Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2013

Subject code: 713003N **Date: 13-06-2013**

Subject Name: Advance Fluid Flow Operation

Time: 10.30 am – 01.00 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)**	Discuss various models of non Newtonian fluid in detail.	**07**
	(b)	Write a detail note on any one viscometer.	**07**
Q.2	**(a)**	Discuss about various flow patterns in horizontal pipes for two phase flow.	**07**
	(b)	Derive A_G / A = u_{GS} / u_G for two phase flow. Where A : cross sectional area of pipe A_G: part of A occupied by gas u_G : gas velocity u_{GS} : superficial gas velocity	**07**
		OR	
	(b)	Discuss in detail about two phase flow pattern map of Hewiit and Roberts for vertical pipes.	**07**
Q.3	**(a)**	Explain performance curves for centrifugal pumps.	**07**
	(b)	Discuss about application of jet in moving machine.	**07**
		OR	
Q.3	**(a)**	Explain how is solid-solid and liquid ï solid mixing achieved?	**07**
	(b)	Write a note on various types of compressors.	**07**
Q.4		A reaction is to be carried out in an agitated vessel. Pilot scale tests have been carried out under fully turbulent conditions in a tank 0.6 m in diameter, fitted with baffles and provided with a flat-bladed turbine, and it has been found that satisfactory mixing is obtained at a rotor speed of 4 Hz when the power consumption is 0.15 kW and the Reynolds number 160,000. What should be the rotor speed in order to achieve the same degree of mixing if the linear scale of the equipment if increased by a factor of 6 and what will be the Reynolds number and the power consumption?	**14**
		OR	
Q.4	**(a)**	Write a note on slurry transport or pneumatic conveying.	**07**
	(b)	Write a brief note on CFD and its application in chemical engineering.	**07**

Q.5 Air at 290 K is compressed from 101.3 kN/m^2 to 2065 kN/m^2 in a two-stage compressor operating with a mechanical efficiency of 85 per cent. The relation between pressure and volume during the compression stroke and expansion of the clearance gas is PV 1.25 = constant. The compression ratio in each of the two cylinders is the same, and the interstage cooler may be assumed 100 per cent efficient. If the clearances in the two cylinders are 4 per cent and 5 per cent respectively, calculate: **14**

(a) the work of compression per kg of air compressed;
(b) the isothermal efficiency;
(c) the isentropic efficiency (γ = 1.4), and
(d) the ratio of the swept volumes in the two cylinders.

OR

Q.5 A Newtonian liquid of viscosity 0.1 s/m^2 is flowing through a pipe of 25 mm diameter and 20 m in length and pressure drop is 105 N/m^2. As a result of process change a small quantity of polymer is added to the liquid and this cause the liquid to exhibit non Newtonian characteristics; its rheology is described adequately by power law model and the flow index is 0.33. The apparent viscosity of the modified fluid is equal to the viscosity of the original liquid at a shear rate of 1000 s^{-1}. If the pressure difference over the pipe is unaltered, what will be the ratio of the volumetric flow rates of the two liquids? **14**

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