

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Regular Examination January / February 2011

Subject code: 713003N

Subject Name: Advance Fluid Flow Operation

Date: 02 /02 /2011

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) Derive $A_G/A = u_{GS}/u_G$ for two phase flow. **07**
 Where A : cross sectional area of pipe
 A_G : part of A occupied by gas
 u_G : gas velocity
 u_{GS} : superficial gas velocity
- (b) Discuss about various flow patterns in horizontal pipes for two phase flow. **07**
- Q.2** (a) Discuss any two models of non Newtonian fluid in detail. **07**
 (b) Discuss in detail about two phase flow pattern map of Taitel and Duckler for horizontal pipes. **07**
- OR**
- (b) Discuss in detail about two phase flow pattern map of Hewitt and Roberts for vertical pipes. **07**
- Q.3** (a) Write a note on Plate and Cone Viscometer. **07**
 (b) Discuss any one viscosity measurement technique in detail. **07**
- OR**
- Q.3** (a) Write a note on Bob and Cup Viscometer. **07**
 (b) Discuss about characteristic curves of centrifugal pump in detail. **07**
- Q.4** (a) Discuss about application of jet in moving machine. **07**
 (b) Write a note on CFD and its application in chemical engineering. **07**
- OR**
- Q.4** (a) Discuss about application of jet in vacuum system. **07**
 (b) Write a note on slurry transport or pneumatic conveying. **07**
- 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 10^5 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} . **14**
 If the pressure difference over the pipe is unaltered, what will be the ration of the volumetric flow rates of the two liquids?
- OR**
- Q.5** A single acting compressor supplies $0.1 \text{ m}^3/\text{s}$ of air measured at 273 K and 101.3 kN/m^2 which is compressed to 380 kN/m^2 . If the suction temperature is 289 K, the stroke is 0.25 m, and the speed is 4.0 Hz, what is the cylinder diameter? Assuming the cylinder clearance is 4 per cent and compression and re compression are isentropic ($\gamma = 1.4$), what are the theoretical power requirement for the compressor? **14**
