JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
[A GOVERNMENT AUTONOMOUS COLLEGE]

JGEC/B.TECH/ CIVIL ENGINEERING/ CE(ES)401/ 2021-22

2022

INTRODUCTION TO FLUID MECHANICS

Full Marks: 70 Times: 3 Hours

The figures in the margin indicate full marks.
Candidates are instructed to write the answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer ***all*** questions 5x2=10

1. Define wetting fluid and non-wetting fluid using the concept of capillarity. 2
2. Write down general differential equation for incompressible flow and irrotational flow in vector form. 1+1
3. State conditions for gradual and sudden closure of the valve. 1+1
4. Define suction head and static head of a centrifugal pump. 1+1
5. What is cavitation? 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any ***five*** questions 12x5 = 60

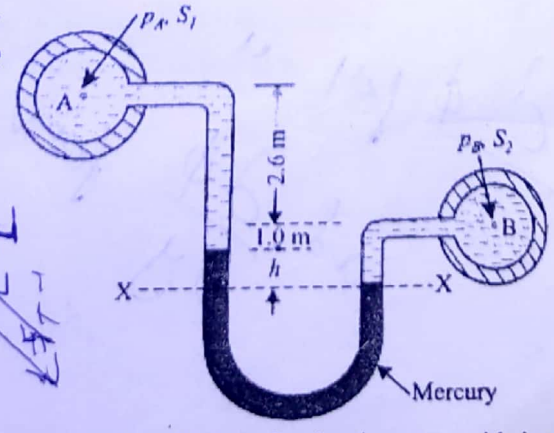
6. i) A U-tube is made up of two capillaries of bores 1.0 mm and 2.2 mm, respectively. The tube is held vertically with zero contact angles. It is partially filled with liquid of surface tension 0.08 N/m. If the estimated difference in the level of two menisci is 14.8 mm, determine the mass density of the liquid. 5

   ii) Two large plane surfaces are 5.8 cm apart. The space between the surfaces is filled with glycerine. What force is required to drag a very thin plate of surface area 0.65 m^2 between the two large plane surfaces at a speed of 1 m/s, if the thin plate is at a distance of 1.76 cm from one of the plane surfaces? Take dynamic viscosity of glycerine = 8.1×10^{-1} Ns/m^2. 7

7. i) The resisting force F of a plane during flight can be considered as a dependent upon length of aircraft (l), velocity (v), air viscosity (μ), air density (ρ), and bulk modulus of air (K). Express the functional relationship between these variables and resisting force using dimensional analysis. 8

   ii) State and explain (with suitable sketches) the conditions of equilibrium of 4
   a) Floating body
   b) Submerged body

8. i) Figure shows a U-tube differential manometer connecting two pressure pipes at A and B. The pipe A contains a liquid of specific gravity 1.6 under a pressure of 110 kN/m^2. The pipe B contains a liquid of specific gravity 0.8 under a pressure of 200 kN/m^2. Find the difference of pressure measured by mercury as fluid filling U-tube. 6



   ii) A solid cylinder 2m in diameter and 2m high is floating in water with its axis vertical. If the specific gravity of the material of cylinder is 0.65, find its metacentric height. State also whether the equilibrium is stable or unstable. 6

9. i) Show how variable density fluid can satisfy incompressible flow equation? 2
ii) Find the acceleration components at a point (1,1,1) and t=2sec for the following flow field. 6
$u = 2x^3+6y^2z+z+5t$, $v = -3x+5y^3-7xzt$, $w = -1.5z^2x+7yz-3tx$
iii) The velocity potential function for a flow is given by $\Phi=5(x^2-y^2)$. Calculate the velocity components at point (2,3). Also determine stream function for the flow. 4

10. i) Determine the total pressure and centre of pressure on a triangular plate of base 4.5 m and altitude 6.2 m when it is immersed vertically in an oil of specific gravity 0.95. The base of the plate coincides with the free surface of oil. 6
ii) An oil of specific gravity 0.85 is flowing through a venturimeter having an inlet diameter 18 cm and a throat diameter 8 cm. the oil-mercury differential manometer shows a reading of 24 cm. Calculate the discharge of oil through the horizontal venturimeter. Take $C_d=0.98$. 5
iii) What is moment of momentum principle. 1

11. i) Three pipes of 450 mm, 360 mm and 390 mm of diameters have lengths of 200 m 400m and 300 m respectively. They are connected in series to make a compound pipe. The ends of this compound pipe are connected in series to make a compound pipe. The ends of this compound pipe are connected with two reservoirs whose difference in water levels is 15.5 m. If coefficient of friction for these pipes are 0.005, 0.0025, 0.0067 respectively; determine the discharge through the compound pipe considering all possible major and minor losses. 8
ii) A pipe of diameter 1.8 m is required to transport an oil of specific gravity 0.82 and viscosity 0.03 poise at a rate of 4000 lit/s. Tests were conducted on a 13 cm diameter pipe using water at 20°C. Find the velocity and rate of flow in the model. Viscosity of water at 20°C = 0.01 poise. 4

