

GUJARAT TECHNOLOGICAL UNIVERSITY**B. E. - SEMESTER – III • EXAMINATION – WINTER 2012****Subject code: 130502****Date: 10-01-2013****Subject Name: 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)** Explain in detail about continuous gravity decanter **07**
(b) Discuss the concept of hydrostatic equilibrium and derive mathematical condition of hydrostatic equilibrium. **07**

- Q.2 (a)** A horizontal cylindrical continuous decanter is to separate 10 m³/h of a liquid petroleum fraction from an equal volume of wash acid. Oil is continuous phase and at the operating temperature has density of 860 kg/m³ and viscosity of 1 cP. Density of acid is 1160 kg/m³. Compute the volume of the vessel, if 95% vessel is filled with given liquid mixture. **07**

- (b)** Explain in detail the behavior of Newtonian and non Newtonian fluid with suitable example. **07**

OR

- (b)** Define skin friction and form friction. Write down Bernoulli equation without friction and explain the correction of Bernoulli equation for fluid friction. **07**

- Q.3 (a)** Write a short note on friction loss from sudden expansion and sudden contraction of cross section of pipe through which incompressible fluid is flowing. **07**

- (b)** Derive Ergun equation. **07**

OR

- Q.3 (a)** For laminar flow of fluid through pipe, derive the following relation for the ratio of local velocity to maximum velocity, **07**

$$\frac{u}{u_{\max}} = 1 - \left(\frac{r}{r_w} \right)^2$$

- (b)** Write a short note on types of fluidization. **07**

- Q.4 (a)** Air enters a convergent-divergent nozzle at a temperature of 555.6 K and a pressure of 20 atm. The throat area is one-half that of the discharge of divergent section. Assuming the Mach number in the throat is 0.8, what are the values of pressure and density at the throat? **07**

Data given: For air $\gamma = 1.4$ and $M = 29$ gm/mol.

- (b)** Write a short note on prevention of leakage around moving parts. **07**

OR

- Q.4 (a)** Explain in detail about isentropic flow of compressible fluid through nozzle. **07**

- (b)** Discuss in detail about gate valve and globe valve. **07**

- Q.5 (a)** A three-stage reciprocating compressor is to compress 306 m³/h of methane from 0.95 to 61.3 atm abs. The inlet temperature is 26.7 °C. For the expected temperature range average properties of methane are $CP = 38.9$ J/(mol °C) and $\gamma = 1.31$. Calculate the power required, if the mechanical efficiency is 80 %? **07**

- (b)** Explain the characteristic curve of centrifugal pump with neat sketches. **07**

OR

- Q.5 (a)** Differentiate between variable head flow meters and variable area flow meters. Briefly describe the construction and working of venture meter. **07**

- (b)** Explain any one method of dimensional analysis with suitable example. **07**
