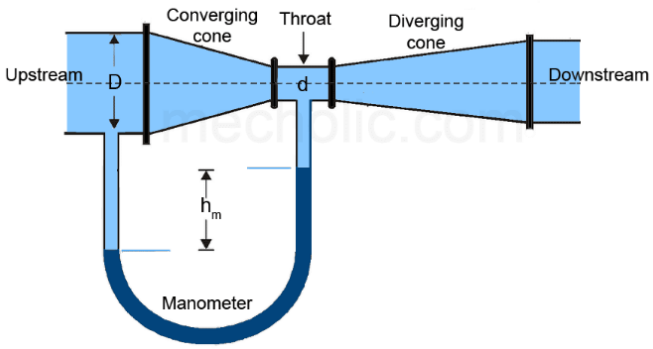
MUZAFFARPUR INSTITUTE OF TECHNOLOGY

COURSE FILE

OF

Fluid Mechanics Theory and Lab

(011307 T+P)



Faculty Name: GULSHAN KUMAR

ASST.PROF., DEPARTMENT OF MECHANICAL ENGINEERING

विज्ञान एवं प्रावैधिकी विभाग
Department of Science and Technology
Government of Bihar

CONTENTS

Department of Mechanical Engineering

Vision

- To strengthen the region through imparting superior quality technical education and research; which enables the fulfillment of industrial challenge and establish itself as a Centre of Excellence in the field of Mechanical Engineering.

Mission

- To build an academic environment of teaching and lifelong learning for students to make them competitive in context with advance technological, economical and ecological changes.
- To enable the students to enhance their technical skills and communications through research, innovation and consultancy projects.
- To share and explore the accomplishments through didactic, enlightenment, R & D programs with technical institution in India and abroad.

Mechanical Engineering Program Educational Objectives

After 4 year of graduation a B.TECH (ME) graduate would be able to

- Graduates will spread and enhance their technical capability and proficiency through vital domain of economical, environmental and social concerns affiliated with the mankind and industry.

- Graduates will able to work professionally with modern methods in the area of Thermal, Mechanical System Design, Manufacturing, Measurement, Quality control and other interdisciplinary fields of concerns.

- Graduates will practice Mechanical engineering in sensible, flexible and ethical manner to benefit the society, industry and nation toward the rapidly changing global technical standards.

- Graduates will serve as ambassadors for engineering by their knowledge, creativity, imagination and innovation and set new extremes in their profession through lifelong learning.

Mechanical Engineering Student Outcomes

Students who complete the B.TECH degree in ME will be able to:

1. An ability to apply the knowledge of mathematics, basic sciences and engineering concepts to solve the complex engineering problems.
2. The ability to conduct experiments and to critically analyze and interpret the experimental data to reach at substantial outcomes.
3. An ability to design systems, components, or processes to meet appropriate needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. An ability to identify, formulates, and solves the complex engineering problems.
5. An ability to function on multi-disciplinary teams that leads the multi-disciplinary projects.
6. An understanding of professional and ethical responsibility.

7. An ability to communicate effectively with written, oral, and visual means.
8. An ability to understand the impact of engineering solutions in a global, environmental, economical and societal context.
9. An ability to recognize the need to engage in life-long learning.
10. An ability to attain knowledge of contemporary issues.
11. An ability to use the techniques, skills, and modern tools necessary for Mechanical engineering practice.
12. Possess ability to estimate costs, estimate quantities and evaluate materials for design and manufacturing purposes.

COURSE OBJECTIVES:

To acquaint students with fluid flow and forces act on it and to present some of the engineering calculations encountered in practice.

Objectives that students will meet at the end of the course:

1. To introduce and explain fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.

2. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.

3. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.

4. To imbibe basic laws and equations used for analysis of static and dynamic fluids.

5. To inculcate the importance of fluid flow measurement and its applications in Industries.

6. To determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.

COURSE OUTCOMES:

After completion of this course, the students should be able to:

1. Knowledge of basic principles of fluid mechanics.
2. Ability to analyse fluid flow problems with the application of the momentum and energy equations.
3. Capability to analyse pipe flows as well as fluid machinery. Identify how properties of fluids change with temperature and their effect on pressure and fluid flow.
4. Describe fluid pressure and its measurement.
5. Define the relationship between pressure and elevation as it relates to manometers, barometers and other pressure measuring devices.
6. Calculate forces on a plane submerged in a static fluid.
7. Calculate buoyancy on a body submerged in a static fluid.
8. Use the general energy equation to calculate changes in fluid flow for circular and non-circular pipes for in-compressible fluids.
9. Select a pump type and pump size to meet capacity and other pumping requirements.

CO-PO MAPPING

Sr. No.	Course Outcome	PO
1.	ME-011307.1 To introduce and explain fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.	PO1, PO6, PO8, PO9
2.	ME-011307.2 Students will able to learn fundamental knowledge of fluid, its properties and behaviour under various conditions of internal and external flows.	PO1, PO2, PO3, PO5
3.	ME-011307.3 Students will able to develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.	PO1, PO2, PO4, PO12
4.	ME-011307.4 Students will able to imbibe basic laws and equations used for analysis of static and dynamic fluids.	PO1, PO3, PO10
5.	ME-011307.5 Students will able to inculcate the importance of fluid flow measurement and its applications in Industries.	PO5, PO7, PO11,PO12
6.	ME-011307.6 Students will able to determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.	PO2, PO5, PO6

