Anna University Exams Nov / Dec 2017 – Regulation 2013
Rejinpaul.com Unique Important Questions – 3rd Semester BE/BTECH
CE6451 Fluid Mechanics and Machinery

PART A

1. Define Viscosity and what is the effect due to temperature on liquid and gases.
2. Define compressibility.
3. Define density or mass density
4. Define Vapour Pressure.
5. Define specific weight or weight density, specific volume
6. Define surface tension and capillarity?
7. Write down the effect of temperature on viscosity of liquid and gases.
8. What is the use of control volume?
9. Calculate the height of capillary rise for water in a glass tube of diameter 1 mm?
10. Define surface tension and capillarity?
11. What are the equivalent pipes? Mention the equation used for it.
12. What are the factors influencing the frictional loss in pipe flow?
13. What is meant by Moody's chart and what are the uses of Moody's chart?
14. Explain minor losses in a pipe Write the uses of dimension analysis?
15. Write the advantages of model analysis
16. Define Boundary layer.
17. Define Boundary layer Thickness.
18. Find the displacement thickness for the velocity distribution in the boundary layer given by $u / U = 2(y / \delta) - (y / \delta)^2$.
19. Draw the velocity and the shear stress distribution for the flow through circular pipes.
20. Explain the types of Similarities.
21. State Buckingham's π theorem.
22. State Euler's, Mach's model law
23. State Froude's model law
24. State Weber's model law
25. State Reynolds's model law
26. State Buckingham's π theorem. Why this method is superior to Rayleigh's method?
27. Derive the scale ratio for velocity and pressure intensity using Froude model law.
28. Define undistorted model and distorted model
29. Write the expression for March number and state its application.
30. What is the function of air vessel in reciprocating pumps?
31. Explain the purpose of Air Vessel and in which pump it is used?
32. Define cavitation and its effects.
33. What is meant by priming of a centrifugal pump? Why is it necessary?
34. Define Priming of a centrifugal pump.
35. Define Specific speed of a centrifugal pump.
36. Define the terms a) Hydraulic gradient line. b) Total Energy line
37. What are the factors influencing the frictional loss in pipe flow?
38. What is an air vessel?
39. Define Manometric Head
40. List out the Efficiencies of a Centrifugal Pump:
41. Classify turbines based on flow direction and working medium?
42. Explain the type of flow in Francis turbine.
43. What is meant by Governing of Turbines?
44. What are an impulse turbine and a reaction turbine?

45. What is draft tube?
46. Define specific speed of a turbine.
47. List the various model laws applied in model analysis
48. Define slip and % slip
49. Define Jet Ratio.Define
50. What is Runaway speed of Turbine.

PART B & C

UNIT-1

1. Determine the power lost in the bearing for a sleeve length of 90 mm, if the dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at190 rpm. The thickness of oil film is 1.5 mm.
2. Determine A liquid has a specific gravity of 0.72. Find its density, specific weight and its weight per litre of the liquid. If the above liquid is used as the lubrication between the shaft and the sleeve of length 100 mm. Determine the power lost in the bearing, where the diameter of the shaft is 0.5 m and the thickness of the liquid film between the shaft and the sleeve is 1 mm. Take the viscosity of fluid as 0.5 N-s/m^2 and the speed of the shaft rotates at 200 rpm.
3. Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8 m x 0.8 m in an inclined plane with an angle of inclination 30° to the horizontal. The weight of the square plate is 300N and it slides down the inclined plane with a uniform velocity of 0.3 m/s.The thickness of oil film is 1.5 mm.
4. Calculate An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. the oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take C_d = 0.98
5. Explain the expression of Bernoulli's equation from the Euler's and state the assumptions made for such a derivation
6. A 45degree reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 600 mm and 300 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm2 and rate of flow of water is 600 liters/s.
7. Water is flowing through a pipe of diameter 30 cm and 20 cm at the section 1 and 2 respectively. The rate of flow through pipe is 35 lps. The section 1 is 8 m above datum and section 2 is 6 m above datum. If the pressure at section 1 is 44.5 N/cm2. Find the intensity of pressure at section 2.
8. A pipe 200 m long slopes down at 1 in 100 and tapers from 600 mm diameter at the higher end to 300 mm diameter at the lower end, and carries 100 litres/ sec of oil having specific gravity 0.8. If the pressure gauge at the higher end reads 60 KN/m2, determine the velocities at the two ends and also the pressure at the lower end. Neglect all losses.
9. A liquid has a specific gravity of 0.72. Find its density, specific weight and its weight per litre of the liquid. If the above liquid is used as the lubrication between the shaft and the sleeve of length 100 mm. Determine the power lost in the bearing, where the diameter of the shaft is 0.5 m and the thickness of the liquid film between the shaft and the sleeve is 1 mm. Take the viscosity of fluid as 0.5 N-s/m2 and the speed of the shaft rotates at 200 rpm.

