Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-III Examination May 2012

Subject code: 130502

Subject Name: Fluid Flow Operation

Date: 15/05/2012 **Time: 02.30 pm – 05.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	State the assumptions and derive Bernoulli's equation for pump work.	**07**
	(b)	Explain centrifugal pumps and their types with neat labelled diagram. Derive head flow relation for an ideal centrifugal pump. Write appropriate assumptions if any.	**07**
Q.2	**(a)**	Classify flow measuring devices according to their working principle and derive mass and volumetric flowrate for ideal and fully developed flow in venturimeter.	**07**
	(b)	Derive for shear stress distribution for fluid in steady flow in a cylindrical tube. Also give the relation between skin friction and wall shear.	**07**
		OR	
	(b)	Starting from the definition of kinetic energy correction factor, prove that $\alpha = 2$ for laminar flow.	**07**
Q.3	**(a)**	Define: (i)Potential flow (ii)Streamlineflow (iii)Viscosity (iv)Steady state flow (v)Irrotational flow (vi)Equivalent diameter (vii)Smooth pipe	**07**
	(b)	Give detailed classification of fluids based on Newton's law of viscosity.	**07**
		OR	
Q.3	**(a)**	A sugar syrup is flowing in a pipe of 55mm i.d at a flow rate of 66.67cm^3/s. The viscosity is 0.15N.s/m^2 and density is 1040kg/m^3. Calculate the frictional loss over a length of 10m.	**07**
	(b)	The U-tube manometer is used to measure pressure drop across an orifice meter. The manometric fluid is mercury(sp.gr.=13.6) and fluid flowing through pipeline and filling manometirc limbs is brine(sp.gr.=1.26). When the pressure at taps is equal, the level of mercury in manometer is one meter below the taps. In operating conditions, the pressure at the upstream tap is 115.324kN/ m^2 absolute and that at the downstream tap is 33.864 kN/ m^2 below atmospheric. What is reading of manometer in centimeter.	**07**
Q.4	**(a)**	What is Fluidization? Give its application in chemical process industries.	**07**
	(b)	Derive Hagen Poiseuille equation.Give its significance.	**07**
		OR	
Q.4	**(a)**	State different methods of dimensional analysis. Explain Bukingham π- method with example in detail.	**07**
	(b)	Derive the continuity equation for one-dimensional compressible flow in differential form.	**07**
Q.5	**(a)**	Define: (i)Cavitation (ii) priming (iii) Vena contracta (iv) Zero head flowrate (v) NPSH (vi) Suction head (vii) Fully developed flow	**07**

	(b)	A 15kW pump with efficiency 80% is discharging oil of specific gravity 0.85 to a overhead tank from a storage tank. The surface oil in the storage tank from the datum line is 5m and that in overhead tank fro datum line is 25m. Both the tanks are open to the atmosphere. If the losses in the piping system are 1.75m of flowing fluid, calculate the volumetric flow rate of the oil.	**07**
		OR	
Q.5	**(a)**	Explain different kinds of valves with neat labelled diagram.	**07**
	(b)	A venturimeter is to be fitted in a pipe of 250mm diameter where pressure head is 7.6m of flowing fluid and the maximum flow is $8.1m^3$ per minute. Determine the least diameter of the throat to ensure that the pressure head does not become negative. Take coefficient of venturimeter as 0.96.	**07**

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