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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech(Applied Petroleum Engg. With gas spl.) **Semester – III**
Subject (Course): Fluid Mechanics **Max. Marks : 100**
Course Code :GNEG223 **Duration : 3 Hrs**
No. of page/s:3

*The question paper consists of three sections. Answer the questions section wise in the answer booklet.

Note: Assume suitable data wherever necessary. The notations used here have the usual meanings.

SECTION – A (Total Marks: 5 x 4 = 20)

- **Attempt all the questions. All questions carry equal marks.**

1. Define cohesion and adhesion with examples. [4]

2. Define bulk modulus of elasticity. Discuss vapor pressure. [4]

3. Define laminar flow and turbulent flow. [4]

4. Discuss relation between stream function and velocity potential. [4]

5. Find the velocity and acceleration at a point (1,2,3) after 1 second for a three dimensional flow given by u=yz+t, v=xz-t, w=xy m/s. [4]

SECTION-B (Answer all questions, Total Marks=40)

6. In a smooth inclined pipe of uniform diameter 250mm , a pressure of 50 kPa was observed at section 1 which was at elevation 10 m. At another section 2 at elevation 12m , the pressure was 20 kPa and the velocity was 1.25 m/s. Determine the direction of flow and the head loss between these two sections. The fluid in the pipe is water. The density of water at 20 degrees Centigrade and 760 mm Hg is 998 kg/m^3. [8]

7.A horizontal venturimeter with inlet diameter 200 mm and throat diameter 100mm is employed to measure the flow of water. The reading of the differential manometer connected to the inlet is 180mm of mercury. If the coefficient of discharge is 0.98, determine the rate of flow. [8]

8. A submarine fitted with a Pitot tube moves horizontally in sea. Its axis is 12m below the surface of water. The pitot tube fixed in front of the submarine and along its axis is connected to the two limbs of a U-tube containing mercury , the reading of which is found to be 200mm. Find the speed of the submarine . Take the specific gravity of sea- water= 1.025 times fresh water. [8]

9. Derive Euler's equation of motion. [8]

10.a) Derive an expression for the volumetric flow rate in a triangular notch and trapezoidal notch. Write down the advantages and advantages of using orificemeter over a venturimeter.

b)Water is flowing through a pipeline of 50cm ID at 30 degrees Centigrade. An orifice is placed in the pipeline to measure the flow rate. Orifice diameter is 20 cm. If the manometer reads 30 cm of Hg, calculate the water flow rate and velocity of the fluid through the pipe.

Density of water at 30 degrees Centigrade = 987 kg/m^3.

Density of mercury = 13600 kg/m^3.

Orifice co-efficient= 0.6. [8]

OR

10. Crude oil of Coefficient of Viscosity= 1.5 poise and relative density 0.9 flows through a 20 mm diameter vertical pipe. The pressure gauges fixed 20 m apart read 600 kN/m^2 and 200kN/m^2. Find the direction and rate of flow through the pipe.

Derive Hagen-Poiseuille theorem. [8]

SECTION-C(Total Marks=40)

Answer both the questions.

11. a) Discuss minor losses and major losses. [10]

b) Describe, giving a sketch, a micromanometer. Explain how it could be used for measuring small pressure difference. [10]

12. a) A trapezoid 2 m wide at the bottom and 1 m deep has side slopes 1:1. Determine : i)Total pressure; ii) Centre of pressure on the vertical gate closing the channel when it is full of water. [10]

b)An annular plate 2m external diameter and 1m internal diameter with its greatest and least depths below the surface being 1.5 m and 0.75 m respectively. Calculate the magnitude, direction and location of the force acting upon one side of the plate due to water pressure. [10]

OR

a) The velocity along the centerline of a nozzle of length l is given by $V=2t(1-x/2l)^2$ where V= velocity in m/s, t= time in seconds from commencement of flow, x= distance from inlet to nozzle. Calculate the local acceleration, convective acceleration and the total acceleration when t=6sec, x=1m and l=1.6 m. [15]

b) Describe and discuss pathline, streamline, streamtube and streakline. [5]