Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

MAR 3 0 2017

Level : B.E.
Year : II

Course : CIEG 204
Semester : I

Exam Roll No. :

Time : 30 mins.

F. M. : 10

Registration No. :

Date :

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Tick (✓) the most appropriate answer.

1. The weight per unit volume of liquid at a standard temperature and pressure is called
   a. Mass density b. Specific gravity c. Specific weight d. Specific volume

2. Gauge pressure at a point is equal to
   a. The sum of absolute pressure and atmospheric pressure
   b. The difference of absolute pressure and atmospheric pressure
   c. The sum of vacuum pressure and absolute pressure
   d. The difference of atmospheric pressure and gauge pressure

3. Bourdon gauge measures
   a. Absolute pressure b. Gauge pressure
   c. Local atmospheric pressure d. Standard atmospheric pressure

4. Centre of pressure of a plane surface immersed in a liquid is
   a. Above the centre of gravity of the plane surface
   b. At the centre of gravity of the plane surface
   c. Below the center of gravity
   d. At the surface of liquid

5. When a vertical wall is subjected to pressure due to liquid on both sides, the resultant pressure is the _____ of the two pressures.
   a. Sum b. Difference c. Arithmetic mean d. Geometric mean

6. For a submerged curved surface, the vertical component of the hydrostatic force is
   a. Mass of the liquid supported by the curved surface
   b. Weight of the liquid supported by the curved surface
   c. The force on the projected area of the curved surface on vertical plane
   d. Area of curved surface

7. A floating body is in stable equilibrium when
   a. The metacentric height is zero
   b. Its center of gravity is below the center of buoyancy
   c. The metacenter is above the center of gravity
   d. The metacenter is below its center of gravity

8. When a body is immersed, wholly or partly, in a liquid it is lifted up by a force equal to the weight of liquid displaced by the body. This statement is called
   a. Pascal's law b. Archimedes' principle
   c. Principle of floatation d. Bernoulli's theorem

9. According to Bernoulli's equation
   a. $z+p/\gamma+v^2/2g=$ constant
   b. $z-p/\gamma+v^2/2g=$ constant
   c. $z-p/\gamma-v^2/2g=$ constant
   d. $z+p/\gamma-v^2/2g=$ constant

10. The ratio of actual discharge of a jet of water to its theoretical discharge is known as
   a. Coefficient of discharge
   b. Coefficient of velocity
   c. Coefficient of contraction
   d. Coefficient of viscosity

11. The ratio of inertia and viscous forces acting in any flow ignoring other forces is called
   a. Euler number b. Froude number c. Reynold's number d. Weber number

12. The dimension of dynamic viscosity are
   a. $MLT^{-1}$ b. $ML^{-1}T$ c. $ML^{-1}T^{-1}$ d. ML-T

13. The loss of head due to sudden enlargement in a pipe is expressed by
   a. $(v_1^2-v_2^2)/2g$ b. $(v_1^2-v_2^2)/g$ c. $(v_1-v_2)^2/2g$ d. $(v_1-v_2)^2/g$

14. Uniform flow occurs
   a. Whenever the flow is steady
   b. When $(\partial v/\partial t)$ is zero everywhere
   c. Only when the velocity vector at any point remains constant
   d. When $(\partial v/\partial s)=0$

15. Steady flow occurs when
   a. Conditions do not change with time at any point
   b. Conditions are the same at adjacent points at any instant
   c. When $(\partial v/\partial s)$ is constant
   d. Conditions change steadily with the time

16. A control volume refers to
   a. a fixed region in space
   b. a specified mass
   c. a closed system
   d. a reversible process only

17. Notch is a device used for measuring
   a. Rate of flow through pipes
   b. Rate of flow through a small channel
   c. Velocity through a pipe
   d. Velocity through a small channel

18. Newton's law of viscosity relates
   a. Pressure, velocity and viscosity
   b. Shear stress and rate of angular deformation in a fluid
   c. Shear stress, temperature, velocity and viscosity
   d. Pressure, viscosity and rate of deformation