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME-011307.1 To introduce and explain fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.	√					√		√	√			
ME-011307.2 Students will able to learn fundamental knowledge of fluid, its properties and behaviour under various conditions of internal and external flows.	√	√	√		√							
ME-011307.3 Students will able to develop understanding about hydrostatic law, principle of buoyancy and stability of a	√	√		√								√

floating body and application of mass, momentum and energy equation in fluid flow.												
ME-011307.4 Students will able to imbibe basic laws and equations used for analysis of static and dynamic fluids.	√		√							√		
ME-011307.5 Students will able to inculcate the importance of fluid flow measurement and its applications in Industries.					√		√				√	√
ME-011307.6 Students will able to determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.		√			√	√						

Syllabus

01 1307 FLUID MECHANICS

L-T-P : 3-1-2 **Credit : 05**

Theory:

Introduction, fluid properties: density, viscosity, compressibility, ideal and real fluids. **Lecture : 04**

1. **Hydrostatics;** fluid force on plane and curved surfaces, manometry, buoyancy, uniformly accelerated motion. **Lecture : 06**
2. **Kinematics of fluid flow.** Generalized continuity equation, Irrotational motion and solution to Laplace equation. Concept of stream lines, Equipotential Lines, Flow Nets. **Lecture : 09**
3. **Dynamics of fluid flow,** Control volume concepts, Euler and Bernoulli's theorems and various application like pivot tube, venturimeter, orifice meter, notches and weir etc; Impulse momentum theory and application. **Lecture : 10**
4. **Introduction to Navier Stokes Equation.** Flow of fluid in closed conduits, Laminar flow of viscous incompressible fluids, Darcy-Weisbach equation, Moody's diagram, and Minor losses Hardy-cross method for pipe networks. **Lecture : 09**
5. **Forces on immersed bodies,** concepts of separation, drag force, circulation and lift force. Dimensional Analysis, Model Similitude : Theory and application. **Lecture : 08**

Reference Book/ Text Books:

1. Fluid Mechanics by V.L.Streeter, E.B. and Wylie, McGraw Hill.
2. Fluid Mechanics by Fox & McDonald, John Wiley.
3. Fluid Mechanics by Munson, John Wiley.
4. Fluid Mechanics by F.M. White.
5. Fluid Mechanics with Engineering Application by R.L. Daugherthy, J.B. Franzini, E.J. Finnermore; McGraw Hill, International Ed.
6. I.H. Shames by Fluid Mechanics, PHI.

Practical:

Viscosity, Metacentric height. Orifice meter, Notches, Reynolds number, Impact of jet.

Institute / School Name :	MIT Muzaffarpur		
Program Name	**B.Tech Mechanical Engineering**		
Course Code	011307		
Course Name	Fluid Mechanics		
L-T-P	3-1-3	**Course Credits**	5
Course Coordinator Name	GULSHAN KUMAR		

LECTURE PLAN

Topics	**Lecture Number**	**Date on which the Lecture was taken**
Introduction		
Definition ,Necessity of Irrigation, Total	**1**	
Planning Concept of Irrigation Project Scope of Irrigation Engineering,	**2**	
Benefits of Irrigation, Ill-effects of Irrigation,	**3**	
History of Irrigation Development in India, Types of Irrigation Systems	**4**	
Methods of Irrigation		
Classification of Irrigation Methods, ,	**5**	
Factors affecting the choice of the Method of Irrigation	**6**	
Surface Irrigation Methods,	**7**	
Sprinkler Irrigation Methods, Sub-Surface Irrigation Methods.	**8**	
Soil-Water Plant Relationship		
Introduction, Composition of Soil, Soil Texture and Soil structure, ,	**9**	
Water holding capacity, Soil Groups of India,	**10**	
Classification of Soil Water, Soil Moisture Tension, Soil Moisture Constants,	**11**	
Depth of Water held by Soil in Root Zone and available to Plants	**12**	
Extraction pattern of soil moisture in root zone by plant roots,	**13**	
Essential elements of plant growth,	**14**	
Non-essential elements of interest in plant nutrition, Maintaining soil fertility,	**15**	
Quality of irrigation water, Saline, Saline-Alkali and Alkali soils	**16**	
Water Requirements of Crops		
Introduction, Limiting soil moisture conditions,	**17**	
Depth of water applied during irrigation and frequency of irrigation,	**18**	
Crop seasons and crops of India, Crop period and base period, Duty of water and delta,	**19**	
Factors affecting duty of water, Methods of improving duty of water,	**20**	
Commanded areas and intensity of irrigation, Other terms related to water requirements of crops,	**21**	
Consumptive use of water – Evapotranspiration, Irrigation efficiencies, Irrigation requirements of crops	**23**	

Definition, Hydrologic cycle, Precipitation, its measurement, Average depth of rainfall over an area Mean Annual rainfall,	**24**	
Evaporation, transportation and evapotranspiration, Infiltration, Runoff, Factors affecting runoff, methods of determination of runoff.	**25**	
Estimation of peak flood discharge,	**26**	
Hydrograph, Unit hydrograph, S-curve,	**27**	
Derivation of unit hydrograph of different unit duration from a hydrograph of given unit duration,	**28**	
derivation of hydrograph from complex storms, synthetic unit hydrograph	**29**	
Groundwater Hydrology		
Introduction, Aquifer, Aquiclude, Aquifuge and Aquitard, Porosity, specific yield and specific retention, Divisions of sub-surface flow, Types of aquifers, Groundwater movement - Darcy's law,	**30**	
Storage coefficient or storativity coefficient of permeability or hydraulic conductivity and coefficient of transmissibility,	**31**	
Well hydraulics, Determination of hydraulic properties of aquifer,	**32**	
Well losses, specific capacity of well and well efficiency, Interference among wells, Artesian gravity well,	**33**	
Partially penetrating well ,Spherical flow in a well	**34**	
Reservoir Planning		
Introduction, Types of reservoir	**35**	
Investigations for reservoir planning	**36**	
Selection of site for a reservoir Zones of storage in a reservoir, Reservoir yield Mass curve and demand curve	**37**	
Determination of reservoir capacity required for a specific yield or demand using mass curve Determination of yield from a reservoir of given capacity	**38**	
Demand patterns for various types of reservoirs Apportionment of total cost of a multipurpose reservoir	**39**	
Flood Routing Reservoir losses Measures to reduce evaporation loss in reservoirs Sediment transport by rivers- Reservoir sedimentation Control of sedimentation of reservoirs	**40**	

