C.U.SHAH UNIVERSITY
Summer Examination-2017

Subject Name : Fluid Mechanics- II

Subject Code : 4TE04FLM1   **Branch: B.Tech (Civil)**

Semester : 4   **Date : 05/05/2017**   **Time : 02:00 To 05:00**   **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)   What does existence of velocity potential in fluid-flow indicates?   1

b)   Identify the law associated with each flow situation.   1

Column A	Column B
(1) Newton's 1st law of motion	(a) Analysis of laminar flow
(2) Newton's 2nd law of motion	(b) Analysis of compressible fluid flow
(3) First law of thermodynamics	(c) Energy transformation in flow system
(4) Second law of thermodynamics	(d) Force exerted by fluid flow on pipe bend
(5) Newton's law of viscosity	(e) Hydrostatic force on submerged bodies and stability of floating bodies

c)   Identify the correct combination of forces represented by equation on left side   1
column
(1) Navier Stokes equation   (a) F_g, F_p, F_v, F_t
(2) Reynolds's equation   (b) F_g, F_p
(3) Euler's equation   (c) F_g, F_p, F_v

d)   Cd of venturimeter lies within the limits _____ .   1

e)   Write the dimension for circulation?   1

f)   Laminar flow through circular tube was studied experimentally by _____ .   1

g)   In laminar flow the Darcy-Weisbach friction factor depends only on the 'Re'   1
number as _____ .

h)   Define critical depth for an open channel flow.   1

i)   Define manometric head?   1

j)   Velocity distribution in turbulent flow is _____ .   1

k) Give the relation between Chezy's constant and Manning's constant.   1

l) Select the number of blades for the following turbines   1

     (a) Pelton Turbine   (1) 16-21
     (b) Francis Turbine   (2) 3-6
     (c) Kaplan Turbine   (3) 18-33

m) What is the most essential feature of turbulent flow ?   1

n) Give the dimension of drag force.   1

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

Q-2 Attempt all questions   **(14)**

a) Define the following terms (i) Fluid mechanics (ii) 1st Law of Thermodynamics (iii) Velocity potential (iv) Newton's 2nd Law of motion (v) 2nd Law of Thermodynamics (vi) Turbine.   6

b) A jet of water 20mm diameter nozzle leaves the tip with 15m/s and is directed vertically upwards. If the jet remains circular, work out its diameter at a point 5m above the nozzle tip. Neglect any loss of energy.   4

c) Given the velocity field V= $(6+2xy+t^2)$i – (xy^2+10t)j + 25k. What is the acceleration of a particle at (3, 0, 2) at time t=1sec.   4

Q-3 Attempt all questions   **(14)**

a) Define the following (i) Stream function (ii) Hydraulic radius (iii) Momentum principle (iv) Stoke's Law (v) Steep slope of channel (vi) Mild slope of channel.   6

b) Explain the Reynold's apparatus with neat sketch. Demonstrate the experiment procedure and mention its use for fluid flow problems.   6

c) Explain the components of acceleration of fluid with equation.   2

Q-4 Attempt all questions   **(14)**

a) Derive the continuity equation in polar coordinates.   6

b) Oil is flowing through a pipe of 0.25m diameter having viscosity equal to 1.5N.s/m^2. Compute the shearing stress at the pipe wall and within the fluid 50mm from the pipe wall, if the maximum velocity is 3m/s at the centre of the pipe. Take sp. gravity of oil as 0.85.   4

c) Draw specific energy curve and mention its uses for channel flow problems.   2

Q-5 Attempt all questions   **(14)**

a) Derive conditions for most efficient rectangular channel section.   4

b) A fluid of viscosity 0.98poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100mm and of length 12m. Calculate the difference of pressure at the two ends of the pipe, if 120kg of fluid is collected in a tank in 30 seconds.   5

c)	Two reservoirs with water level difference of 30m are to be joined by 0.8m diameter pipe. Calculate the discharge when a cast iron rough pipe of roughness k=0.02mm is used. The length of pipe is 5km. What will be the percentage increase in discharge if the cast iron pipe is replaced by steel rough pipe of same diameter having roughness k=0.01mm. Neglect minor losses.	5

Q-6 Attempt all questions   **(14)**

  a) Explain the various methods of measurement of viscosity with neat sketches.   6

  b) Determine the average height of irregularities 'k' for a rough pipe of 12.5cm diameter if the velocity at a point 3.5cm from wall is 40% more than the velocity at 1cm from pipe wall.   6

  c) Draw venturimeter and explain its parts.   2

Q-7 Attempt all questions   **(14)**

  a) An irrigation lined canal of rapezoidal section has to carry a discharge of 12cumec at a longitudinal slope of 0.0048. Find the dimensions of most economical section if channel has side slope of 3 horizontal to 2 vertical. Take n=0.013.   5

  b) Compute the bottom width of a rectangular channel required to carry a discharge of 18cumec as a critical flow with depth of flow equal to 1.5m.   4

  c) A sluice gate discharges water into a horizontal rectangular channel with a velocity of 8m/s and depth of water is 0.5m. The width of the channel is 5m. Determine whether a hydraulic jump will occur, and if so, find its height and corresponding loss of energy.   5

Q-8 Attempt all questions   **(14)**

  a) Give the difference between reaction turbine and impulse turbine.   6

  b) Explain principle and working of pelton wheel turbine.   8