Roll No. .....
Total No. of Questions: 09

Total No. of Pages: 02

BTECH, 2014
FLUID MECHANICS
PAPER CODE: ME 206
PAPER ID:[A0810]

TIME : 03 Hours

Maximum Marks : 60

Instructions to Candidates:

1) Section – A is compulsory consisting of Ten questions carrying Two marks each.
2) Section –B contains Five questions carrying Five marks each and students has to attempt any four questions
3) Section – C contains Three questions carrying Ten marks each and students has to attempt any two questions

Section- A

Q1.

a) Define viscosity or co-efficient of viscosity or Absolute viscosity. Also explain the variation of viscosity with temperature.
b) Draw the stress strain relationship for the following fluids and discuss the behavior of each fluid under an external shear force: an ideal fluid, a Newtonian fluid, a pseudo plastic fluid, a dilatant fluid, a Bingham fluid, and a plastic.
c) Define velocity potential function and list out its properties. What is relation between stream function and velocity potential function?
d) What is doublet and define the strength of doublet?
e) If the centre of gravity of a floating body is above its Meta centre, what is the type of equilibrium of the body?
f) Define and explain the term Hydraulic Gradient Line and Total Energy Line.
g) Define vortex flow and differentiate between free and forced vortex flow.
h) What are the advantages of triangular notch or weir over rectangular notch or weir?
i) What are the advantages of venturimeter over orificemeter?
j) What do you understand by stagnation pressure and dynamic pressure?

Section- B

Q2. Show that the streamlines and equipotential lines form a net of mutually perpendicular lines.

Q3. What is a free jet of liquid? Derive an expression for the path travelled by free jet issuing from a nozzle.

Q4. What are distorted models? What are the reasons of constructing such models for rivers?

Q5. The velocity components of fluid flow (incompressible) are

$$u= x^2y,\ v= 2yz- xy^2,\ w= x^2-z^2$$

Show that the flow is kinematically possible.

Q6. A rectangular plane surface 1m wide and 3m deep lies in water in such a way that its plane makes an angle of 30^0 with the free water surface. Determine the total pressure and position of center of pressure when the upper edge is 2m below the free surface.

Section C

Q7. Derive a relation for the torque required to rotate the cone at a constant angular velocity ω for the conical thrust bearing. For one such bearing, 120 W gets dissipated when a shaft with maximum cone radius 100 mm turns with 620 rpm over a uniform fluid layer of thickness 1.2 mm. if the semi-angle for the conical bearing is 30^0, find the dynamics viscosity of the fluid.

Q8. The angle of a reducing bend is 60^0(that is deviation from initial direction to final direction). Its initial diameter is 300 mm and final diameter 150 mm and is fitted in a pipeline, carrying a discharge of 360 liters/sec. The pressure at the commencement of the bend is 2.943 bar. The friction loss in the pipe bend may be assumed as 10% of kinetic energy at exit of the bend. Determine the force exerted by the reducing bend.

Q9. An aircraft propeller of diameter d rotating at a speed N and advancing with speed v in air of density ρ and viscosity μ develops a thrust V. Using Buckingham Pi- theorem, show that the thrust developed can be related through

$$\pi_1 = \phi\ (\pi_2, \pi_3)$$

Where, $\pi_1= T/\rho V^2d^2$, $\pi_2= \rho Vd/\mu$ and $\pi_3= dN/V$

If the effect of Reynolds number is relatively small, establish the value of corresponding speed for testing propellers.

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