Institute / School Name :	Muzaffarpur institute of technology, Muzaffarpur		
Program Name	B.Tech (MECHANICAL ENGINEERING)		
Course Code			
Course Name	Fluid Mechanics		
L-T-P	3-1-3	**Course Credits**	5
Course Coordinator Name	GULSHAN KUMAR		

1. Objectives of the Course

Course Objectives: 1. To introduce and explain fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.

2. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.

3. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.

4. To imbibe basic laws and equations used for analysis of static and dynamic fluids.

5. To inculcate the importance of fluid flow measurement and its applications in Industries.

6. To determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.

Text Books (TB)

TB1: Fluid mechanics by SOM and BISWAS

TB2: Fluid Mechanics by CENGEL

Reference Books (RB)

1. Fluid Mechanics by V.L.Streeter, E.B. and Wylie, McGraw Hill.
2. Fluid Mechanics by Fox & McDonald, John Wiley.
3. Fluid Mechanics by Munson, John Wiley.
4. Fluid Mechanics by F.M. White.
5. Fluid Mechanics with Engineering Application by R.L. Daugherthy, J.B. Franzini, E.J. Finnermore; McGraw Hill, International Ed.
6. I.H. Shames by Fluid Mechanics, PHI.

S.No.	**Link of Journals, Magazines, websites and Research Papers**
1.	http://nptel.ac.in/courses/112103019/1
2.	http://nptel.ac.in/courses/105104148/
3.	
4.	
5.	
6.	

Course Plan

Lecture Number	Topics	Web Links for video lectures	Text Book / Reference Book / Other reading material	Page numbers of Text Book(s)
1-4	**Introduction**		TB1, RB1	1-50
	Introduction, fluid properties: density, viscosity, compressibility, ideal and real fluids.	http://nptel.ac.in/courses/105104148/		
	Tutorial - 1			
5-10	Hydrostatics		TB1,	51-95
	fluid force on plane and curved surfaces, manometer, buoyancy, uniformly accelerated motion.	http://nptel.ac.in/courses/105104148/		
	Tutorial – 2, Assignment I			
11-19	Kinematics of fluid flow		TB1, RB3	96-168
	Generalized continuity equation, Irrational motion and solution to Laplace equation. Concept of stream lines, Equipotential Lines, Flow Nets.	http://nptel.ac.in/courses/112103019/14		
	Tutorial - 3			
20-29	Dynamics of fluid flow		TB1, RB3	168-210
	Control volume concepts, Euler and Bernoulli's theorems and various application like pivot tube, venturimeter, orifice meter, notches and weir etc; Impulse momentum theory and application.			
	Tutorial – 4, Assignment 2			
30-38	Introduction to Navier Stokes Equation		TB1, RB3	210-261
	. Flow of fluid in closed conduits, Laminar flow of viscous incompressible fluids, Darcy-Weisbach equation, Moody's diagram, and Minor losses Hardy-cross method for pipe networks.			
	Tutorial - 5			
	Forces on immersed bodies			
39-46	concepts of separation, drag force, circulation and lift force. Dimensional Analysis, Model Similitude : Theory and application		TB1, RB3	262-315

1. **Evaluation Scheme:**

Component 1*	Sessional Test (ST)*	20
Component 2	Assignment Evaluation	10
Component 3**	End Term Examination**	70
	Total	**100**

SYLLABUS

Topics	No of lectures	Weightage
Introduction, fluid properties: density, viscosity, compressibility, ideal and real fluids.	4	4%
fluid force on plane and curved surfaces, manometer, buoyancy, uniformly accelerated motion.	6	12%
Generalized continuity equation, Irrational motion and solution to Laplace equation. Concept of stream lines, Equipotential Lines, Flow Nets.	9	28%
Control volume concepts, Euler and Bernoulli's theorems and various application like pivot tube, venturimeter, orifice meter, notches and weir etc; Impulse momentum theory and application.	10	33%
Flow of fluid in closed conduits, Laminar flow of viscous incompressible fluids, Darcy-Weisbach equation, Moody's diagram, and Minor losses Hardy-cross method for pipe networks.	9	15%
concepts of separation, drag force, circulation and lift force. Dimensional Analysis, Model Similitude : Theory and application	8	8%

This Document is approved by:

Designation	Name	Signature
Course Coordinator		
H.O.D		
Principal		
Date		

Evaluation and Examination Blue Print:

Internal assessment is done through quiz tests, presentations, and assignments work. Two sets of question papers are asked from each faculty and out of these two, without the knowledge of faculty, one question paper is chosen for the concerned examination. The components of evaluations along with their weightage followed by the University is given below

