KATHMANDU UNIVERSITY
End Semester Examination [C]
June, 2018

Marks Scored:

Level : B.E.
Year : III
Course : MEEG 301
Semester : I

Exam Roll No. :
Time: 30 mins.
F. M. : 20

Registration No.:
Date : JUN 10 2018

SECTION "A"
[20 Q. ×1 = 20 marks]

Tick the most appropriate answer.

1. When a constant shear force is applied to a fluid
   [ ] it never stops deforming
   [ ] it deforms only after a limiting force
   [ ] it stops deforming after maximum shear angle
   [ ] it assumes a deformed shape as long as the same force is applied

2. Specific volume of a fluid represents
   [ ] weight of fluid per unit volume
   [ ] ratio of mass density of fluid to the mass density of a standard fluid
   [ ] reversed of the mass density
   [ ] prevent governor exceed limits

3. Which of the following represent the ideal plastic fluid
   [ ] no deformation when stressed up to yield stress and beyond that behaves like a Non-Newtonian fluid
   [ ] no deformation when stressed up to yield stress and beyond that behaves like a Newtonian fluid
   [ ] viscosity coefficient is smaller at greater rates of velocity gradient
   [ ] viscosity coefficient is smaller at larger rates of velocity gradient

4. Pressures below atmospheric pressure is measured as
   [ ] gage pressure
   [ ] absolute pressure
   [ ] vacuum pressure
   [ ] both absolute and vacuum pressure

5. A floating object becomes unstable when
   [ ] centroid of the displaced volume is located above the center of buoyancy
   [ ] centroid of the floating object is located above the center of buoyancy
   [ ] centroid of the displaced volume is located below the center of buoyancy
   [ ] centroid of the floating object is located below the center of buoyancy

6. Which of the following expression represents the material derivative of a variable
   [ ] $\frac{d}{dt} = \frac{\partial}{\partial t} + (\vec{\rho} \cdot \nabla)$
   [ ] $\frac{d}{dt} = \frac{\partial^2}{\partial t} + (\vec{v} \cdot \nabla)$
   [ ] $\frac{d}{dt} = \frac{\partial}{\partial t} + (\vec{v} \cdot \nabla)$
   [ ] $\frac{d}{dt} = \frac{\partial^2}{\partial t} + (\vec{p} \cdot \nabla)$

7. Transformation from control systems study to control volume study is given by
   [ ] Lagrangian descriptions
   [ ] Eulerian descriptions
   [ ] Material derivative
   [ ] Reynolds Transport Theorem

8. Devices used for flow rate measurement of liquid through small channel is called
   [ ] Weirs
   [ ] Notches
   [ ] Pitot
   [ ] Orifice

9. The pressure at a point where the fluid is brought to a complete stop is called as
[ ] stagnation pressure [ ] static pressures
[ ] dynamic pressures [ ] none of above

10. The type of control volume chosen for the study of motion of an are plane is
[ ] fixed control volume [ ] moving control volumes.
[ ] expanding control volume [ ] deforming control volumes.

11. The boundary layer thickness for the same flow conditions with high viscos fluid is
[ ] smaller than that of low viscos fluid [ ] larger than that of low viscos fluid
[ ] information on density is also needed [ ] viscosity has no effects

12. In turbulent flow, the hydrodynamic entry length is given by
[ ] $0.05\,\mathrm{Re}\,D$ [ ] $1.395\,\mathrm{Re}\,D$ [ ] $0.05\,\mathrm{Re}\,D^{1/4}$ [ ] $1.395\,\mathrm{Re}\,D^{1/4}$

13. What is the maximum velocity in a pipe with the laminar flow and average velocity 2 m/s
[ ] 4 m/s [ ] 2 m/s [ ] 2.5 m/s [ ] 3 m/s

14. Hydraulic diameter is defined such that
[ ] it represents the same velocity conditions for non-circular tubes to circular tubes
[ ] it represents the same boundary layer for non-circular tubes to circular tubes
[ ] it reduces to diameter of circular tubes to dimensions of non-circular tubes
[ ] it reduces to dimensions of non-circular tubes to diameter of circular tubes

15. If the pumping power requirement is 1 kW with a 2 unit diameter pipe, what is the pumping power requirement for 1 unit diameter pipe with the same flow conditions
[ ] 4 kW [ ] 8 kW [ ] 16 kW [ ] 32 kW

16. Which of the following statement is true for the observation from Moody's chart
[ ] friction factor is independent of Reynolds number for laminar flow
[ ] fiction factor is independent of Reynolds number for transition flows.
[ ] fiction factor is independent of Reynolds number for turbulent flows.
[ ] none of above

17. Minor losses in pipe flows due to change is flow characteristics is proportional to
[ ] velocity of flow [ ] square of velocity of flow
[ ] pressure drop in flow [ ] square of pressure droop in flow

