Code No: Z – 82 – 2015

FACULTY OF ENGINEERING & TECHNOLOGY
T.E. (Mech.) (Revised) Examination
MAY/JUNE, 2015

Fluid Mechanics & Machineries

Time: Three Hours | Max. Marks: 80

"Please check whether you have got the right the question paper"

Note: i) *Attempt any three questions from each section (Section A & B).*
ii) *Figures to the right indicate full marks.*
iii) *Draw diagrams or graphs wherever required.*
iv) *Assume suitable data, if necessary.*

SECTION-A

Q.1	(a)	Explain surface tension and capillarity. Also find the relations for surface tension on liquid droplet, hollow bubble and liquid jet.	06
	(b)	Calculate the capillary rise in a glass tube of 2.5 mm diameter when immersed vertically in (a) water and (b) mercury. Take surface tension $\sigma = 0.0725$ N/m for water and $\sigma = 0.52$ N/m for mercury in contact with air. The specific gravity for mercury is given as 13.6 and angle of contact = 130^0.	07
Q.2	(a)	Explain practical application of Bernoulli's equation.	07
	(b)	The water is flowing through a taper pipe of length 100 m having diameters 600mm at the upper end and 300mm at the lower end, at the rate of 50 lit/s. The pipe has slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2.	06
Q.3	(a)	A pipe diameter 1.5m is required to transport an oil of sp. gravity 0.90 and viscosity 3 x 10^{-2} poise at the rate of 3000 lit/s. Tests were conducted on a 15 cm diameter pipe using water at 20^0C. Find the velocity and rate of flow in the model. Viscosity of water at 20^0C=0.01 poise.	06
	(b)	The pressure difference Δp in the pipe of diameter D and length 'l' due to turbulent flow depends on the velocity V, viscosity μ, density ρ and roughness k. Using Buckingham's π-theorem, obtain an expression for Δp.	07
Q.4	(a)	Explain the impact of computational fluid dynamics (CFD) on fluid mechanics.	06
	(b)	Explain model of the finite control volume fixed in space and moving with the fluid.	07

P.T.O.

Q.5 Write short notes on (Any two) : **7x2=14**

(a) Inclined plane surface submerged in liquid.

(b) Pitot – tube

(c) Momentum and energy correction factors.

SECTION-B

Q.6 (a) A jet of water having a velocity of 15 m/s strikes a curved vane which is moving with a velocity of 5 m/s. The vane is symmetrical and is so shaped that the jet is deflected through 120^0. Find the angle of the jet at inlet of the vane so that there is no shock. What is the absolute velocity of the jet at outlet in magnitude and direction and the work done per unit weight of water? Assume the vane to be smooth. **08**

(b) Water is flowing through a pipe at the end of which a nozzle is fitted. The diameter of the nozzle is 100mm and the head of water at the centre nozzle is 100 m. Find the force exerted by the jet of water on a fixed vertical plate. The coefficient of velocity is given as 0.95. **05**

Q.7 (a) A Kaplan turbine develops 24647.6 kW power at an average head of 39 meters. Assuming a speed ratio of 2, flow ratio of 0.6 diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate the diameter, speed and specific speed of the turbine. **07**

(b) A Pelton wheel turbine is having a mean bucket diameter of 1m and is running at 1000 rpm. The net head on the Pelton wheel is 700m. If the side clearance angle is 15^0 and discharge through nozzle is $0.1 m^3/s$, find power available at the nozzle and hydraulic efficiency of the turbine. **06**

Q.8 (a) A centrifugal pump delivers water against a net head 14.5 meters and a design speed of 1000 rpm. The vanes are curved back to an angle 30^0 with the periphery. The impeller diameter is 300mm and outer width is 50 mm. Determine the discharge of the pump if manometric efficiency is 95%. **07**

(b) Explain main characteristics curves and operating characteristics curves of centrifugal pump. **06**

Q.9 (a) Explain the working principle of hydraulic press with neat sketch. **06**

(b) An accumulator is loaded with 40 kN weight. The ram has a diameter of 30 cm and stroke of 6m. Its friction may be take as 5%. It takes two minute to fall through its full stroke. Find the total work supplied and power delivered to the hydraulic appliance by the accumulator, when 7.5 lit/s is being delivered by a pump, while the accumulator descends with the stated velocity. **07**

Q.10 Write short notes on (any two) **7x2=14**

(a) Francis turbine

(b) Cavitation and priming of centrifugal pump.

(c) Hydraulic intensifier.

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