Sessional Test 20%

Internals 10%

End term examination 70%

List of students in fluid mechanics

Name	Roll. No.
VISHAL KUMAR	16M61
MANOHAR KUMAR	16M26
BABUL KUMAR	16M57
HIMANSHU KUMAR	17M01
KESHAV KUMAR	17M02
SUMIT KUMAR THAKUR	17M03
SHIVAM	17M04
DHEERAJ KUMAR	17M05
RAHUL RAJ	17M06
AVINASH KUMAR	17M07
RAHUL KUMAR	17M08
SATISH KUMAR	17M09
NARENDRA KUMAR KAMAT	17M10
RAUSHAN KUMAR	17M11
SAUBHIK KUMAR MAHTO	17M12
DHIRAJ KUMAR	17M13
PRABHAKAR PANDEY	17M14
PRATYUSH CHANDRA	17M15
HIMANSHU KUMAR	17M16
ANIKET KUMAR	17M17
AYUSH KUMAR	17M18
SAURAV KUMAR	17M19
MD AFZAL	17M20
VIKASH KUMAR	17M21
HRIDAYESH TEJAS JHA	17M22
RAJ KUMAR	17M23
ABHIMANYU KUMAR	17M24
SUDHANSHU RANJAN	17M25
MANJEET RAJ	17M26
ANJALI GUPTA	17M27
AJAY KUMAR	17M28
ABHIMANYU KUMAR	17M29
AJIT KUMAR	17M30
RAHUL KUMAR	17M31
GAURAV KUMAR	17M32
SHIVAM SAGAR	17M33
NITISH KUMAR	17M34
VEER KUMAR	17M35
BIRENDRA KUMAR PANDIT	17M36
SANTOSH KUMAR	17M37
PRASHANT KUMAR	17M38

List of students in fluid mechanics

ALOK KUMAR	17M39
AYUSHI DIVYA	17M40
MAYANK GAUTAM	17M41
RAMAN MAHTO ANAND	17M42
KISHAN RAJ	17M43
RAJANISH KUMAR SHARMA	17M44
PRITI KUMARI	17M45
SHUBHAM KUMAR	17M46
ASHWANI KUMAR	17M47
AMAR KUMAR RISHI DEV	17M48
RAHUL KUMAR	17M49
GAURAV KUMAR	17M50
RAJNISH KUMAR RANJAN	17M51
SHATRUNJAY KUMAR	17M52
SAURAV KUMAR	17M53
NAND KISHOR BHARTI	17M54
CHANDAN KUMAR	17M55
RITISH KUMAR	17M56
SALIF KHAN	17M57
PRIYA RANA	17M58
ROHIT RANJAN	17M59
HARSH RAJ	17M60
AMIT KUMAR CHOUDHARY	17M61
SUNIL PUSHPAM	17M62
MOHIT RAJ	17M63

Code : 011307

2012

FLUID MECHANICS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

(v) Assume any suitable data, if required.

1. Write short notes on any *seven* of the following, preferably one or two sentence(s) : 2×7=14

(a) Hydraulics

(b) Cohesion

(c) Stoke

(d) Metacentre

(e) Vorticity

(f) Hydraulic grade line

(g) Streamline

(h) Stagnation point

(i) Model analysis

(j) Drag force

2. *(a)* Is there any analogy of Hooke's law in fluids? If so, state the parallel law in fluids. 6

(b) A conical thrust bearing idealized as a cone of semi-angle 30°, maximum cone diameter 20 cm rests and revolves over a uniform fluid layer of thickness 0·1 cm at 600 r.p.m. If the fluid has a viscosity of 1 poise, calculate the rate of heat dissipated in the bearing. 8

3. *(a)* Define the following and give one example of each : 6

(i) Steady and unsteady flows

(ii) Uniform and non-uniform flows

(iii) Laminar and turbulent flows

(iv) Rotational and irrotational flows

(b) Calculate the capillary effect in millimeters in a glass tube of 4 mm diameter, when immersed in *(i)* water and *(ii)* mercury. The temperature of the liquid is 20 °C and the values of surface tension of water and mercury at 20 °C in contact with air are 0·0735 N/m and 0·51 N/m respectively. The contact angle for water = 0° and for mercury = 130°. Take specific weight of water at 20 °C as equal to 9790 N/m^3. 8

4. *(a)* Define metacentre and metacentric height. Derive an expression for metacentric height for experimental method. 6

(b) A 1 m wide and 1·5 m deep rectangular plane surface lies in water in such a way that its plane makes an angle of 30° with the free water surface. Determine the total pressure and position of centre pressure when the upper edge is 0·75 m below the free water surface. 8

5. *(a)* Define and explain briefly the velocity potential and stream function. 6

(b) If for a two-dimensional flow the stream function is given by $\psi = 2xy$, calculate the velocity at the point (3, 6). Show that the potential ϕ exists for this case and deduce it. 8

6. *(a)* State and prove Bernoulli's equation and write the assumptions involved in deriving it. 6

(b) A 0·225 m diameter cylinder is 1·5 m long and contains water up to a height of 1·05 m. Estimate the speed at which the cylinder may be rotated about its vertical axis so that the axial depth becomes zero. 8

7. *(a)* Define dimensionless Reynolds' number, Froude's number and Mach's number and state their significance for fluid flow problems. 4

(b) Using the method of dimensional analysis, obtain an expression for the discharge Q over a rectangular weir. The discharge depends on the head H over the weir, acceleration due to gravity g, length of the weir crest L, height of the weir crest over the channel bottom Z and the kinematic viscosity ν of the liquid. 10

8. *(a)* What are the major and minor losses in pipe flow? Under what circumstances will they be negligible? 6

(b) Water flows through a pipeline whose diameter varies from 25 cm to 15 cm in a length of 10 m. If the Darcy-Weisbach friction factor is assumed constant at 0·018 for the whole pipe, determine the head loss in friction when the pipe is flowing full with a discharge of 0·06 m^3/s. 8

9. Write short notes on any *three* of the following : 14

(a) Types of fluids

(b) Free vortex

(c) Venturi meter

(d) Stability of floating body

(e) Water hammer

★ ★ ★

Code : 011307

B.Tech 3rd Semester Exam., 2013

FLUID MECHANICS

Time : 3 hours *Full Marks* : 70

Instructions:

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

(v) Assume any suitable data, if required.

