M.Tech. Heat Power Engineering (CBCS Pattern) Sem-III

PHPS32x / PHPS32(A) - Elective-III : Advanced Fluid Mechanics

P. Pages : 2 **GUG/W/22/11056**

Time : Three Hours * 1 8 4 0 * Max. Marks : 70

Notes : 1. All questions carry equal marks.
2. Assume suitable data wherever necessary.
3. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
4. Discuss the reaction, mechanism wherever necessary.
5. Answer **any five** questions.

1. a) Define with S. I. units specific weight, specific gravity & surface tension. **4**

b) Two glass tubes 'A' & 'B' having diameter 'D' mm & 2 mm respectively are immersed in water at 20ºC one after another. By immersing glass tube B it is observed that capillary rise increases by 50% over a capillary rise of glass tube 'A'. Find out the diameter of glass tube 'A' & capillary rise in both the cases. Take surface tension for water at 20ºC at 0.075N/m **6**

c) Explain the term – intensity of pressure & pressure head. **4**

2. a) Petrol of specific gravity 0.8 flows upward through a vertical pipe. 'A' & 'B' are two point's in a pipe & point 'B' being 30 cm higher than 'A'. Connection are led from 'A' & 'B' to a U – tube containing mercury. If the difference of pressure between 'A' & 'B' is $1.8\,m/cm^2$. Find the reading shown by differential mercury gauge. **6**

b) Determine the capillarity in a glass tube of 2mm diameter when immersed in water & mercury. The surface tension for water & mercury are 0.075 N/m & 0.52 N/m respectively. Assume Sp. Gravity of mercury as 13.6. **4**

c) Explain the phenomenon of Newton's law of viscosity. Also define Newtonian & Non – Newtonian fluid with theoretical diagram. **4**

3. a) Enumerate the limitations that have tube borne in mind & applications of solving various fluids mechanics problems while applying Bernoulli's theorem. **4**

b) What do you mean by meta centre & metacentric height? How do you find the meta centre? **4**

c) Discuss in brief with nautch velocity potential function & stream function. **6**

4. a) Derive the Euler's equation of motion for one dimensional fluid flow. **5**

b) State the principle on which the equation of continuity is based. Obtain an expression for continuity equation for a three dimensional fluid flow. **6**

c) Discuss in brief types of fluid flow. **3**

5. a) A jet of water issuing from an orifice 3.0 cm diameter under a constant head of 1.5 m, pulls 0.915 m vertically before it strikes the ground at a distance of 2.28 m measured horizontally from vena contracta. The discharge was found to be 105 lit / min. Determine $C_c, C_d \& C_v$ for an orifice. **6**

b) Distinguish between laminar flow & turbulent flow. Explain the importance of fluid mechanics. **4**

c) Discuss in brief weir & Notches used in fluid mechanics. **4**

6. a) Explain the following hydraulic coefficient. **6**

i) Coefficient of velocity (C_v)

ii) Coefficient of discharge (C_d)

iii) Coefficient of contraction (C_c)

b) Determine the height of rectangular weir of length 6.5 mtr. To be built across a rectangular channel. The maximum depth of water on the upstream side of the weir is 1.8 m & discharge is 2010 lit /sec. take $C_d = 0.6$ & Neglect and contraction. **8**

7. a) Explain the following **any two**. **6**

i) Flow through branched pipes.
ii) Power transmission through pipes
iii) Water hammer

b) Discuss in brief various losses in pipes & fittings. Also mention the various equations for pipe flow. **4**

c) Explain with the help of neat sketch total energy line & hydraulic gradient line. **4**

8. a) Explain the following **any three**. **6**

i) Boundary layer concept
ii) Boundary layer thickness
iii) Displacement thickness
iv) Momentum thickness

b) Discuss in brief Dimensional Homogeneity, Rayleigh's method, Buckingham's II – theorem. **6**

c) Define drag & lift on immersed bodies. **2**

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