B.E.(with Credits)-Regular-Semester 2012-Mining Engineering Sem III

MN303 - Fluid Mechanics

P. Pages : 2 **GUG/W/16/3799**

Time : Three Hours * 3 6 3 4 * Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Solve all questions.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and Chemical equations should be given wherever necessary.
6. Illustrate your answers wherever necessary with the help of neat sketches.
7. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodyanmic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
8. I.S.I. Hand book for structural steel section, I.S. code 800/1962 or 1964, I.S. 456 (Revised) I.S. 875 may be consulted.

1. a) Define Newton's law viscosity. Explain the Newtonian & non-Newtonian fluid with Rheological diagram. **8**

b) Determine the capillarity in a glass tube of 2 mm diameter when immersed in water & mercury. The surface tension for water & mercury are 0.072 N/m & 0.52 N/m respectively. Assume specific gravity of mercury as 13.6. **8**

OR

2. a) A cylindrical block of diameter 0.2 m is placed over an inclined plane such that it length is perpendicular to the plane. The weight of the block is 500 N & inclination of a plane is 45^o with the horizontal. The sliding velocity is 0.4 m/sec downwards. There is a lubricant between the block & the plane, whose viscosity is 12.6 poise. Determine the thickness of lubricant is millimeter. **10**

b) Define total pressure & centre of pressure. What is their significance ? Give some engineering examples. **6**

3. a) Differentiate the following : **6**
i) Dynamic viscosity & kinematic viscosity
ii) Gauge pressure & absolute pressure.

b) The velocity components in two dimensional flow field for an incompressible fluid are expressed as : **10**

$$u = \frac{y^3}{3} + 2x - x^2y$$

$$v = xy^2 - 2y - \frac{x^3}{3}$$

Obtain an expression for velocity potential function (ϕ) & stream function (x)

OR

4. a) Distinguish between : **6**
i) Uniform flow & non-uniform flow.
ii) Rotational flow & Irrotational flow.

b) Check if the function $\phi = x^2 - y^2 + y$ represents the velocity potential for two dimensional irrotational flow & determine the corresponding steam function. **10**

5. a) List out various forces influencing motion. Derive Euler's equation of motion & integrate it to obtain Bernoulli's equation. State the assumption made therein. **8**

b) Derive continuity equation in Cartesian co-ordinate form. **8**

OR

6. a) Water flows down an inclined tapering pipe 45 meter long at a slope of 1 in 10. The areas at the upper & lower ends of the pipe are 8 m^2 & 3 m^2 respectively. If the velocity at the lower end is 4.5 m/sec & pressure at the upper end is 100 kPa, calculate the pressure at the lower end & rate of flow through the pipe, Ignore energy losses. **6**

b) What is meant by "Vena Contracta" explain why it is formed. **10**

7. a) Derive the Euler's equation of motion for one dimensional fluid flow & explain Bernoulli's equations for ideal & real fluid alongwith its mathematical expression. **10**

b) Explain working principle of orificemeter with neat sketch. **6**

OR

8. a) Differentiate between centrifugal & reciprocating pump. **6**

b) A centrifugal pump has an impeller with 25 cm inner diameter of 50 cm outer diameter. When running at 600 r.p.m. discharge water at the rate of 8 m^3/min. against head of 8.5 m. The water enter impeller without whirl & shock. Vanes are set at outlet at an angle of 45° & area of flow of impeller is 0.06 m^2. **10**
Determine :
i) The manometric efficiency of pump &
ii) An inlet vane angle.

9. a) Define the coefficient of discharge, % slip & negative slip of reciprocating pump. **8**

b) Explain the working of air lift pump with its merits & demerits. **8**

OR

10. Write short notes on :

i) Cavitation, its effect & prevention. **5**

ii) Maintenance of pump. **5**

iii) Main component parts of centrifugal pump. **6**

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