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Code No: 123BK **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, November/December-2016
FLUID MECHANICS
(Common to CE, CEE)

Time: 3 Hours Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART - A (25 Marks)

1.a) What is vapour pressure? Explain. [2]
b) List out different fluid properties along with their significance. [3]
c) What do you mean by 1-D,2-D,and 3-D flows? [2]
d) Distinguish fluid Statics, Kinematics and Dynamics. [3]
e) Distinguish between notch and weir. [2]
f) Explain about Navier-Stokes equation. [3]
g) What is Vonkarman momentum integral? [2]
h) Explain about boundary layer in transition. [3]
i) Explain Reynolds number. [2]
j) Compare velocity profiles for laminar and turbulent flow in pipes. [3]

PART - B (50 Marks)

2.a) Enunciate Newton's law of viscosity. Explain the importance of viscosity in fluid motion. What is the effect of temperature on viscosity of water and that of air?
b) An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of shaft is 0.5 m and it rotates at 200 rpm. Calculate the power lost in the oil for a sleeve length of 100 mm. The thickness of the oil film is 1.0 mm. [5+5]

OR

3.a) Derive an expression for the depth of centre of pressure of an inclined surface immersed in a liquid.
b) Find the total pressure and the centre of pressure on a vertical gate of the size 4 m × 6 m with 4 m edge coincides with the water surface. Assume one side of gate is filled with water, while on the other side of air. [5+5]

4.a) Define the following:
i) Steady flow,
ii) Non-uniform flow,
iii) Laminar flow, and
iv) Two-dimensional flow.
b) The water is flowing through a taper pipe of length 50 m having diameters 40 cm at the upper end and 20 cm at the lower end, at the rate of 60 litres/s. The pipe has a slope of 1 in 40. Find the pressure at the lower end if the pressure at the higher level is 24.525 N/cm^2. [5+5]

OR

5.a) Define stream line, path line and streak line. Derive mathematical expressions for each of these lines.

b) A 75 cm diameter uniform pipe bend turns the directions of flow of gasoline of sp.gr. 0.79 through an angle of 120^0 in the horizontal plane. The constant pressure and velocity through the bend are 90 KPa and 3 m/s respectively. Find the magnitude and direction of the force to be exerted on the bend to achieve the directional change. [5+5]

6.a) Integrate three-dimensional Euler's equations for steady flow condition and prove that each one of them yields Bernoulli's equation.

b) A pipe of diameter 200 mm conveys a discharge of 2250 litres of water per minute and has a pressure of 15.70 kPa at a certain section. Find the total energy head with respect to a datum of 5 m below the pipe. [5+5]

OR

7.a) Differentiate between:
i) Bernoullis equation and Eulers equation
ii) Velocity head and Pressure head
iii) Energy equation and momentum equation.

b) The centre line of a pipe conveying water is horizontal. The sectional areas at sections 1-1 and 2-2 are 5 m^2 and 2 m^2 respectively. The pressure intensity and velocity at section 1-1 are 39.25 kPa and 1.2 m/sec respectively. Calculate the velocity and pressure at section 2-2. Ignore losses. [5+5]

8.a) What conditions should be satisfied for separation of boundary layer? Discuss briefly the methods that can be used to prevent separation.

b) How will you determine whether a boundary layer flow is attached flow or detached flow or on the verge of separation? [5+5]

OR

9.a) Describe pressure drag and friction drag.

b) What is meant by boundary layer? Explain with a neat sketch, development of boundary layer along a flat plate held parallel to uniform flow. Point out the salient features. [2+8]

10.a) Show that the loss of head due to sudden expansion in pipe line is a function of velocity head.

b) The rate of flow of water through a horizontal pipe is 0.3 m^3/s. The diameter of the pipe is suddenly enlarged from 250 mm to 500 mm. The pressure intensity in the smaller pipe is 13.734 N/cm^2. Determine: (i) loss of head due to sudden enlargement, (ii) pressure intensity in the large pipe and (iii) power lost due to enlargement. [5+5]

OR

11.a) Explain the terms: (i) Pipes in parallel (ii) Equivalent pipe and (iii) Equivalent size of the pipe.

b) Three pipes of lengths 800 m, 600 m and 300 m and of diameter 400 mm, 300 mm and 200 mm respectively are connected in series. The ends of the compound pipe is connected to two tanks, whose water surface levels are maintained at a difference of 15 m. Determine the rate of flow of water through the pipes if $f = 0.005$. What will be diameter of a single pipe of length 1700 m and $f = 0.005$, which replaces the three pipes. [5+5]

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