the pivots. Assume the gate reactions act in the horizontal plane as the resultant water pressure. Neglect the weight of the gates. | **6** |
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| **15** | **(a)** | Define and distinguish between steady flow and unsteady flow and show that the flow rate per unit width between stream lines in two dimensional flow is equal to the difference between the values of the stream function corresponding to these streamlines. | **6** | **2010** |
|  | **(b)** | Two velocity components in a two dimensional flow field for an incompressible fluid are expressed as u = 2y and v = 2x. Show that these functions represent a possible case of an irrotational flow and obtain an expression for stream function. | **6** |
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| **16** | **(a)** | Define and distinguish between circulation and vorticity and prove that vorticity in a plane is equal to the twice the rotation component about the axis normal to the plane. | **6** | **2010** |
|  | **(b)** | Prove that the velocity fields u = -Cx and v = -Cy represent a possible case of an irrotational flow | **6** |