

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: BTECH.  
BRANCH: CIVIL ENGINEERING**

**SEMESTER : III/ADD  
SESSION : MO/2024**

**SUBJECT: CE203 FLUID MECHANICS**

**TIME: 3 Hours**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|---|-----|-----|----|
|   |     | CO  | BL |
| Q.1(a) Discuss the Newton's law of viscosity. Differentiate between dynamic viscosity and kinematic viscosity.  | [5] | CO1 | K2 |
| Q.1(b) A cylinder of 0.3 m diameter rotates concentrically inside a fixed cylinder 0.31 m diameter. Both the cylinders are 0.5 m long. Determine the viscosity of the liquid which fills the space between the cylinders if a torque of 1.25 N-m is required to maintain an angular velocity of 50 rpm.   | [5] | CO1 | K3 |
|   |     |     |    |
| Q.2(a) With the help of sketch, define metacenter and metacentric height of a floating body.  | [5] | CO2 | K2 |
| Q.2(b) A circular plate 3.0 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 hydrostatic force on one face of the plate and the position of the center of pressure.  | [5] | CO2 | K3 |
|   |     |     |    |
| Q.3(a) What do mean by non-dimensional numbers? Discuss the following non-dimensional numbers with appropriate expressions.<br>(i) Reynolds number, (ii) Froude number, and (iii) Mach number   | [5] | CO3 | K2 |
| Q.3(b) A vertical venturimeter 30 cm X 15 cm is provided in a vertical pipe to measure the flow of oil of RD = 0.85. The difference in elevations of the throat section and the entrance section is 1 m. The direction of flow being vertically upwards. The U-tube differential manometer shows a reading of 30 cm. Determine the discharge through the pipe. Assume $C_d = 0.95$ .              | [5] | CO3 | K3 |
|   |     |     |    |
| Q.4(a) Derive the condition of critical flow in an open channel.  | [5] | CO4 | K2 |
| Q.4(b) An irrigation channel of a trapezoidal section, having side slopes 3H:2V, is to carry a discharge of 10 m <sup>3</sup> /s on a longitudinal bed slope of 1 in 5000. The channel is to be lined for which the value of Manning's roughness coefficient is 0.012. Find the dimensions of the most economical section of the channel.   | [5] | CO4 | K3 |
|   |     |     |    |
| Q.5(a) Differentiate between an impulse turbine and a reaction turbine. With the help of a sketch, show the component parts of a Francis turbine.   | [5] | CO5 | K2 |
| Q.5(b) A single-acting reciprocating pump has a plunger of diameter 250 mm and a stroke of 350 mm. If the speed of the pump is 60 rpm and it delivers 16.5 liters per second of water against a suction head of 5 m and a delivery head of 20 m, find the theoretical discharge, coefficient of discharge, the slip, the percentage of slip of the pump and the power required to drive the pump. | [5] | CO5 | K3 |

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