1. Answer any *seven* questions from the following is short, preferably *1* or *2* sentence(s).

What are the following? 14

Fluid

Capillarity

Stoke

Piezometer

Stream tube

Weir

(a) Hydraulic Grade Line (HGL)

(b) Stagnation point

(c) Friction loss in pipe

(d) Drag force

2. (a) Define the following and give one example of each : 6

(i) Steady and unsteady flows

(ii) Uniform and non-uniform flows

(iii) Laminar and turbulent flows

(iv) Rotational and irrotational flows

(b) Calculate the capillary effect in millimeters in a glass tube of 4 mm diameter, when immersed in *(i)* water and *(ii)* mercury. The temperature of the liquid is 20 °C and the values of surface tension of water and mercury at 20 °C in contact with air are 0·0735 N/m and 0·51 N/m respectively. The contact angle for water = 0° and for mercury = 130°. Take specific weight of water at 20 °C as equal to 9790 N/m^3. 8

3. (a) State Newton's law of viscosity and distinguish between Newtonian and non-Newtonian fluids with examples. 6

(b) A cylinder of 120 mm diameter rotates concentrically inside a fixed cylinder of diameter 125 mm. Both cylinders are 300 mm long. Find the viscosity of the liquid that fills the space between the cylinders if a torque of 0·90 N m is required to maintain a speed of 60 r.p.m. 8

4 (a) Define centre of buoyancy and metacentre. Explain stable, unstable and neutral equilibrium of a floating body. 6

(b) A rectangular pontoon 12 m long and 8 m broad and 3 m deep weighs 800 kN. It carries on its upper deck a boiler 5 m diameter weighing 500 kN. The centre of gravity of the boiler and pontoon may be assumed as their centres of figure and on the same vertical line. Find the metacentric height. Weight of sea water is 10055 N/m^3. 8

5. (a) Define laminar flow, turbulent flow, give one example of each and distinguish between streamlines, streak lines and path lines.

(b) In a two-dimensional incompressible flow, the fluid velocity components are given by $u = x - 4y$ and $v = -y - 4x$. Show that velocity potential exists and determine its form. Find also the stream function. 8

6. (a) State Buckingham's pi theorem. Explain how dimensionless constants can be framed from a set of variables influencing a phenomenon. What is the utility of Buckingham's theorem? 6

(b) The discharge Q over a weir depends on the head of water H, the acceleration due to gravity g, the density ρ, the viscosity μ, and the surface tension σ. Obtain an expression for the discharge using Buckingham's pi theorem. 8

7 (a) What are the different energies of a fluid? Explain each of them. 6

(b) A cylindrical tank 0·9 m in diameter and 2 m high open at top is filled with water to a depth of 1·5 m. It is rotated about its vertical axis at N r.p.m. Determine the value of N which will raise water level even with the brim. 8

 (Continued)

8. (a) Derive Darcy-Weisbach formula for calculating loss of head due to friction in a pipe. 6

(b) A pipeline of 600 mm diameter is 1·5 km long. To increase the discharge another line of the same diameter is introduced parallel to the first in the second-half of the length. If $f = 0 \cdot 01$ and head at inlet is 300 mm, calculate the increase in discharge. 8

9. Write short notes on any *three* of the following : 14

(a) Real and Ideal Fluids

(b) Circulation and Vorticity

(c) Venturi Meter

(d) Major Losses in Pipe

(e) Syphon

★★★

Code : 011307

B.Tech 3rd Semester Exam., 2014

FLUID MECHANICS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer (any *seven*) : 2×7=14

(a) Falling drops of water become spherical due to

(i) adhesion

(ii) cohesion

(iii) viscosity

(iv) absorption

(v) surface tension

(b) The coefficient of viscosity is a property of

(i) the fluid

(ii) the boundary condition

(iii) the body over which flow occurs

(iv) the flow velocity

(c) The continuity equation represents conservation of

(i) mass

(ii) momentum

(iii) energy

(iv) vorticity

(d) A streamline is a line

(i) connecting midpoints of a flow cross-section

(ii) connecting points of equal velocity in a flow field

(iii) tangent to which at any point gives the direction of velocity vector at that point

(iv) drawn normal to the velocity vector at any point

(e) Navier-Stokes equations are associated with

(i) buoyancy

(ii) turbulence

(iii) viscosity

(iv) compressibility

(v) vorticity and circulation

(f) The velocity distribution at any section of a pipe for steady laminar flow is

(i) linear

(ii) exponential

(iii) parabolic

(iv) hyperbolic

(g) Which of the following has the form of Reynolds number?

(i) $\frac{\Delta_\rho}{\rho v^2}$

(ii) $\frac{v^2 l\rho}{\sigma}$

(iii) $\frac{v d\rho}{\mu}$

(iv) $\frac{v}{\sqrt{gd}}$

(h) The square root of inertia force to gravity force is known as

(i) pressure coefficient

(ii) Froude's number

(iii) Weber number

(iv) Mach number

(i) One atmospheric pressure equals

(i) $1{\cdot}0132\ kgf/cm^2$

(ii) 760 mm of mercury

(iii) $1{\cdot}0135\ N/m^2$

(iv) 10·3 mm of water

(v) Any of the above

(j) The range of coefficient of discharge for a venturimeter is

(i) 0·6–0·7

(ii) 0·7–0·85

(iii) 0·85–0·92

(iv) 0·92–0·98

2. (a) Check whether the following functions represent possible flow phenomenon of irrotational type :

