B.E./B.TECH. Degree Examination, December 2020

Fourth Semester

ME16404-Fluid Mechanics and Machinery

(Regulation 2016)

Time: Three hours Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. A fluid is said to be ideal, if it is
   (a) incompressible
   (b) inviscous
   (c) viscous and incompressible
   (d) inviscous and compressible
   (e) inviscous and incompressible
2. Falling drops of water become spheres due to the property of
   (a) adhesion
   (b) cohesion
   (c) surface tension
   (d) viscosity
   (e) compressibility.
3. Euler's dimensionless number relates the following
   (a) inertial force and gravity
   (b) viscous force and inertial force
   (c) viscous force and buoyancy force
   (d) pressure force and inertial force
   (e) pressure force and viscous force
4. When a piping system is made up primarily of vertical lift and very little pipe friction, the pump characteristics should be
   (a) horizontal
   (b) nearly horizontal
   (c) steep
   (d) first rise and then fall
   (e) none of the above
5. What is effect of vapor pressure on a fluid?
6. Where is the equivalent pipe concept is applied in pipe flow?
7. What is application of Reynolds number in conducting dimensional analysis?
8. Compare specific speed of a turbine and pump

PART B - (4 X16 = 64 marks)

09. (a) If the velocity profile of a fluid over a plate is parabolic with the vertex 20 cm from the plate, where the velocity is 120 cm/sec. Calculate the velocity gradients and shear stresses at a distance of 0, 10 and 20 cm from the plate, if the viscosity of the fluid is 8.5 poise. **(16)**

(OR)

(b) The inlet and throat diameters of a horizontal Venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of Cd for the Venturimeter. **(16)**

10. (a) The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is11.772 N/cm^2. Determine:
(i) loss of head due to sudden enlargement, (ii) pressure intensity in the large pipe,
(iii) power lost due to enlargement **(16)**

(OR)

(b) A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f = 0.01 for both sections of the pipe. **(16)**

11. (a) The impeller of a centrifugal pump is 0.5m in diameter and rotates at 1200 rpm. Blades are curved back to an angle of 30 ° to the tangent at outlet tip. If the measured velocity of flow at outlet is 5 m/s, find the work input per kg of water per second. Find the theoretical maximum lift to which the water can be raised if the pump is provided with whirlpool chamber which reduces the velocity of water by 50%. **(16)**

(OR)

(b) The cylinder bore diameter of a single acting reciprocating pump is 150 mm and the stroke of 300 mm. The pump runs at 50 rpm and lifts water to a height of 25 m. The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge. If the actual discharge is 4.2 litres/second, find the percentage slip and also determine the acceleration head at the beginning and middle of the delivery stroke. **(16)**

12. (a) A Pelton turbine running at 720 rpm uses 300 kg of water per second. If the head available is 425 m, determine the hydraulic efficiency. The bucket deflects the jet by165°. Also find the diameter of the runner and jet. Assume Cv = 0.97 and φ = 0.46, Blade velocity coefficient is 0.9. **(16)**

(OR)

(b) (i) Analyse the velocity diagram of a Kaplan turbine and find the best operating condition with neat sketch **(8)**

(ii) Analyse the velocity diagram of a Francis turbine and find the best operating condition with neat sketch **(8)**