BTS(C) – IV – 05 – 021 (E)

B. Tech Degree IV Semester Examination
May 2005

CE 405 (B) FLUID MECHANICS

(2002 Admissions onwards)

Time : 3 Hours Maximum Marks : 100

I. (a) Define Ideal fluid, Newtonian fluid and Thyxotropic fluid. (6)

(b) Define surface tension. What are the factors that affect surface tension? (6)

(c) Two large plane surfaces are 25 mm apart. This space is filled with glicerine of dynamic viscosity 0.804 N sec/m^2. Find what force is required to drag a very thin plate of area 0.5 m^2 between the two surfaces at a speed of 0.6 m/sec (i) if the plate is equidistant from the two surfaces, (ii) if the plate is 10 mm from one of the surfaces. (8)

OR

II. (a) Show that the centre of pressure of any lamina immersed under liquid is always below its centroid. (10)

(b) A ship displaces 41500 kN when floating in sea water with its axis vertical and a weight of 4100 kN is placed on the centre line. Moving this weight by 1 m towards one side of the deck causes a plumb bob suspended from a 2.75 m long string to move by 300 mm. Find the metacentric height of the unloaded ship. (10)

III. (a) Write short notes on :

(i) Stream lines and path lines

(ii) Steady flow and unsteady flow

(iii) Laminar flow and turbulent flow. (9)

(b) A 300 mm x 150 mm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section of the venturimeter is 300 mm. The differential U-tube mercury manometer shows a gauge deflection of 250 mm. Calculate (i) the discharge of the oil and (ii) the pressure difference between the entrance section and the throat section. Take the coefficient of venturimeter as 0.98 and the specific gravity of mercury as 13.6. (11)

OR

IV. (a) Describe how the coefficients of an orifice can be determined. (6)

(b) Write short notes on (i) Cipolletti weir (ii) Sutro weir (6)

(c) Find the depth and top width of a V-notch capable of discharging a maximum of 0.7 m^3/sec and such that the head shall be 7.5 cm for a discharge of 5.6 litres/sec. Its C_d is the same as that of a similar (in material and sharpness of edges only) right angled V-notch for which $Q = 1.407\ H^{5/2}$. (8)

V. (a) Derive Darcy Weisbach equation for energy loss due to friction in pipe flow. (8)

(b) two reservoirs are connected by a pipe 2250 m long and 22.5 cm in diameter, the difference in water levels being 7.5 m. Determine the flow through the pipe if f = 0.03. Also find the percentage increase in the discharge if for the last 600 m a second pipe of the same diameter is laid along side the first. (12)

OR

VI. (a) Briefly explain - (i) Geometric similarity (ii) Kinematic similarity and (iii) Dynamic similarity (6)

(Turn Over)

	(b)	Define Weber Number, Mach Number and Cauchy Number.	(6)
	(c)	A 1:16 scale model was tested in fresh water at a corresponding velocity. The proto type flying boat has to move in sea water of specific weight 10105 N/m^3 at a velocity of 25 m/sec. Find the corresponding speed of the model. If the wave making resistance of the proto type is estimated to be 5490 N, what would be the corresponding wave making resistance of the model?	(8)
VII.	(a)	Differentiate between pipe flow and open channel flow.	(5)
	(b)	What are the qualifications for uniform flow in open channels?	(5)
	(c)	A rectangular channel 5.4 m wide and 1.2 m deep has a slope of 1 in 1000 and is lined with good rubble masonry for which Manning's N = 0.017. It is desired to increase the discharge to a maximum by changing the channel slope or the form of section. The dimensions of the section may be changed but the channel must contain the same amount of lining. Compute the new dimensions and probable increase in discharge.	(10)
		OR	
VIII.	(a)	Show that for a hydraulically efficient trapezoidal channel section, the three sides of the channel are tangential to the semicircle described on the water line.	(8)
	(b)	With a neat sketch, explain the term specific energy.	(4)
	(c)	A trapezoidal channel has a bottom width of 6 m and side slopes of 1:1. If the depth of flow is 1.5 m at a discharge of 20 m^3/sec, compute the specific energy and the critical depth.	(8)
IX.	(a)	With a neat sketch, explain the elements of a hydro electric power plant.	(6)
	(b)	Explain the different classification of turbines.	(6)
	(c)	A pelton wheel working under a head of 500 m has an overall efficiency of 85% and runs at 430 rpm developing 6990 KW of shaft power. Taking the bucket speed as 0.47 times the jet speed and assuming $C_v = 0.97$, find - (i) The wheel diameter and (ii) Jet diameter	(8)
		OR	
X.	(a)	Explain the working principle of a reciprocating pump.	(6)
	(b)	Briefly explain - (i) Slip (ii) Percentage slip and (iii) Specific speed of centrifugal pump.	(6)
	(c)	A single acting reciprocating pump has a plunger diameter of 25 cm and stroke of 35 cm. If the speed of the pump is 60 rpm and it delivers 16.5 litres per second of water, find the theoretical discharge, coefficient of discharge, the slip and the percentage slip of the pump.	(8)

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