(i) $\phi = x^2 - y^2 + y$

(ii) $\phi = \sin(x + y + z)$

(iii) $\phi = \frac{4x}{x^2 + y^2}$

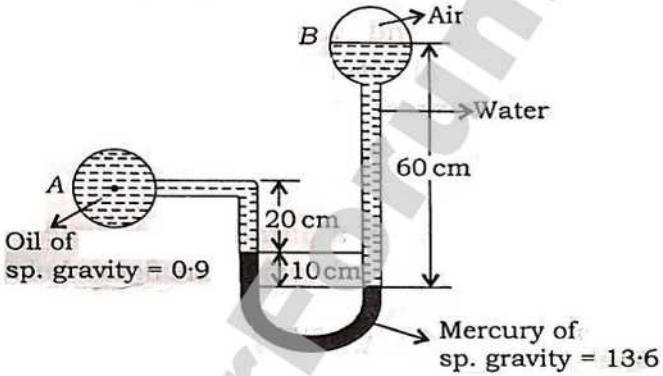
(b) Define surface tension. Prove that the relationship between surface tension and pressure inside a droplet of liquid in excess of outside pressure is given by

$$P = \frac{4\sigma}{d}$$

6+8=14

3. *(a)* With neat sketches, explain the conditions of equilibrium for floating and submerged bodies.

(b) A differential manometer is connected at the two points *A* and *B* as shown in the figure below :



At *B*, air pressure is 9·81 N/cm^2 (absolute), find the absolute pressure at *A*. 6+8=14

4. *(a)* Derive Euler's equation of motion along a streamline and hence derive the Bernoulli's theorem.

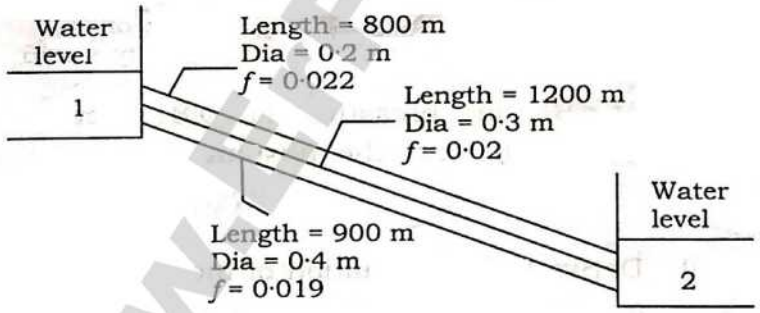
(b) A conical tube 1·5 m long is fixed vertically with its smaller end upwards and it forms a part of pipeline. Water flows down the tube and measurements indicate that velocity is 4·5 m/sec at the

smaller end, 1·5 m/sec at the larger end and the pressure head is 10 m of water at the upper end. Presuming that loss of head in the tube is expressed as

$$\frac{0{\cdot}33(v_1 - v_2)^2}{2g}$$

where v_1 and v_2 are the velocities at the upper and lower ends, make calculations for the pressure head at the lower end of the conical tube. 14

5. *(a)* The details of a parallel-pipe system for water flow are shown in the figure below :



(i) If the frictional drop between the junctions is 15 m of water, determine the total flow rate.

(ii) If the total flow rate is 0·66 m^3/sec, determine the individual flow and the friction drop.

(b) Find the difference in drag force exerted on a flat plate of size 2 m × 2 m when the plate is moving at a speed of 4 m/sec normal to its plane in *(i)* water and *(ii)* air of density 1·24 kg/m^3. Coefficient of drag is given as 1·15. 8+6=14

6. (a) Prove that the discharge through a triangular notch or weir is given by

$$Q = \frac{8}{15} C_d \tan(\theta/2) \sqrt{2g}\, H^{5/2}$$

(b) The head of water over a rectangular notch is 900 mm. The discharge is 300 litres/sec. Find the length of the notch, when $C_d = 0{\cdot}62$. 8+6=14

7. (a) Using Rayleigh's method, determine the rational formula for discharge Q through a sharp-edged orifice freely into the atmosphere in terms of constant head H, diameter d, mass density ρ, dynamic viscosity μ and acceleration due to gravity g.

(b) Define the following :

(i) Laminar and turbulent flow

(ii) Rotational and irrotational flow

(iii) Uniform and non-uniform flow

8+6=14

8. (a) Define the equation of continuity. Obtain an expression for continuity equation for a three-dimensional flow.

(b) *(i)* What do you mean by equipotential line and a line of constant stream function?

(ii) Describe the uses and limitations of the flow nets. 14

Write short notes on any *three* of the following : 14

(a) Boundary layer separation and its control

(b) Different types of fluid

(c) Hydraulic Grade Line (HGL)

(d) Pitot tube

(e) Circulation and vorticity

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Code : 011307

B.Tech 3rd Semester Exam., 2015

FLUID MECHANICS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer (any *seven*) : 2×7=14

(a) An ideal fluid

(i) has no viscosity

(ii) satisfies the relation $PV = RT$

(iii) obeys the Newton's law of viscosity

(iv) is both incompressible and non-viscous

(b) Typical example of a non-Newtonian fluid of pseudoplastic variety is

(i) air

(ii) blood

(iii) water

(iv) printing ink

(c) If G is the centre of gravity, B is centre of buoyancy and M is metacentre of a floating body, then for the body to be in unstable equilibrium, when

(i) $MG = 0$

(ii) $BG = 0$

(iii) M is below G

(iv) M is above G

(d) The centre of buoyancy is

(i) centre of gravity of the body

(ii) centre of displaced fluid volume

(iii) point of intersection of the buoyant force and the centreline of the body

(iv) point of intersection of the buoyant force and the gravitational force

(e) The continuity equation represents the conservation of

(i) mass

(ii) momentum

(iii) energy

(iv) vorticity

(f) A steady irrotational flow of an incompressible fluid is called

(i) streamline flow
(ii) creeping flow
(iii) shear flow
(iv) potential flow

(g) Each term of Bernoulli's equation stated in the form $\frac{P}{w}+\frac{V^2}{2g}+y$ = constant, has unit of