19. Lift force ($F_L$) is expressed mathematically as
   a. $F_L=\frac{1}{2}\rho U^2*C_L$ b. $F_L=\frac{1}{2}\rho U^2*C_L*A$ c. $F_L=2\rho U^2*C_L*A$ d. $F_L=\rho U^2*C_L*A$
   Where the symbol has their usual meaning

20. Time of emptying a tank through an orifice at its bottom is given by
   a. $2A\sqrt{H_1}/C_d*a^2*2g$
   b. $2A\sqrt{H_1}/C_d*a^2*\sqrt{2g}$
   c. $A\sqrt{H_1}/C_d*a^2*\sqrt{2g}$
   d. $4A\sqrt{H_1}/C_d*a^2*\sqrt{2g}$

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F. M. : 40

SECTION "B"

Make suitable assumptions when needed. The figures in the parenthesis indicate the marks allocated for the question.

1. Derive the continuity equation of two dimension, $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$ [5]

2. Inside a 60 mm diameter cylinder a piston of 59 mm diameter rotates concentrically. Both the cylinder and piston are 80 mm long as shown in Figure 1. If the space between the cylinder and piston is filled with oil of viscosity of 0.3 NS/m$^2$ and a torque of 1.5 Nm is applied, find the rpm of the piston and the power required. [4]

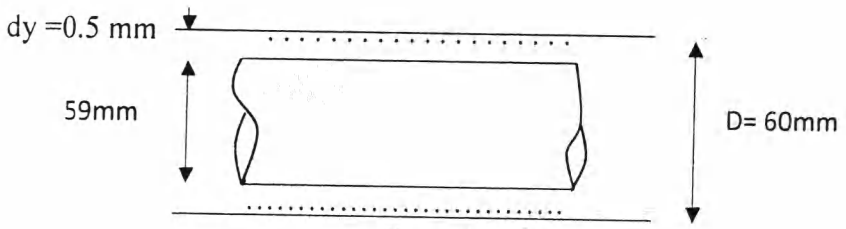



Figure 1

**OR**

Two large fixed parallel planes are 12 mm apart. The space between the surfaces is filled with an oil of viscosity of 0.9 NS/m$^2$. A flat thin plate 0.2 m$^2$ area moves through the oil at a velocity of 0.25 m/s. Calculate the drag force

i. When the plate is equidistant from the planes as shown in Figure 2a
ii. When the thin plate is at a distance of 3.5mm from one of the plane surfaces Figure 2b.

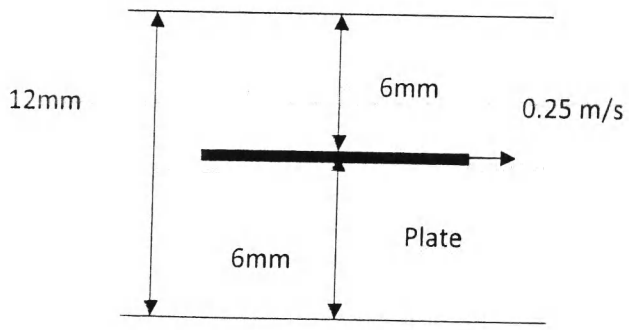



Figure 2a

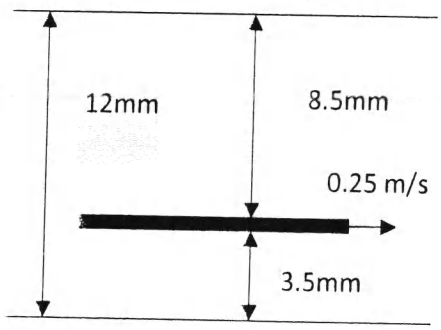



Figure 2b

3. Explain boundary layer theory with neat diagram. [3]

4. A pipe of diameter 300 mm carries water at a velocity of 20 m/s as shown in Figure 3. The pressure at points A and B are given as 294.3 kN/m$^2$ and 225.63 kN/m$^2$ respectively while the datum head at A and B are 20 m and 30 m. Find the loss of head between A and B. [3]

