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Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, November 2014
(2013 Scheme)
13.303 : FLUID MECHANICS
(MS)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions.

1. Define the term compressibility.
2. Explain Newton's law of viscosity.
3. How will you classify pressure measuring instruments ?
4. Differentiate between rotational and irrotational flow.
5. Explain flow net.
6. Sketch a pitot static tube and explain its working.
7. What do you understand by critical Reynold's Number ?
8. Explain the phenomenon of water hammer in pipes.
9. List any two methods to control boundary layer separation.
10. Define kinematic similarity. **(10×2=20 Marks)**

PART – B

Answer **1** question from **each** Module.

Module – I

11. a) Explain the phenomenon of surface tension. Obtain an expression for pressure intensity inside a droplet and a liquid jet due to surface tension. **10**

b) Determine the difference of pressure between pipes A and B when connected to an inverted U-tube differential manometer containing oil of specific gravity 0.8 as the manometric liquid. The pipe A conveys a water and a fluid of sp. gravity 0.9 flows through the pipe B. The position of liquid in the left limb is 80 cm from the centre line of pipe A whereas liquid in the right limb is at a height of 50 cm from the centre line of pipe B. The pipe A and B are at different levels and the manometer reading is 15 cm of oil. If $P_A = 5 \times 10^4$ N/m^2 and the barometer reading is 730 mm of mercury, find the pressure in pipe A in meters of water absolute. **10**

12. a) State and prove Pascal's law. **10**

b) Derive an expression for the force exerted on a submerged inclined plane surface by the static liquid and locate the position of the centre of pressure. **10**

Module – II

13. a) Write short notes on (i) circulation and vorticity (ii) stream function and potential function. **10**

b) A velocity potential for a 2-D flow is given by, $\phi = x^2 - y^2$. Determine :

i) The velocity components in the x and y direction. Check to see whether the velocity components satisfy the condition of flow continuity and irrotationality.

ii) Stream function and the flow rate between the stream line (1, 0) and (1, 1).

iii) Also show that the stream lines and potential lines intersect orthogonally at (1, 1). **10**

14. a) Derive Euler's equation of motion. How will you obtain Bernoulli's equation from it ? **10**

b) A venturimeter with 200 mm at inlet and 100 mm throat is laid with axis horizontal and is used for measuring the flow of oil of specific gravity 0.8. The difference of levels in the U-tube manometer reads 180 mm of Hg whilst 11.52×10^3 kg of oil is collected in 4 minutes. Calculate the discharge co-efficient for the meter. **10**

Module – III

15. a) Derive an expression to find the loss of head due of friction, of the flow through the pipe is turbulent. **10**

    b) The pressure at the inlet of a pipe line is 1000 kPa and the pressure drop is 200 kPa. The pipe line is 1.5 km long. If 100 kW is to be transmitted over this pipe line, find the diameter of the pipe and efficiency of transmission. Take f = 0.006. **10**

16. a) Show that the mean velocity in a circular pipe for viscous flow is equal to two times the average velocity of flow. **10**

    b) Three pipes of 400 mm, 200 mm and 300 mm diameters have lengths of 400 m, 200 m and 300 m respectively. They are connected in series to make a compound pipe. The ends of compound pipes are connected to a tank whose difference of water level is 16 m. If f′ is same for all pipes and equal to 0.005, determine the discharge through the compound pipe neglecting all minor losses. **10**

Module – IV

17. a) Explain :
        1) Displacement thickness
        2) Momentum thickness
        3) Energy thickness
        4) Shape factor. **10**

    b) Find the displacement thickness, momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = \frac{y}{\delta}$. Also calculate the shape factor. **10**

18. a) State and explain the significance of Buckingham's pi theorem. Also explain, how will you select repeating variables while applying dimensional analysis using Buckingham's Pi theorem ? **10**

    b) Write short notes on :
        1) Model analysis
        2) Various types of similarities existing between a model and a prototype. **10**