(i) N (ii) mN/kg
(iii) mN/N (iv) mN/s

(h) Euler's dimensionless number relates

(i) inertia and gravity force
(ii) viscous and inertia force
(iii) pressure and inertia force
(iv) buoyant and viscous force

(i) The lift force, per unit length, on a cylinder depends on

(i) shape of the body
(ii) size of the body
(iii) density of the flowing fluid
(iv) specific gravity of the material of the body

(j) The equations of motion for a viscous fluid are known as

(i) Euler equation
(ii) Reynolds equation
(iii) Navier-Stokes equation
(iv) Hagen-Poiseuille equation

2. (a) Explain the classification of fluids based on Newton's law of viscosity. Give the examples also.

(b) The velocity distribution in a pipeline is prescribed by the relation $u=2y-y^2$, where u denotes the velocity at a distance y from the solid boundary. Calculate—

(i) shear stress at the wall;
(ii) shear stress at 0·5 cm from the wall;
(iii) total resistance for a 2 cm diameter pipe over a length of 100 m.

Assume coefficient of viscosity $\mu=0{\cdot}4$ poise. 6+8=14

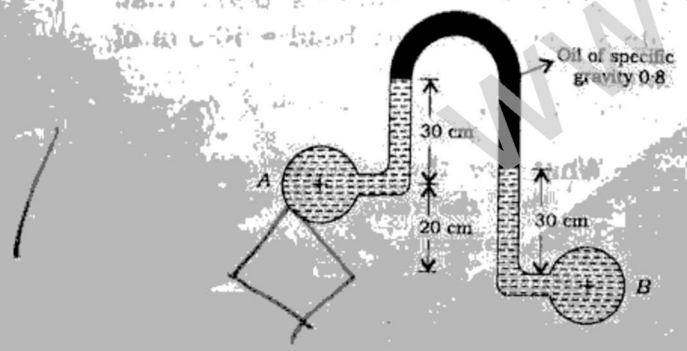
3. (a) A rectangular burge of width b and a submerged depth of H has its centre of gravity at the waterline. Find the metacentric height in terms of b/H and hence show that for stable equilibrium of the burge $b/H \geq \sqrt{6}$.

(b) Define surface tension. Prove that the relationship between surface tension and pressure inside a droplet of liquid in excess of outside pressure is given by

$$P = \frac{4\sigma}{d}$$ 8+6=14

4. (a) Define pressure. Obtain an expression for the pressure intensity at a point in a fluid.

(b) The figure shows an inverted differential manometer which is connected to two pipes A and B which convey water. The fluid in manometer is oil of specific gravity 0·8. For the manometer readings shown in the figure, find the pressure difference between A and B. 6+8=14



5. (a) Define the equation of continuity. Obtain an expression for continuity equation for a three-dimensional flow.

(b) A fluid flow field is given by

$$V = x^2yi + y^2z\,j - (2xyz + yz^2)k$$

Prove that it is a possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2, 1, 3). 6+8=14

6. (a) In a 100 mm diameter horizontal pipe and a venturimeter of 0·5 contraction ratio has been fixed. The head of water on the meter when there is no flow is 3 m (gauge). Find the rate of flow for which the throat pressure will be 2 meters of water absolute. The coefficient of discharge is 0·97. Take atmospheric pressure head = 10·3 m of water.

(b) (i) What are the assumptions made in the derivation of Bernoulli's equation?

(ii) Write down Bernoulli's equation and explain the different terms. 8+6=14

7. *(a)* State Buckingham's π-theorem. Show that the resistance R to the motion of a sphere of diameter D moving with a uniform velocity V through a real fluid having mass density ρ and viscosity μ is given by

$$R = \rho D^2 V^2 f\left(\frac{\mu}{\rho VD}\right)$$

(b) Explain the Rayleigh's method for dimensional analysis. 8+6=14

8. *(a)* An airfoil of chord length 2 m and of span 15 m has an angle of attack as 16°. The airfoil is moving with a velocity of 80 m/sec in air whose density is 1·25 kg/m^3. Find the weight of the airfoil and the power required to drive it. The values of coefficient of drag and lift corresponding to angle of attack are given as 0·03 and 0·5 respectively.

(b) Define the following terms :

(i) Drag

(ii) Lift 8+6=14

9. Write short notes on any *three* of the following : 14

(a) Boundary layer separation and its control

(b) Pitot tube

(c) Hydraulic Grade Line (HGL)

(d) Circulation and vorticity

(e) Different types of fluid motion

★★★

Code : 011307

B.Tech 3rd Semester Examination, 2016

Fluid Mechanics

Time : 3 hours *Full Marks : 70*

Instructions :

*(i) There are **Nine** Questions in this Paper*

*(ii) Attempt **Five** questions in all.*

*(iii) **Question No. 1 is Compulsory.***

(iv) The marks are indicated in the right hand margin.

(v) Assume data if necessary with proper justification.