10. **Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE.**

UNIT-2

1. **Determine A pipe line of 0.6 m diameter is 1.5 km long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if 4*f* = 0.04. The head at inlet is 300 mm**
2. **Show the Hagen Poiseuille formula for the flow through circular pipes.**
3. **Determine A fluid of viscosity 0.7 Pa. s and specific gravity 1.3 is flowing through a pipe diameter 120 mm. the maximum shear stress at the pipe value is 205.2 N/m^2. Determine the pressure gradient, Reynolds number and average velocity?**
4. **Find A crude oil of kinematic viscosity 0.4 strokes is flowing through a pipe of diameter 300 mm at the rate of 300 liters per sec. Find the head lost due to friction for a length of 50 m of the pipe. Take Coefficient of friction as 0.006.**
5. **Derive For a flow of viscous fluid flowing through a circular pipe under laminar flow conditions show that the velocity distribution is a parabola. And also show that the average velocity is half of the maximum velocity.**
6. **Find the displacement thickness, the moment thickness and the energy thickness for the velocity distribution in the boundary layer given by $u / U = 2(y / \delta) - (y / \delta)^2$.**
7. **Derive the Darcy – Weisbach equation for the loss of head due to friction in pipes and Explain the Reynold's Experiment**
8. **The rate of flow of water through a horizontal pipe is 0.25 m3/sec. The diameter of the pipe is suddenly enlarged from 200 mm to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm2. Determine (i) loss of head due to sudden enlargement (ii) pressure intensity in the large pipe and (iii) power lost due to enlargement.**
9. **Describe the Moody's chart.**
10. **A pipe line of 0.6 m diameter is 1.5 km long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if Darcy's friction factor is 0.04. The head at inlet is 300mm.**

UNIT-3

1. **Find an expression for Δp. The pressure difference Δp in a pipe of diameter D and length l due to turbulent flow depends on the velocity υ, viscosity μ, density ρ and roughness *k*. Prove it by Buckingham's π theorem**
2. **Find The velocity through a circular orifice is given by V = $\sqrt{2gH\Phi}\left[\frac{D}{H},\frac{\mu}{\rho \upsilon H}\right]$, where H is the head causing flow. D is the diameter of the orifice, μ is coefficient of viscosity, ρ is the mass of density and g is the acceleration due to gravity.**
3. **Define similitude and explain its types**
4. **Find The pressure drop in an airplane model of size 1/10 of its prototype is 80 N/cm^2. The model is tested in water. Find the corresponding pressure drop in the prototype. Take density of air = 1.24 k*g*/m^3. The viscosity of water and air is 0.01 poise 0.00018 poise.**

5. Show the five different types of dimensionless numbers
6. Determine a 1:100 model is used for model testing of ship. The model is tested in wind tunnel. The length of ship is 400 m. The velocity of air in the wind tunnel around the model is 25 m/s and the resistance is 55N. Determine the length of model. Also find the velocity of ship as well as resistance developed. Take density of air and sea water as 1.24 Kg/m^3 and 1030 kg/m^3. The kinematic viscosity of air and sea water are 0.018 stokes and 0.012 stokes respectively
7. Find The velocity through a circular orifice is given by V = $\sqrt{2gH\Phi}\left[\frac{D}{H},\frac{\mu}{\rho\upsilon H}\right]$, where H is the head causing flow. D is the diameter of the orifice, μ is coefficient of viscosity, ρ is the mass of density and g is the acceleration due to gravity.
8. The power developed by hydraulic machines is found to depend on the head H, flow rate Q, density ρ, Speed N , runner diameter D and acceleration due to gravity g. Obtain suitable dimensionless parameters to correlate experimental results.
9. Check whether the following equation is dimensionally homogeneous. $T = 2\pi\sqrt{(L/g)}$
10. List the criteria for selecting repeating variable in this dimensional analysis?

