VIII.(b) A Francis Turbine runner is to be designed for the following data:-

Net Head (H)	= 60m	Shaft power	= 367.8 KW (500 hp)
Speed (N)	= 600 rpm	Hydraulic efficiency	= 85%
Overall efficiency	= 80%	Flow ratio (ψ)	= 0.15
Breadth ratio (n)	= 0.10		

Assume the inner diameter as one half the outer diameter. The velocity of flow is constant throughout. The discharge is radial. Neglect vane thickness. Calculate the vane angles. (12)

IX. (a) Explain with suitable figures the main parts of a centrifugal pump and its working. Also derive an expression for the work done. (10)

(b) Calculate the specific speed of a centrifugal pump running at 1000rpm. The diameter of the impeller is 300mm and the width is 60mm. The pump delivers 120 litres/second with a manometric efficiency of 85%. The effective outlet blade angle is 30°. Neglect the thickness of blades. (6)

(c) Write a note on the main performance curves of centrifugal pumps. (4)

OR

X. (a) Explain the terms:

(i) Positive Displacement Pumps
(ii) Effect of acceleration
(iii) Effect of friction
(iv) Effect of air vessels. (8)

(b) A double acting reciprocating pump has the suction lift of 4m, length of suction pipe 6m, diameter of suction pipe 10cm, diameter of pump plunger 15cm and length of stroke 45cm. If the coefficient of friction f = 0.025, determine the maximum speed at which it can be run when there is -

(i) no air vessel on the suction side.
(ii) a large air vessel on the suction side close to the cylinder.

Take atmospheric pressure as 10.3m of water and separation pressure of 2.5m of water. Take velocity head into account. (12)

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B.Tech. Degree III Semester Examination
January 2002

ME

ME/SE 305 FLUID MECHANICS AND MACHINERY

Time: 3 Hours Maximum Marks: 100

I. (a) Write short notes on;

(i) Bulk modulus of elasticity
(ii) Specific weight
(iii) Viscosity (6)

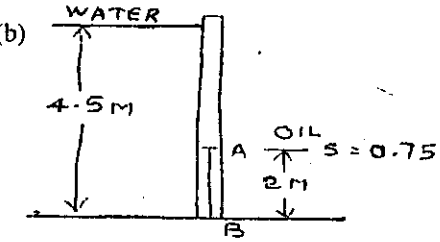
(b) At a point in a layer of glycerine, the shear stress is 0.1962 N/m^2 and the velocity gradient is 0.25m/second/m. Calculate the coefficient of dynamic viscosity. (8)

(c) Write Newton's equation of viscosity. What do you understand by the Newtonian and non-Newtonian fluids? (6)

OR

II. (a) Explain the Bourdon Gauge with a neat figure and the method of measurement of pressure. (8)

(b)



The figure shows a gate AB hinged at the end A. If the gate is 1.5m wide, calculate the horizontal force required at B to keep the gate in equilibrium. (8)

(c) Define centre of pressure and centre of buoyancy. (4)

III. (a) Explain laminar and turbulent flows of fluids using suitable figures. (4)

(b) What is the difference between steady and unsteady flow? (4)

III. (c) A stream function is defined by the expression $\phi = 2x^2 - y^2$. Calculate the components of velocity and the velocity at point $P(x = 3,\ y = 1)$. (12)

OR

IV. (a) Derive the Euler's equation from fundamentals. (6)

(b) What is a pitot tube? What all measurements can you make using it? How? (7)

(c) 0.220 cumecs of gasoline (s = 0.82) flows through an inclined venturimeter in the upward direction. The meter is inclined at 30° to the horizontal and has the inlet and throat diameter 30cm and 15 cm respectively. If the throat is 0.60m above the inlet and the pressure gauges at the entrance and the throat show pressure of 141.264 kN/m^2 (1.44 Kgf/cm^2) and 75.537 kN/m^2 (0.77 Kgf/cm^2) respectively, calculate the coefficient of the venturimeter. (7)

V. (a) Derive Chezy's formula from Darcy-Weisbach equation. (4)

(b) Define the terms energy gradient and hydraulic gradient. (4)

(c) Two reservoirs are connected by a pipe line consisting of two pipes, one of 15cm diameter and length 6cm and the other of diameter 22.5 cm and 16m length. If the difference of water levels in the two reservoirs is 6m, calculate (i) the discharge (ii) loss of head due to friction. (iii) Also draw the energy gradient line. (12)

OR

VI. (a) Using Buckingham's Pi-theorem, show that the discharge over a spillway can be expressed as $Q = VD^2\phi\left[\sqrt{gD/V}\ ,\ H/D\right]$

where

V = velocity of flow D = throat depth

H = Head causing flow g = acceleration due to gravity (12)

VI. (b) A model of a rectangular notch 1.2m wide 5.0m wide in a channel is built to a scale 1 : 20. The average depth of water in the channel is 3.5m. The model was tested in a laboratory where the velocity of flow was maintained constant at 0.6m/sec. It was observed that the force acting on the model was 4.0N and the height of the standing wave was 40mm. Determine the following for the prototype.

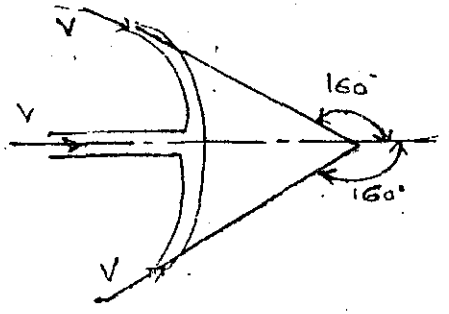
(i) The corresponding speed

(ii) The force acting

(iii) The height of the standing wave at nose. (8)

VII. (a) Find the expression for the thrust on a stationary curved vane when the jet strikes at the centre. What is the work done? (8)

(b) A jet of water 10mm diameter strikes a fixed cup which deflects the jet by 160° as shown in figure. If the reaction of the cup is 88.29N (9 Kgf) when the discharge is 0.002 cumecs, calculate the ratio of the actual force to the theoretical force of the jet. Also find the ratio of the velocity at outlet to that at inlet. (12)



OR

VIII (a) Differentiate between:

(i) Radial flow and axial flow turbines

(ii) Impluse and reaction turbines

(iii) Inward flow and outward flow turbines

(iv) Flow ratio and speed ratio. (8)