CE3391 FLUID MECHANICS AND MACHINERY

IMPORTANT QUESTIONS

UNIT - I FLUID PROPERTIES AND FLOW CHARACTERISTICS

2 - Mark

1. Give the properties of ideal fluid.
2. Define Weight density
3. What is specific gravity? How is it related to density?
4. Define Newton's law of Viscosity.
5. Give some examples for Viscous fluid.
6. Define surface tension.
7. Define the term capillarity.
8. What is meant by vapor pressure of a fluid?
9. What is the effect of cavitation?
10. Define steady and unsteady flow.
11. What are the assumptions of the Bernoulli's equations?
12. Justify the use of control volume.

13 – Mark

1. Calculate the specific weight and specific gravity of 1 liter of a liquid which weighs 7 N.
2. Draw and explain the shear stress-velocity gradient profile for Newtonian fluids.
3. Differentiate compressible and incompressible fluids. Give suitable examples.
4. Analyze non-Newtonian fluids. Give suitable examples.
5. Differentiate kinematic viscosity with dynamic viscosity.
6. Explain the effect of temperature on viscosity of liquids and gases.
7. What are the assumptions made in deriving continuity equation?
8. State the equation of continuity to three dimensional in steady flow.

UNIT - II FLOW THROUGH PIPES AND BOUNDARY LAYER

2 - Mark

1. Write down Hagen-Poiseuille equation for laminar flow.
2. Define equivalent diameter of a non-circular tube.
3. Differentiate between T.E.L and H.G.L.
4. What are the conditions for a fluid to be hydraulically smooth?
5. Define the term Kinetic energy correction factor.
6. Differentiate between laminar and turbulent flow.
7. What is equivalent pipe? Mention the equation used for it.
8. What is meant by boundary layer separations?
9. Give four examples of laminar flow.
10. Define boundary layer thickness.
11. What is a syphon" Mention its applications.
12. Draw the velocity distribution and the shear stress distribution for the flow through circular pipes.
13. What are the losses experienced by a fluid when it is passing through a pipe?
14. What do you mean by flow through parallel pipes?
15. Identify the applications of Moody's diagram.
16. Write down the causes of minor energy losses in flow through pipes.
17. Define displacement thickness.
18. Define momentum thickness.
19. Give the expression of loss of energy due to sudden contraction and enlargement.
20. Define the terms and lift

13 - Mark

1. Derive the equation of flow of viscous fluid through circular pipe and obtain the equation for parabola. ratio of maximum to average velocity, pressure drop.
2. Derive the expression for shear stress and velocity distribution for the flow through circular pipe and using that derive the Hagen Poiseuille formula.

3. An oil of viscosity 0.1 Ns/m and relative density 0.9 is flowing through a circular pipe of diameter 50 cm and of length 300m. The rate of flow of fluid through the pipe is 3.5 liters / Sec. Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall.

UNIT - lll DIMENIONAL ANALYSIS AND MODEL STUDIES

2 - Mark

1. List the methods of dimensional analysis.
2. What is Dimensional homogeneity?
3. State the advantages of Dimensional and model analysis.
4. State and apply the significance Buckingham's a theorem
5. What is meant by similitude?
6. Difference between Rayleigh's method and Buckingham's it theorem.
7. Develop the dimensions of the following Physical Quantities:
   (i) Pressure
   (i) Surface Tension
   (ii) Dynamic viscosity
   (iii) Kinematic Viscosity
8. What are the similarities between model and prototype?
9. Mention the circumstance which necessitates the use of distorted models.
10. Submarine is tested in the air tunnel. Identify the model law applicable.
11. Deline Froude's number and Ruler's number
12. What is meant by undistorted model?
13. State the Fourier law of dimensional homogeneity.
14. Mention the significance of Reynolds's model law.
15. State the methods of dimensional analysis
16. How are the equations derived in Raleigh's method?
17. State three demerits of a distorted model.
18. Develop the Euler model law and give its significance
19. Define Mach number and state its applications
20. Explain the different types of similarities that must exist between a prototype and its model.

