

II B. Tech I Semester Supplementary Examinations Dec – 2013

FLUID MECHANICS AND HYDRALICS MACHINES

(Com. to EEE, ME, MM)

Time: 3 hours

Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks

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1. a) Differentiate between simple and differential type of manometers.  
b) A rectangular plate of size 25cm x 50cm and weighing 25kg (f) slides down  $30^{\circ}$  inclined surfaces at a uniform velocity of 2mt/sec .if the uniform 2mm gap between the plate and inclined surface is filled with oil. Determine the viscosity of oil? (7M+8M)
2. a) State and derive Bernoulli's theorem, mentioning clearly assumptions underlying it.  
b) A bend in pipe line conveying water gradually reduces from 0.6 to 0.3mts diameter and deflects the through angle of  $60^{\circ}$  . At the large end the gauge pressure is  $171.675\text{KN/m}^2$  . Determine the magnitude and direction of force exerted on bend when there is no flow. (7M+8M)
3. a) Explain the measurement of flow using an pitot tube?  
b) A venturimeter has its axis vertical, the inlet and throat diameters being 150mm and 75mm respectively. The throat is 225 mm above inlet and  $c_{d3}=0.96$ . Petrol of specific gravity 0.78. Flows up through the water meter at a rate if  $0.029\text{mt}^3/\text{sec}$ . find the pressure difference between inlet and throat. (8M+7M)
4. a) Derive an expression for the force exerted by fluid on moving flat plate.  
b) A jet of water having a velocity of 45mt/sec impinges without should a series of vanes moving at 15mt/sec. The direction of motion of vanes being inclined at  $20^{\circ}$  to that of the jet. The relative velocity at out let is 0.9 of that at inlet, and the absolute velocity of water at exit is to be normal to motion of vanes. Find i) Vane angle at entrance and exit. ii) Work done on vanes per unit weight of water supplied by soil. (8M+7M)
5. Explain the concept of pumped storage plants and the storage requirements briefly. (15M)
6. a) Explain briefly the principles on which pelton wheel works?  
b) Design a pelton wheel which is required to develop 1500Kw, when working under a head of 160mts at a speed of 420rpm.the overall efficiency may taken as 85% and assume other data required. (7M+8M)
7. Explain the performance of the turbines using characteristic curves. (15M)
8. Explain the performance of an centrifugal pump using performance characteristic curves.(15M)



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1. a) Describe with the help of neat sketches different types of manometers.
 b) What is the pressure within a droplet of water 0.5mm in diameter at 20°C , if the pressure outside the droplet is standard atmospheric pressure of 1.03Kg (f)/cm^2 .
 Given $\sigma = 0.0075 \text{ Kg(f)/mt}$ for water at 20°C . (7M+8M)

2. a) State and derive Euler's equation?
 b) A 0.25mts diameter pipe carries oil of specific gravity 0.8 at the rate of 120lits/sec, and the pressure at a point A is 19.62KN/m^2 . If the point is 3.5mts above the datum line, calculate the total energy at a point A in mts. of oil. (7M+8M)

3. a) Derive Darcy Weisbach equation?
 b) A venturimeter is to be fitted in a pipe 0.25mts dia, where the pressure head is 7.6mts of flowing liquid and the maximum flow is $8.1\text{m}^3/\text{min}$. Find the least dia of the throat to ensure that pressure head does not become negative. Take $c_d=0.96$ (8M+7M)

4. a) Derive an expression for the force exerted by jet on stationary curved vane striking it at the centre.
 b) A jet of water 75mm in diameter having velocity of 20m/s strikes a series of flat plates arranged around the periphery of a wheel such that each plate appears successively before the jet. If the plates are moving at a velocity 5mt/sec., compute the force exerted by jet on the plate, the work done per second on the plate and efficiency of the jet? (8M+7M)

5. How do you estimate the power developed from a given catchment area. Discuss various efficiencies briefly. (15M)

6. a) Explain briefly the principles on which Kaplan turbine works?
 b) A Kaplan turbine produces 50000 kW under a net head of 25mts with an overall efficiency of 92%. Taking the value of speed ratio K_u as 1.6, flow ratio ψ as 0.5 and the hub diameter as 0.35 times the outer diameter. Find the diameter and speed of the turbine. (7M+8M)

