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**MMTP - 104****M.E./M.Tech. I Semester**

Examination, December 2015

**Advance Fluid Mechanics***Time : Three Hours**Maximum Marks : 70*

- Note :* i) Answer any five questions.  
 ii) All questions carry equal marks.  
 iii) Assume suitable data if necessary.

1. a) Discuss basic laws related with fluid mechanics.  
 b) Derive the following continuity equation  

$$\frac{D\rho}{Dt} + \rho \nabla \cdot \mathbf{V} = 0$$
2. a) Discuss in detail Reynolds Transport theorem and its applications.  
 b) Write note on local and material derivatives.
3. A conical vessel with base upper most is rotated about its axis which is vertical. The vessel was filled completely with water at rest. After rotating the vessel at 60 r.p.m. only 0.0142 m<sup>3</sup> of water remained in it. Calculate the ratio of the radius of the base to its height.

4. The velocity components of two dimensional plane motion of a fluid are

$$u = \frac{y^2 - x^2}{(x^2 + y^2)^2} \text{ and } v = \frac{-2xy}{(x^2 + y^2)^2}$$

Determine the discharge across a line joining point (1,1) and (2,2) given that the thickness of the fluid stream normal to the x-y plane is "t".

5. a) Describe the use and limitations of flow nets.  
 b) Derive the pressure equation.
6. a) Discuss the separation of boundary layer.  
 b) Discuss stagnation pressure in compressible flows.
7. a) Obtain an expression for the work done per second by water on the runner of a Pelton wheel. Hence drive an expression for maximum efficiency of the pelton wheel.  
 b) Discuss in detail main parts of a centrifugal pump.
8. Write short notes on any four of the following :  
 a) Concept of continuum  
 b) Control mass and control volume analysis  
 c) N-S equations  
 d) Sonic properties  
 e) Proto-type testing

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