

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**  
(MID SEMESTER EXAMINATION SP/2023)

CLASS: B.TECH  
BRANCH: BIOTECHNOLOGY

SEMESTER : IV  
SESSION : SP/2023

SUBJECT: BE209 FLUID MECHANICS AND HEAT TRANSFER

TIME: 02 Hours

FULL MARKS: 25

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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|---|-----|----|---------------|
| Q.1(a) An oil of sp. gr. 0.7 is flowing through a pipe of diameter 300mm at the rate of 500 liters/s. Find the head lost due to friction and power required to maintain the flow for a length of 1000m. Assume $\nu=0.29$ stokes  | [2] | 1  | Knowledge     |
| Q.1(b) An incompressible fluid (kinematic viscosity, $7.4 \times 10^{-7} \text{ m}^2/\text{s}$ , specific gravity, 0.88) is held between two parallel plates. If the top plate is moved with a velocity of 0.5 m/s while the bottom one is held stationary, the fluid attains a linear velocity profile in the gap of 0.5 mm between these plates; Calculate the shear stress in Pascals on the surfaces of top plate?        | [3] | 1  | Understanding |
| Q.2(a) Water is pumped at a rate of $36 \text{ m}^3/\text{h}$ from a tank 2 m below the pump to an overhead pressurized vessel 10m above the pump. The pressure values at the point of suction from the bottom tank and at the discharge point to an overhead vessel are 120 kPa and 240 kPa. All pipes in the system have same diameter. Neglecting frictional losses, What is the power required (Kw) to deliver the fluid? | [5] | 1  | Application   |
| Q.3(a) Rainwater runoff from a parking lot flows through a 3-ft diameter pipe, completely filling it. Whether flow in a pipe is laminar or turbulent? Support your answer with appropriate calculations.  | [2] | 1  | Analysis      |
| Q.3(b) The rate of flow of water through a horizontal pipe is 250 litre/sec, The pipe diameter 200 mm is suddenly enlarged to 400 mm. Find (i) Loss of head (ii) Change in pressure (iii) Loss of fluid power?  | [3] | 2  | Analysis      |
| Q.4(a) The pressures at two sections of a horizontal pipe are $0.3 \text{ kgf/cm}^2$ and $0.6 \text{ kgf/cm}^2$ and the diameters are 7.5 cm, and 15 cm respectively. Determine the direction of flow if water flows at a rate of 8.5 kg/sec. State your assumptions.   | [2] | 2  | Analysis      |
| Q.4(b) A Venturimeter of 10 mm throat diameter is used to measure the velocity of water in a horizontal pipe of 20 mm diameter. If the pressure difference between the pipe and throat sections is found to be 30 kPa then, neglecting frictional losses, the flow velocity is?   | [3] | 2  | Understanding |
| Q.5 Figure shows the schematic for the measurement of velocity of air (density= 1.2 kg/m <sup>3</sup> ) through a constant area duct using a pitot tube and a water tube manometer. The differential head of water (density = 1000 kg/m <sup>3</sup> ) in the two columns of the manometer is 10 mm. Take acceleration due to gravity as 9.8m/s <sup>2</sup> . The velocity of air in m/s is?                                 | [5] | 2  | Application   |