7. a) Explain briefly about cavitations and water hammer?
 b) Write a short note on surge tank. (7M+8M)

8. Explain the working principle of reciprocating pumps with neat sketches. (15M)

Code No: R21021

R10

SET - 3

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1. a) Describe with a neat sketch U-tube manometer and how it is used for the measurement of the pressure.  
b) A plate 0.0254m distant from a fixed plate, moves at 61cm/sec and requires a force of 0.2Kg (f)/m<sup>2</sup> to maintain this speed. Determine the dynamic viscosity of the fluid between the plates. (7M+8M)
2. a) State and derive the momentum equation.  
b) When 2500lits. of water flows per min through a 0.3mts diameter pipe which later reduce to a 0.15 dia pipe. Calculate the velocity of flow in two pipes. (7M+8M)
3. a) Two reservoirs are connected by a pipe 2250mts long and 0.225mts in diameter, the difference in water levels being 7.5mts. Determine the flow through pipes in lits/min.  
If  $f = 0.03$   
b) How do you measure the flow using a venturimeter Explain? (7M+8M)
4. a) Derive an expression for the force exerted by a fluid jet on a moving curved vane?  
b) A jet of water 50mm in diameter having a velocity of 20m/sec, strikes normally a flat smooth plate. Determine the thrust on plate i) if the plate is at rest ii) if the plate is moving in the same direction as the jet with a velocity of 8m/sec. (8M+7M)
5. Explain briefly about the elements of hydro electric power station with the help of neat sketches if necessary. (15M)
6. a) What are the classifications of turbines, Explain?  
b) State and Explain Draft tube theory? (7M+8M)
7. a) Explain: i) Unit speed ii) Unit discharge iii) unit power of a hydraulic turbine.  
Derive the Expressions for each of them.  
b) Explain in brief about selection of a turbine. (8M+7M)
8. Explain with neat sketches the working of a single stage centrifugal pump? (15M)

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1. a) Explain how a peizometer can be used for the measurement of pressure with the help of a neat sketch.
b) What should be the diameter of a droplet of water, if pressure inside is to be $0.0018 \text{ Kg(f)/cm}^2$ greater than the outside? Given the values of surface tension of water in contact with air at 20°C as 0.0075 Kg(f)/mt . (7M+8M)
2. a) State and Derive equation of continuity for one dimensional flow.
b) A pipe 300mts long has slope of 1 in 10 and tapers from 1.2mt diameter at the higher end to 0.6mt diameter at lower end. Quantity of water flowing is 5400lits/min. If the pressure at higher end is 68.67Kpa. Find pressure at lower end. Neglect losses (7M+8M)
3. a) Explain the construction and working of an orifice meter with a neat sketch.
b) Two reservoirs are connected by three pipes laid in parallel, their diameters are d , $2d$ & $3d$. Assuming f to be same for all pipes. Determine discharge through each of the larger pipes if the smallest pipe is discharging 1cumec. (8M+7M)
4. a) Derive an expression for the force exerted by a jet on a stationary flat plate?
b) A jet of water 75 mm diameter having a velocity of 20m/sec, strikes normally a flat smooth plate. Determine the thrust on the plate if the plate is moving in the same direction as the jet with a velocity of 5m/sec. (8M+7M)
5. Explain in detail about the types of hydroelectric power plants? (15M)
6. a) Explain briefly the principle in which a Francis turbine works?
b) A Kaplan turbine produces 60000 kW under a net head of 25mts with an overall efficiency of 90%. Taking the value of speed ratio K_u as 1.6, flow ratio ψ as 0.5.and the hub diameter as 0.35 times the outer diameter. Find the diameter and speed of the turbine. (7M+8M)
7. Explain in briefly about the governing of turbines. (15M)
8. a) Under what headings centrifugal pumps are classified.
b) Derive an expression for the work done of a centrifugal pump. (7M+8M)