

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), Nov.-Dec. 2015

B. Tech in Chemical Engineering, Semester III

Roll No.....

CHE 302: Fluid Flow Operations

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	The head loss in a sudden pipe expansion from area A_1 to area A_2 and from velocity V_1 to velocity V_2 is given by (a) $(1 - A_1/A_2)^2 \cdot V_1^2/2g$ (b) $(1 - A_1/A_2)^2 \cdot V_2^2/2g$ (c) $(1 - A_2/A_1)^2 \cdot V_1^2/2g$ (d) $(1 - A_2/A_1)^2 \cdot V_2^2/2g$	
ii.	For a Newtonian fluid (a) Shear stress is proportional to shear strain (b) Rate of shear stress is proportional to shear strain (c) Shear stress is proportional to rate of shear strain (d) Rate of shear stress is proportional to rate of shear strain	
iii.	The dimension of surface tension is: (a) ML^{-1} (b) L^2T^{-1} (c) $ML^{-1}T^{-1}$ (d) MT^{-2}	
iv.	The shear stress developed in lubricating oil, of viscosity 9.81 poise, filled between two parallel plates 1 cm apart and moving with relative velocity of 2 m/s is: (a) 20 N/m ² (b) 196.2 N/m ² (c) 29.62 N/m ² (d) 40 N/m ²	
v.	The hydrodynamic boundary layer thickness is defined as the distance from the surface where the (a) Velocity equals the local external velocity (b) Velocity equals the approach velocity (c) Momentum equals 99% of the momentum of the free stream (d) Velocity equals 99% of the local external velocity	
vi.	The loss of head at the entrance of pipe is given by: (a) $0.5 V_2^2/2g$ (b) $0.5 V_1^2/2g$ (c) $2.5 V_2^2/2g$ (d) $2.5 V_1^2/2g$	

vii.	How is the difference of pressure head, "h" measured by a mercury-oil differential manometer expressed? (a) $h = x \left[1 - \frac{S_g}{S_o} \right]$ (c) $h = x [S_o - S_g]$ Where x = manometer reading; S _g and S _o are the specific gravities of mercury and oil, respectively.	(b) $h = x [S_g - S_o]$ (d) $h = x \left[\frac{S_g}{S_o} - 1 \right]$
viii.	The hydraulic mean depth (where A = area and P = wetted perimeter) is given by: (a) P / A	(b) P ² / A (c) A / P (d) $\sqrt{A}/P$
ix.	Bodies in flotation to be in stable equilibrium, the necessary and sufficient condition is that the centre of gravity is located below the..... (a) Metacentre (c) Centre of gravity	(b) Centre of pressure (d) Centre of buoyancy
x.	If U _∞ = free stream velocity, u = velocity at y and δ = boundary layer thickness, then in a boundary layer flow, the momentum thickness θ is given by: (a) $\theta = \int_0^\delta \frac{u}{U_\infty} \left(1 - \frac{u}{U_\infty} \right) dy$ (c) $\theta = \int_0^\delta \frac{u^2}{U_\infty^2} \left(1 - \frac{u}{U_\infty} \right) dy$	(b) $\theta = \int_0^\delta \frac{u}{U_\infty} \left(1 - \frac{u^2}{U_\infty^2} \right) dy$ (d) $\theta = \int_0^\delta \left(1 - \frac{u}{U_\infty} \right) dy$

Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
(a)	When a flat plate of 0.1 m ² area is pulled at a constant velocity of 30 cm/sec parallel to another stationary plate located at a distance 0.01 cm from it and the space in between is filled with a fluid of dynamic viscosity = 0.001 Ns/m ² , Calculate the force required to be applied.	
(b)	Calculate the discharge through a pipe of diameter 200 mm when the difference of pressure head between the two ends of a pipe 500 m apart is 4m of water. Take the value of 'f' = 0.009 in the formula $h_f = \frac{4fLV^2}{d \times 2g}$.	
(c)	Determine the viscosity of a liquid having kinematic viscosity 6 stokes and specific gravity 1.9	
(d)	Differentiate between Newtonian and Non-Newtonian fluid with an example.	
Q.3A	Define the following dimensionless numbers: (a) Reynolds number (b) Mach number (c) Euler number (d) Froude number (e) Weber number	05