18. For flow in pipes in parallel arrangements
[ ] the head loss is the same in each pipe
[ ] the total head loss is the sum of the head losses in individual pipe
[ ] the flow rate is the same in each pipe
[ ] the pressure is the same in each pipe

19. Normalized equation means
[ ] the equation having the same dimensions in additive terms
[ ] the equation rendered to non-dimensional by dividing each additive terms by a same parameter
[ ] the equation with the non-dimensional terms in the of order unity
[ ] the equation with dimensional homogeneity

20. Which of the following is not the part of CFD process
[ ] Geometry description [ ] Specification of boundary conditions
[ ] Parameterization [ ] Flow solution

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SECTION "B"
[5 Q. ×11 = 55 marks]

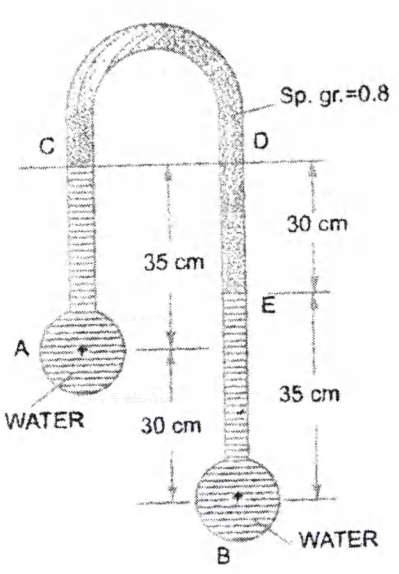
Attempt *ALL* questions.

Q.N.1

a) Explain the principle of pressure measurements by Bourdon Gauge.What do you mean by differential pressure measurement? [2+1]

b) Derive expression to determine the resultant force, and center of pressure for a submerged inclined plane surface [5]

c) Determine the difference of pressure between the pipes as shown in the following figure. [3]



Q.N.2

a) Discuss the properties and applications of stream tubes? [3]

b) What are the different methods of flow measurements commonly applied the fluid flow applications. Discuss the principle of flow measurement by Venturimeter [2+3]

c) The velocity in a fluid flow is given by $V = 4x^3i - 10x^{2yj} + 2tk$. Find the velocity and acceleration of a fluid particle at (2,1,3) at time t=1. [3]

Q.N.3

a) Discuss the formation and characteristics of boundary layer growth in pipe [3]

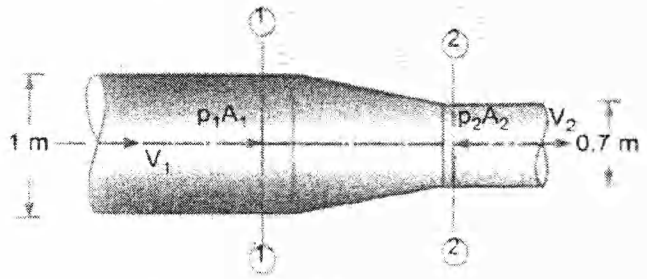
b) Water is flowing over a thin smooth plate of length 4m and width 2m at a velocity of 1.0 m/s. If the boundary layer flow changes from laminar to turbulent at a Reynold'snumber $5x10^5$, find (i) the distance from the leading edge up to which boundary layer is laminar, (ii) thickness of boundary layer at the transition point and drag force (iii) the drag force on one side of the plate. Take viscosity of water to be $9.81x10^{-4}$ Ns/m^2. [5]

c) A crude oil of kinematic viscosity 0.4 stroke is flowing through a pipe of diameter 300 mm at the rate of 300 lit per sec. Find the head loss due to friction for a length of 50 m of the pipe. [3]

Q.N.4

a) Draw the Moody Chart showing the important parameters [3]

b) The diameter of a pipe gradually reduces from 1 m to 0.7 m as shown in the figure. The pressure intensity at the center-line of 1 m section is 7.848 kN/m^2 and rate of flow of water through the pipe is 600 lit/s. Find the intensity of pressure at center line of 0.7 m section. Also determine the force exerted by flowing water on the transition of the pipe. [5]



c) Experiments were conducted in a wind tunnel with a wind speed of 50 km/hr on a flat pate of size 2 m long and 1 m wide. The density of air is 1.15 kg/m^3. The co-efficient of lift and drag are 0.75 and 0.15 respectively. Determine: (i) the lift force (ii) the drag force, (iii) power exerted by air on the plate. [3]

Q.N.5

a) With example discuss dimensional homogeneity and its application [3]

b) Using Buckingham's Π-theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gh}\, f\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$. [5]

c) Derive the expression to calculate the flow rate in inclined pipes with the diameter D, length L, viscosity μ, Pressure difference ΔP, and inclination θ. [3]