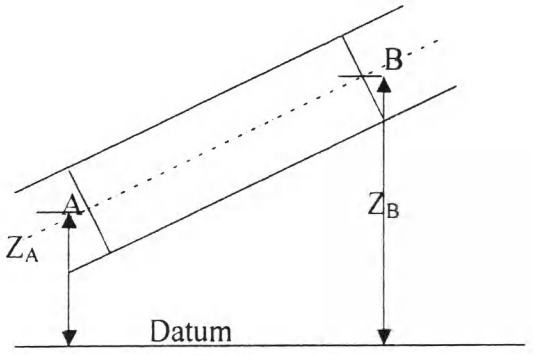


Figure 3

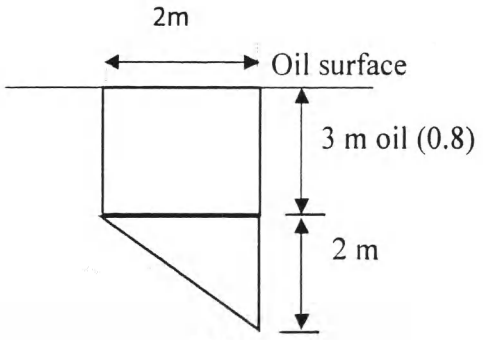


Figure 4

5. Calculate the resultant hydrostatic pressure and its centre of pressure on the vertical plane shown in Figure 4. [5]

6. An orificemeter consisting of 0.1 m diameter orifice in 0.25 m diameter pipes has a coefficient of 0.65. The pipe delivers oil of specific gravity 0.8. The pressure difference on the two sides of the orifice plate is measured by mercury oil differential manometer. If the differential gauge reads 0.8 m of mercury. Calculate the rate of flow in cumecs. [4]

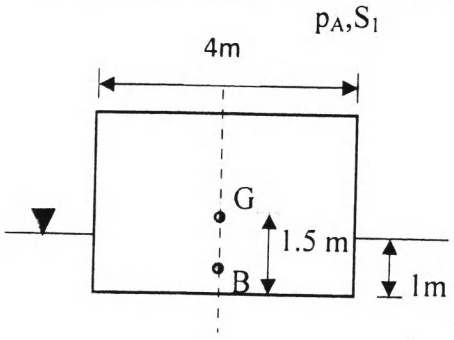
**OR**

Find the discharge over a rectangular notch of width 6 m. The head of water over the notch is 1.5 m. The velocity of approach given as 0.05 m/s. Take $C_d = 0.6$

7. Write short notes on [ *ANY THREE* ] [3 × 3 = 9]
   a. Path line, Stream line and Streak line
   b. Drag and lift force
   c. Pascal's law
   d. Sluice gate
   e. Bulk modulus and Compressibility

8. What is Dimensional analysis? Describe Rayleigh's method of Dimensional analysis? [3]

9. A barge has a depth of immersion of 1m from its base. If it is 4m wide, 15m long, and 3m depth of uniform cross section, Find the metacentric height. [4]




**OR**

Figure 5 shows a U-tube differential manometer connecting two pressure pipes at A and B. The pipe A contains a liquid of specific gravity 1.6 under a pressure of 110 kN/m$^2$. The pipe B contains oil of specific gravity 0.8 under a pressure of 200 kN/m$^2$. Find the difference of pressure measured by mercury as fluid filling U-tube.

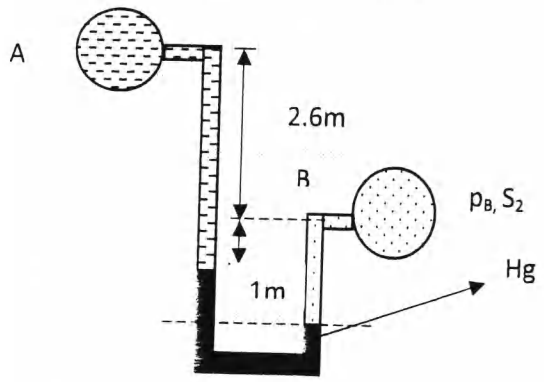



Figure 5