13 – Mark

1. List the criteria for selecting repeating variable in this dimensional analysis?
2. Check whether the following equation is dimensionally homogeneous.
   $T=2\pi\sqrt{(L/g)}$
3. The resisting force (R) of a supersonic plane during flight can be considered as dependent upon the length of the air craft '' velocity 'V' air viscosity 'μ' air density 'ρ' and bulk modulus of air is 'K' Express the functional relationship between these variables and the resisting force.
4. The power P developed by a water turbine depends on the rotational speed N, operating head H. gravity g. diameter D and width B of the runner, density p and viscosity u of water. Show by dimensional analysis that

$$P = \rho D^5 N^3 \frac{H}{D'} \frac{D}{B'} \frac{\rho D^2 N}{\mu} \frac{ND}{\sqrt{gH}}$$

UNIT - IV TURBINES

2 - Mark

1. Classify turbines according to flow.
2. What is meant by high head turbines. Give examples.
3. Define hydraulic efficiency of a turbine.
4. What is cavitations? How can it be avoided in reaction turbines?
5. Define specific speed of a turbine.
6. Classify the different types of draft tubes.
7. Define the terms: Hydraulic Machines, Turbines and Pumps.
8. Discuss the role of draft tube in Kaplan turbine.
9. Illustrate an example for a low head turbine, a medium head turbine a high head turbine.
10. Draw the outlet triangle for turbine when the jet angle is 90".
11. Differentiate the impulse and reaction turbine.
12. Draw the velocity triangle diagram for Pelton Wheel turbine.
13. Give the comparison between impulse and reaction turbine.,
14. Write a note on performance curves of turbine.
15. Prepare a short note on Governing of Turbines.
16. Formulate the expression for the efficiency of a draft tube.

17. Define unit speed of a turbine.
18. Define volumetric efficiency of turbine.
19. A shaft transmits 150 KW at 600rpm. Evaluate the torque in Nm.
20. Define the terms unit power, unit speed and unit discharge.

13 - Mark

1. Discuss about the hydroelectric power plant with neat sketch. Also explain various efficiencies.
2. Explain the constructional details of Pelton wheel with neat diagram.
3. Analyze the inlet and outlet velocity triangles of a Pelton turbine and indicate the direction of various velocity components. Derive the expression for hydraulic efficiency.
4. A Pelton wheel has a mean bucket speed of 10 m's with a jet of water flowing at the rate of 700 Ips under a head of 30 m. The buckets deflect the jet through an angle of 160. Identify the power given by the water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98
5. A Pelton wheel, working under a head of 500 m develops 13 MW when running at a speed of 430 rpm. If the efficiency of the wheel is 85%.

UNIT - V PUMPS

2 - Mark

1. What is suction head of a pump?
2. Define mechanical efficiency of a pump.
3. Why actual discharge be greater than theoretical discharge in reciprocating pump?
4. Summarize factor determines the maximum speed of a reciprocation pump.
5. List the functions of an air vessel.
6. What is specific speed of a pump? How are pumps classified based on this number?
7. When does negative slip occur?
8. State the Euler's equation of hydrodynamic machines.
9. Summarize the losses in centrifugal pump.
10. What is Roto dynamic pumps? Give examples.
11. Prepare the main components of reciprocating pump.

12. Define "Slip" of reciprocating pump. When does the negative slip occur?
13. What is speed ratio?
14. What are rotary pumps? Give examples.
15. Define the manometric efficiency and mechanical efficiency of a pump.
16. Illustrate hydraulic efficiency.
17. What is meant by NPSH?
18. Complete the expression for the work saved in a reciprocating pump by using air vessel.
19. Uses of indicator diagram.
20. Examine the cavitations problem in centrifugal pump.

13 - Mark

1. Derive the expression for force exerted by the jet un
   a. Stationary vertical plate
   b. Stationary inclined plate
2. A jet of water of diameter 75 mm moving with a velocity of 25 m/s strikes a fixed plate in such a way that the angle between the jet and plate is 60%. Find the force exerted by the jet on the plate
   (i) in the direction normal to the plate and
   (ii) in the direction of the jet.
3. A jet of water of diameter 50 mm moving with a velocity of 40 m/'s. strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the jet of water in the direction of the jet, if the jet is deflected through an angle of 120 at the outlet of the curved plate.