UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: ADE | **Semester – III[rd]**
Subject (Course): Applied Fluid Mechanics | **Max. Marks : 100**
Course Code : GNEG-225 | **Duration : 3 Hrs**
No. of page/s: 02

Instructions:
Attempt all questions. Section A (each carrying 5 marks); Attempt any four question from Section B (each carrying 10 marks). Attempt ant two question Section C (each question carrying 20 marks).

Section A (Attempt all)

1	Why do golf balls have dimples? What would happen if the dimples were not made? Explain with a diagram.	**[5]**	**CO5**
2	Can a rotating cylinder in a flow produce lift force? If yes, why do modern aircrafts not have cylindrical wings? If no, why not?	**[5]**	**CO4**
3	Differentiate between the criterion of stability of floating bodies and submerged bodies. Why are these criteria different? Explain with diagrams.	**[5]**	**CO1**
4	Name the four kinds of motion of a fluid element and explain them briefly.	**[5]**	**CO2**

Section B (Attempt any Four)

5	Experiment were conducted in a wind tunnel with wind speed of 50 km/hr on a flat plate 2 m long and 1 m wide. The mass density of air is 1.15 kg/m^3, and plate is kept at such an angle that the coefficients of lift and drag are 0.75 and 0.15 respectively. Determine the lift force, drag force, resultant force and power exerted by the air stream on the plate.	**[10]**	**CO5**
6	A 30 cm diameter horizontal pipe terminates in a nozzle with the exit diameter of 7.5 cm. if the water flows through at a rate of 0.15 m^3/s, what force will be exerted by fluid on the nozzle?	**[10]**	**CO5**
7	A plate of length 500 mm and width 250 mm has been placed longitudinally in a stream of crude oil which flows with a velocity of 6 m/s. if the oil has specific gravity 0.9 and viscosity 1 stoke calculate 1) Boundary layer thickness at the middle of the plate. 2) Shear stress and the middle of the plate 3) Friction drag on one side of the plate.	**[10]**	**CO4**
8	An oil of viscosity 1.5 poise and specific gravity 0.85 flows in 15 cm diameter	**[10]**	**CO4**

pipe. Observations state that the velocity along the center line of the pipe is 3.5 m/s. Calculate 1) Quantity of oil being conveyed. 2) Shear Stress at the pipe. 3) is it laminar or turbulent flow.

9 A circular orifice of diameter 7.5 mm is provided in a tank containing water to a height of 1.2 m above orifice. The jet strikes a wall 1.25 m away and 0.35 m vertically below the centerline of the contracted section of the jet. The actual discharge through the orifice is measured to be 40 kg of water in 5 minutes. Compute the orifice coefficients. **[10]**

SECTION C (Attempt any two)

10 (a) Prove that for a steady laminar flow between two fixed parallel plates, the average velocity is $\frac{2}{3}^{rd.}$ of maximum velocity.

(b) Two parallel plates are placed 10 mm apart. The bottom plate is fixed and top plate is moving at speed of 1 m/s. The viscosity is 0.8 Ns/m^2. If the pressures drop from 200 kPa to 100 kPa over a distance of 100 m. Determine the rate of flow. **[20] CO5**

11 Three pipes of 400 mm, 200 mm and 300 mm diameters and having lengths of 400 m, 200 m and 300 m respectively are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference in water level is 16 cm. the friction factor is same to all the pipes and is equal to 0.02. determine the discharge through the compound pipe for the following cases: **[20] CO4**

a) Neglecting minor losses
b) Including minor losses.

12 (a) The velocity distribution in laminar boundary layer over a flat plate is assumed to be given by second order polynomial $u= a+ by+ cy^2$, determine its form using necessary boundary conditions.

(b) A submarine can be assumed to have cylindrical shape with rounded nose. Assuming its length to be 55 m and the diameter 6 m. determine the total power required to overcome boundary friction if it cruise at 8 m/s velocity in water at 20 deg C. Take density of water 1030 kg/m^3 and viscosity $1*10^{-6}$ m^2/s. **[20] CO3**