Enrollment No: _____   Exam Seat No:_____

C.U.SHAH UNIVERSITY
Summer Examination-2018

Subject Name: Fluid Mechanics

Subject Code: 4TE04FME1   **Branch: B.Tech (Mechanical, Automobile)**

Semester: 4   **Date: 26/04/2018**   **Time: 10:30 To 01:30**   **Marks: 70**

Instructions:
(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1   **Attempt the following questions:**   **(14)**

A. The property of fluid by virtue of which it offers resistance to shear is called
(a) Surface tension   (b) Adhesion   (c) Cohesion   (d) Viscosity

B. _____ is the ability of fluid to change its volume under pressure.
(a) Vapour pressure   (b) Surface tension
(c) Compressibility   (d) Capillary

C. The bulk modulus of elasticity with increase in pressure
(a) Increases
(b) Decreases
(c) Remains constant
(d) Increases first up to certain limit and then decreases

D. The stress-strain relation of the newtonean fluid is
(a) Linear   (b) Parabolic   (c) Hyperbolic   (d) Inverse type

E. Falling drops of water become spheres due to the property of
(a) Surface tension   (b) Adhesion   (c) Cohesion   (d) Viscosity

F. The resultant upward pressure of a fluid on a floating body is equal to the weight of the fluid displaced by the body. This definition is according to
(a) Buoyancy   (b) Equilibrium of a floating body
(c) Archimedes' principle   (d) Bernoulli's theorem

G. For a floating body to be in stable equilibrium, its metacentre should be
(a) Below the center of gravity   (b) Below the center of buoyancy
(c) Above the center of buoyancy   (d) Above the center of gravity.

H. Which of the following is the unit of kinematic viscosity

(a) Pascal   (b) Faraday   (c) Poise   (d) Stroke

I. The equation of continuity holds good when the flow
(a) Is steady   (b) Is one dimensional
(c) Velocity is uniform at all the   (d) All of the above

J. The flow along a closed curve is called
(a) Ir-rotational flow   (b) Rotational flow
(c) Circulation   (d) Vorticity

K. The ratio between inertia force with respect to viscous flow is known as
(a) Froude's number   (b) Weber''s number
(c) Mach number   (d) Reynold's number

L. Flow having Mach number 1 is known as
(a) Sonic flow   (b) Supersonic flow
(c) Subsonic flow   (d) Hypersonic flow

M. A grid obtained by drawing series of equipotential lines and stream lines is known as
(a) Flow net   (b) Potential function
(c) Stream function   (d) None

N. The fluid forces considered in the Navier-Stokes equation are
(a) Gravity, pressure and turbulent
(b) Gravity, pressure and viscous
(c) Pressure, viscous and turbulent
(d) Gravity, viscous and turbulent

Attempt any four questions from Q-2 to Q-8

Q-2   **Attempt all questions**

a) Explain the condition of stability for a submerged and floating body with neat diagram   **(07)**

b) Explain the following terms: **(07)**
     i.   Surface tension
     ii.   Cavitation
     iii.   Metacenter
     iv.   Dynamic viscosity
     v.   Specific gravity
     vi.   Ideal fluid
     vii.   Bulk modulus

Q-3   **Attempt all questions**

a) Derive Euler's equation of motion. Also state and derive Bernoulli's equation.   **(07)**

b) Explain stream function and potential function for uniform flow. A stream function is given by $\psi = x^2 - y^2$. Determine the corresponding velocity   **(07)**

potential function.

Q-4   **Attempt all questions**

a)   Write a brief note on Inverted U tube manometer.   **(03)**

b)   Obtain an expression for capillary rise of liquid.   **(04)**

c)   What is venturimeter? Derive an expression for the discharge through a venturimeter.   **(07)**

Q-5   **Attempt all questions**

a)   Two plate spaced at 5 mm distance creates shear stress0.25 N/m^2, when upper plate is moving at a velocity of 2.5 m/s. if the mass density of oil is 900 kg/m^3. Find the dynamic and kinematic viscosity of oil.   **(03)**

b)   A pipe is having diameters 30 cm and 15 cm at the cross sections 1 and 2 respectively through which water is flowing. The velocity of water at section 1 is given as 5 m/s. Determine the velocity head at section 1 and 2, and flow rate in a pipe.   **(04)**

c)   Explain briefly: **(07)**
   i.   Steady flow and unsteady flow
   ii.   Uniform flow and non-uniform flow
   iii.   Laminar flow and turbulent flow
   iv.   Rotational flow and irrotational flow

Q-6   **Attempt all questions**

a)   Explain Buckingham's π – theorem for dimensional analysis.   **(07)**

b)   Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 25 N/cm^2 and the pressure at the upper end is 10 N/cm^2. Determine the difference in the datum head if the rate of flow through pipe is 45 lit/sec.   **(07)**

Q-7   **Attempt all questions**

a)   Derive equation for total pressure and center of pressure for vertically immersed surface.   **(07)**

b)   Derive the Hagen-Poiseuille equation for laminar flow in the circular pipe.   **(07)**

Q-8   **Attempt all questions**

a)   Derive an expression of continuity equation for 3-D flow and reduce it for steady, incompressible 2-D flow in Cartesian coordinate system.   **(07)**

b)   Define Mach number. Derive the equation for velocity of sound wave in a compressible fluid in terms of bulk modulus and density.   **(07)**