12. i) A ring main consists of a quadrilateral network ABCD and a triangular network ADE, the pipe AD being common to both networks. The resistances of the pipelines are AB = 4, BC = 2, CD = 5, DA= 4, AE = 2, DE = 3 units. Let a flow of 10 units enter at E and flows of 3, 4, 3 units leave at B, C, D respectively. Determine the magnitudes of the pipe flows to an accuracy of 0.1 flow unit and indicate their directions on the sketch. 12

$\frac{\partial \phi}{\partial x}$ for u and $\frac{\partial \phi}{\partial y}$ for v

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SURVEYING & GEOMATICS

Full Marks: 70

Times: 3 Hours

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GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer ***all*** questions 5x2=10

1. What is non-transit theodolite? What is Line of collimation of a theodolite? 1+1
2. What is swinging of theodolite? What is Face normal of a theodolite? 1+1
3. How to measure Horizontal angle by Repetition method with a theodolite? 2
4. In triangle ABC, the line AC was used as base of known length. Calculate strength of figure if angles A, B and C were observed as 60°, 40° and 50° respectively. 2
5. What is contour gradient? What is Transiting of a theodolite? 1+1

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any ***five*** questions 12x5 =60

6. i) Discuss the comparison between Terrestrial photogrammetry and Aerial photogrammetry. 4
   ii) Discuss advantages and disadvantages of Aerial Vertical photograph over conventional Map. 4
   iii) Discuss advantages and disadvantages of Photogrammetric Surveying. 4

7. i) Classify the triangulation system and discuss them briefly. 4
   ii) Describe the different rules used for Adjustment of plane triangle. 4
   iii) What do you understand by Strength of figure in Triangulation system? 2
   iv) What are the objectives of triangulation? 2

8. i) Write short notes on (a) Visual Remote sensing System and (b) Satellite Remote sensing. 3+3
   ii) Discuss about the different types of Aerial Photographs according to the Tilt or Direction of exposure with neat sketches. 6

9. i) For the following theodolite traverse, find the length of DE so that A, E, F may be in the same straight line. 8

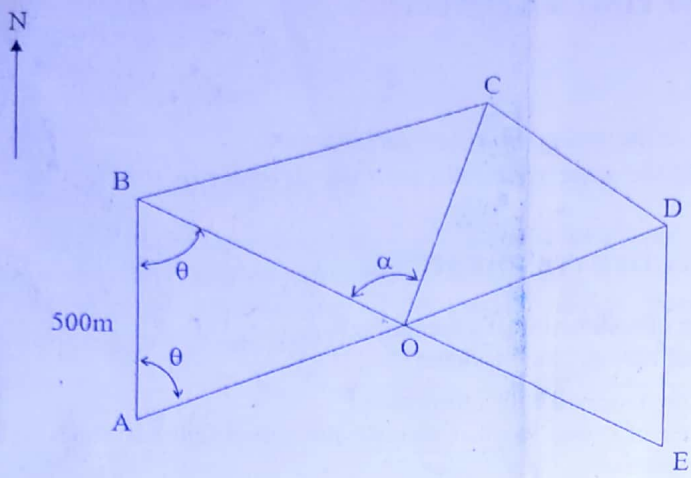
Line	Length (m)	Reduced Bearing
AB	200	S84°30'E
BC	100	N75°18'E
CD	80	N18°45'E
DE	?	N29°45'E
EF	150	N64°10'E

   ii) What are the rules used for balancing a closed traverse? Describe them briefly. 4

10. i) Describe the "Interaction of electromagnetic radiation and Earth" / "Energy budget of incoming solar radiation on earth and atmosphere" with neat sketch. 6
    ii) What is spectral resolution in Remote Sensing? 2
    iii) What are the different types of satellites are used in Remote Sensing? Give one example of each. 2
    iv) What is Digital Number in Remote Sensing? What is Spectral Signature in Remote Sensing? 1+1

11. Write short notes on the any 3 (three) of the following: 4×3 =12
    i) Terrestrial laser scanner.
    ii) Principle of Differential GPS.
    iii) Distomats.
    iv) Auto-level.

12. i) Given the polygon shown in the figure which is a part of a triangulation system. The straight lines BE and AD are equal in length and point O is located at their midpoint. The azimuth of line BC is 255 degrees. If the angle θ = 70 degrees and length AB is equal to 500 meters, determine the length of CD. Note that α = 90 degrees.



8

ii) Discuss about different types of Triangulation Layouts with neat sketches. 4