

**Government College of Engineering, Aurangabad**  
(An Autonomous Institute of Government of Maharashtra)  
**M.E. (Water Resources Engineering) Examination**  
End Semester Examination .....

**CE-544 & CE 504 –ADVANCED FLUID MECHANICS**

Time: Three Hours

5 DEC 2016

Max. Marks:60

*“Verify the course Code and check whether you have got the correct question paper”*

- N.B.:-
1. All questions are compulsory
  2. All questions carry equal marks
  3. Assume suitable data if necessary and state it clearly

Q.No. 1 Solve any two (2 X 6 = 12)

- a) State the Newton’s law of viscosity? Explain the importance of viscosity in fluid motion? What is the effect of temperature on viscosity of water and air?
- b) Define Newtonian and Non Newtonian fluids?
- c) The velocity vector in a fluid flow is given by  $v = 2x^3i - 5x^2yj + 42tk$  Find the velocity and acceleration of a fluid particle at (1, 2, 3) at time  $t=1$ .

Q. No. 2 Solve any Two (2 X 6 = 12)

- a) State the momentum equation? How will you apply momentum equation for determining the force exerted by a flowing liquid on a pipe bend?
- b) Define moment of momentum equation. Where this equation is used.
- c) An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. Oil of sp.gr. 0.8 is flowing through the orifice meter in which the pressure difference is measured by mercury oil differential manometer on the two sides of the orifice meter; Find the rate of flow of oil when the reading of manometer is 40. Coefficient of discharge for the meter is given as 0.6.

Q.No. 3 Solve Any two (2 X 6 = 12)

- a) Define the terms
  - i. Displacement thickness
  - ii. Energy thickness
- b) Air is flowing over a smooth plate with a velocity of 10 m/s. The length of the plate is 1.2 m and width is 0.8 m. If laminar boundary layer exists up to a value of  $Re = 2 \times 10^5$ , find the maximum distance from the leading edge up to which laminar boundary layer exists. Take kinematic viscosity of air =0.15 stokes.
- c) Water is flowing through a 20 cm dia pipe with coefficient of friction  $f=0.04$ , The shear stress at a point 4 cm from the pipe axis is 0.00981 N/cm<sup>2</sup>. Calculate the shear stress at the pipe wall.

Q.No. 4 Solve any two (2 X 6 = 12)

- a) What do you understand by turbulent flow? What factor decides the type of flow in pipes?

- b) Explain Prandtl mixing length theory for turbulent shear stress?
- c) Two reservoirs with a surface level difference of 20 m are to be connected by 1.0 m diameter pipe 6 km long. What will be the discharge when a cast iron pipe of roughness  $k=0.3$  mm is used. Neglect all local losses.

Q. No. 5 Solve any Two

(2 X 6 = 12)

- a) Define the term dimensional analysis and model analysis? What do you mean by fundamental units and derived units?
- b) Define the terms
  - i) Model analysis
  - ii) Hydraulic similitude
- c) Find the expression for the power P, developed by a pump when P depends upon the head H, the discharge Q and specific weight  $w$  of the fluid?