UNIT-4

1. Find The cylinder bore diameter of a single-acting reciprocating pump is150 mm and its stroke is 300 mm. The pump runs at 50 rpm and lifts water through a height of 25m. The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 litres/s, find the percentage slip. Also determine the acceleration head at the beginning and middle of the delivery stroke.
2. Determine A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a head of 40m. the velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at angles of 40° at outlet. If the outer diameter if the impeller is 500 mm & width at outlet is 50 mm determine:(i) Vane angle at inlet (ii) Manometric efficiency(iii) Work done by impeller on water per second.
3. Derive the expression for the pressure head due to acceleration in the suction and delivery pipes of the reciprocating pumps.
4. Determine The internal and external diameter of an impeller of a centrifugal pump which is running at 1200 rpm are 300 mm and 600 mm. the discharge through the pump is 0.05 m^3/s and the velocity of the flow is constant and equal to 2.5 m/s. The diameter of the suction and delivery pipes are 6 m(abs) and 30 m(abs) of water. If the outlet vane angle is 45° and power required to drive the pump is 17 KW, determine :(i)Vane angle of the impeller at inlet.(ii)Overall efficiency of the pump. (iii) Manometric efficiency of pump.
5. Explain the working of Lobe and vane pumps.
6. A centrifugal pump is to discharge 0.118m3/s at a speed of 1450 rpm against a head of 25m. The impeller diameter is 250mm. Its width at outlet is 50mm and the manometric efficiency is 75%. Find the vane angle at outer periphery of the impeller
7. A centrifugal pump is to discharge 0.118m3/s at a speed of 1450 rpm against a head of 25m. The impeller diameter is 250mm. Its width at outlet is 50mm and the manometric efficiency is 75%. Find the vane angle at outer periphery of the impeller
8. Explain about working principle of centrifugal pump & Reciprocating pump.

9. **A centrifugal pump is to discharge 0.118m3/s at a speed of 1450 rpm against a head of 25m. The impeller diameter is 250mm. Its width at outlet is 50mm and the manometric efficiency is 75%. Find the vane angle at outer periphery of the impeller**
10. **A centrifugal pump is to discharge 0.118m3/s at a speed of 1450 rpm against a head of 25m. The impeller diameter is 250mm. Its width at outlet is 50mm and the manometric efficiency is 75%. Find the vane angle at outer periphery of the impeller**

UNIT-5

1. **Explain the efficiency of a turbine and Explain the working of Kaplan turbine.Construct its velocity triangles**
2. **Find A Kaplan turbine runner is to be designed to developed 9100 KW. The net available head is 5.6 m. If the speed ratio = 2.09, flow ratio = 0.68, overall efficiency = 86% and the diameter of the boss is 1/3 the diameter of the runner. Find the diameter of the runner, its speed and the specific speed of the turbine?**
3. **Explain the Performance Characteristics curve of turbine**
4. **Determine The following data is given for Francis turbine: Net Head = 60 m, speed = 700 rpm, shaft power = 294.3 KW, η_o = 84%, n_h = 93%, flow ratio = 0.2, breadth ratio = 0.1, outer diameter of the runner is two times inner diameter of runner. The thickness of vanes occupies 5% of the circumferential area of the runner. Velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine: (i)The guide blade angle(ii) Runner vane angle at the inlet and outlet(iii)Diameter of the runner at inlet and outlet (iv)Width of the wheel at inlet**
5. **Calculate For a high head storage capacity dam of net head 800 m, it had been decided to design and install a Pelton wheel for generating power of 13,250 KW running at a speed of 600 RPM, if the coefficient of jet is 0.97 speed ratio = 0.46 and the Ratio of jet diameter is 1/5 of the wheel diameter calculate (i) Number of jets, (ii) Diameter of jets (iii) Diameter of Pelton wheel, (iv) No of buckets and(v) Discharge of one jet.**
6. **Determine The following data is given for Francis turbine : Net Head = 60 m, speed = 700 rpm, shaft power = 294.3 KW, η_o = 84%, n_h = 93%, flow ratio = 0.2, breadth ratio = 0.1, outer diameter of the runner = 2 inner diameter of runner. The thickness of vanes occupies 5% of the circumferential area of the runner. Velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine : (i)The guide blade angle (ii)Runner vane angle at the inlet and outlet(iii)Diameter of the runner at inlet and outlet(iv)Width of the wheel at inlet**
7. **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%, examine the rate of flow through the turbine, the diameter of the wheel and the diameter of the nozzle. Take speed ratio as 0.46 and coefficient of velocity for the nozzle as 0.98**
8. **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%, examine the rate of flow through the turbine, the diameter of the wheel and the diameter of the nozzle. Take speed ratio as 0.46 and coefficient of velocity for the nozzle as 0.98**
9. **Explain about draft tube and its types. (3)**
10. **A Pelton turbine is required to develop 9000 kW when working under a head of 300 m the impeller may rotate at 500 rpm. Assuming a jet ratio of 10 and an overall efficiency of 85% calculate(i) Quantity of water required, (ii) Diameter of the wheel, (iii) No of jets, (iv) No and size of the bucket vanes on the runner.**