

## GANPAT UNIVERSITY

B. Tech. Semester: 4<sup>th</sup> Civil Engineering

Regular Examination April - June 2015

## 2CI 405 Fluid Mechanics II

Time: 3 Hours / As per Scheme

Total Marks: 70

- Instruction:**
- 1 All Questions are Compulsory.
  - 2 Figure to the Right indicates Full Marks.
  - 3 Assume Suitable Data if necessary.

## Section - I

- Q1 (A) Define Hydraulic Gradient line and Total Energy Line. In which 6  
circumstances the Total Energy Line and Hydraulic Gradient line would be  
[i] parallel [ii] Non-parallel and [iii] identical?
- (B) Derive on the basis of dimensional analysis suitable parameters to present 6  
the thrust developed by a propeller. Assume that the thrust P depends upon  
the angular velocity, speed of advance V, diameter D, Dynamic viscosity  $\mu$   
, mass density  $\rho$ , elasticity of the fluid medium which can be denoted by  
the speed of sound in medium C.

OR

- Q1 (A) Define 'Syphon'. Discuss the limit of summit height of syphon pipe above 6  
the free surface of the source.
- (B) In order to estimate the drag force on an airplane that cruises at 100m/s, 6  
wind-tunnel test is carried out on a 1: 15 scale model. The airplane cruises  
at an altitude where there is 10% drop in standard atmospheric pressure.  
The wind tunnel test is also carried out at 100m/s and the measured drag  
force in one of the test is 5N. Determine the required air pressure in the  
tunnel and drag force on the prototype (assuming the same air temperature  
for the model and prototype).
- Q2 (A) A 7.5 m wide rectangular channel conveys  $12\text{m}^3/\text{sec}$  of water with a 6  
velocity of 1.5m/s. make calculation for : (i) specific energy (ii) depth of  
water for minimum value of specific energy (iii) critical velocity
- (B) State the Chezy's, Bazin's, Kutter's and manning's formulas for uniform 5  
flow through channel. What are the dimensions of constant C in chezy's  
formula?

OR

- Q2 (A) Design a concrete lined channel to carry a discharge of  $500\text{m}^3/\text{sec}$  at a slope 6  
of 1 in 4000. The side slopes of channel may be taken as 1:1. The  
manning's roughness co-efficient for the lining is 0.014. assume the  
permissible velocity in the section is 2.5m/s.
- (B) Explain specific energy curve. What do you understand by critical depth of 5  
an open channel when the flow in it is not uniform?
- Q3 (A) Write a short note on Water Hammer phenomenon. 4
- (B) Define distorted model, Reynolds number and Froude number. 4

- (C) A rectangle channel carries a uniform flow with a Froude number 3.25. Find out the ratio of critical depth to the normal depth to this flow. 4

### Section – II

- Q 4 (A) Define: streamlines streak lines and path lines. Distinguish between Lagrangian and Euler's methods of study of Fluid flow. 6
- (B) A stream function follows the law  $\psi = 2x^2 - 3y^2$  [m units]. Find the velocity components at a point (1,2). 6

OR

- Q 4 (A) Define velocity potential function  $[\phi]$  and stream function  $[\psi]$ . Show that equipotential lines are orthogonal to the stream lines at all points of intersection. 6
- (B) In a two dimensional flow, the velocity component in the X direction is  $u = 6x - 2x^2y + y^3$ . For the flow to be continuous, find the velocity component in the Y direction. 6
- Q 5 (A) Derive an expression for Shear stress distribution, velocity distribution, Maximum velocity, Ratio of Maximum and Average Velocity for viscous flow passing through a circular pipe. 6
- (B) Find the velocity and acceleration at point (2, 4, 2) after 3 seconds for a 3-D flow field given by  $u = yz + t$ ,  $v = xz - t$  and  $w = xy$  m/s. 5

OR

- Q 5 (A) A town of 3.5 lac population is to be supplied water from a reservoir at a distance of 5 km. The lowest water level in the reservoir is 20 m below the water works of the town. Considering the per capita consumption of 140 lpd and the power availability for the operation of pumps to be 16 hrs. and maximum demand is 1.5 times that of the average demand, find the dia. of supply pipe and the HP of the pump to be installed. [Take friction factor  $f = 0.005$  and pump efficiency as 70%]. 6
- (B) A fluid of viscosity  $0.8 \text{ Ns/m}^2$  and Sp. gravity 1.15 is flowing through a pipe of dia. 80 mm. The maximum shear stress at the pipe wall is given as  $75 \text{ N/m}^2$ . Find:  
[i] Pressure gradient.  
[ii] The average velocity.  
[iii] Reynolds number of the flow. 5
- Q 6 Write a brief note with neat sketch/diagram for any three of the followings. 12
- (A) Reynolds Experiments
  - (B) Rotating Cylinder type Viscometer
  - (C) Characteristics of Turbulent flow
  - (D) Boundary Layer
  - (E) Hydro dynamically smooth and rough boundaries

END OF PAPER