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1. Choose the correct answer (any seven) : 2×7=14

(a) Discharge coefficient of a 'Venturimeter' is:

(A) less than Orifice meter

(B) approximately equal to 0.65

(C) greater than Orifice meter

(D) greater than 1.2

(b) Correct unit for Kinematic Viscosity is:

(A) Ns/m^2 (B) m^2/s

(C) m/kg.s (D) kg/m^2s

(c) For 2-D flow field, the equation of streamline is given as:

(A) u/dx=dy/v (B) dx/u=dy/v

(C) du/dx+dv/dy=0 (D) dy/u=dx/v

(d) The stream function for a 2-D flow is given by ψ =2xy+ constant The flow between the streamlines (1,1) and (2,2) would be:

(A) 4 units (B) 6 units

(C) 8 units (D) 10 units

(e) Consider the Chezy's equation for the flow velocity through a channel: $V = C\sqrt{(mi)}$ where V is flow velocity in m/s,m is the hydraulic mean depth in meter and i is longitudinal slope of the channel. The dimensions of the Chezy constant C are:

(A) $ML^{-1}T$ (B) $L^{1/2}T^{-1}$

(C) $M^0L^0T^0$ (D) L^2T^{-1}

(f) Each term of Bernoulli' equation has the unit of:

(A) Newton (B) Meter

(C) Pascal (D) N/m^2

(g) The equation of motion for a viscous fluid are known as :

(A) Euler's equation

(B) Reynolds equation

(C) Navier-Stokes equation

(D) Hagen-Poiseuille equation

(h) Momentum integral equation for zero pressure gradient is given by:

(A) $\tau_0 / \rho = U_\infty d\theta / dx$

(B) $\tau_0 / \rho = (U_\infty d\theta / dx)^2$

(C) $\tau_0 / \rho = U_0^2 d\theta / dx$

(D) $\tau_0 / \rho = U_\infty (d\theta / dx)^2$

(i) The pressure at the bottom of a water Lake is 1.5 times to that at half the depth. If the water barometer reads 10 m. the depth of lake is:

(A) 10 m (B) 15 m

(C) 20 m (D) 25 m

(j) The barnoulli equation refers to the conservation of:

(A) mass (B) momentum

(C) force (D) energy

2. (a) State the Newton's law of viscosity and give examples of its application. 6

(b) The velocity distribution for flow over a flat plate is given by $u = \frac{3}{4}y - y^2$ in which u is the velocity in meter per second at a distance y metre above the plate. Determine the shear stress at y= 0.15 m. Take dynamic viscosity of fluid as 8.6 poise. 8

3. (a) An inclined-tube reservoir manometer is constructed as shown in Fig. 1. Derive a general expression for the liquid deflection, L, in the inclined tube, due to the applied pressure difference, Δp. Also obtain an expression for the manometer sensitivity, and discuss the effect on sensitivity of D, d, θ and SG. 9

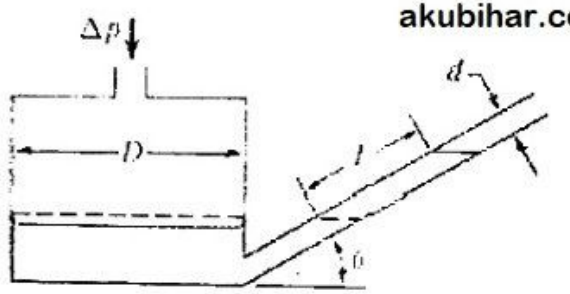

Fig. 1

3. (b) What is manometer ? How are they classified? 5

4. (a) Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plate surface submerged in the liquid. 7

(b) Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre of the plate is 3 m below the free surface of water. Find the position of centre o pressure. 7

5. (a) Consider a flow with velocity components $u=0$, $v = -y^3 - 4z$, and $w = 3y^2 z$.

i. Is this a one-, two-, or three-dimensional flow?

ii. Demonstrate whether this is an incompressible or compressible flow.

iii. Derive a stream function for this flow. 8

(b) What do you understand by 'local acceleration' and 'convective acceleration'? 6

6. (a) A 300 mm diameter pipe carries water under a head of 20 m with a velocity of 3.5 m/s. If the axis of the pipe turns through 45°, find the magnitude and direction of the resultant force at the bend. 8

(b) What is venturimeter ? Derive an expression for the discharge through a venturimeter. 6

7. (a) When tested in water ($\rho = 998 kg/m^3$ and $\mu = 0.001$ kg/m.s) flowing at 2 m/s, an 8 cm diameter sphere has a measured drag of 5 N. What will be the velocity and drag force on a 1.5 m diameter weather balloon moored in sea-level standard air (p=1.2255 kg/m^3 and $\mu = 1.78 \times 10^{-5} kg/m.s$)? 7

(b) The drag force, F, on a smooth sphere depends on the relative velocity, V, the sphere diameter, D, the fluid density, p, and the fluid viscosity, μ. Obtain a set of dimensionless groups that can be used to correlate experimental data. 7

8. (a) In Fig.2 the flowing fluid is CO_2 at 20°C. Neglect losses. If P$_1$=170 kPa and the manometer fluid is Meriam red oil (SG=0.827), estimate (a) p^2 and (b) the gas flow rate in m^3/h. 8

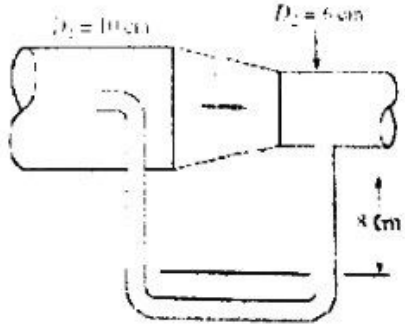

Fig. 2

(b) What do you mean by boundary layer separation ? Discuss the methods of preventing the separation of boundary layer. 6

9. Write short notes on following: 5+5+4

(i) Navier-Stokes Equation

(ii) Flow Net

(iii) Friction Drag and Pressure drag

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Code : 011307

B.Tech 3rd Semester Exam., 2017

FLUID MECHANICS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer (any *seven*) : 2×7=14

(a) The resultant hydrostatic force acts through a point is known as

(i) centre of gravity

(ii) centre of buoyancy

(iii) centre of pressure

(iv) None of the above

(b) For a floating body, the buoyant force passes through the

(i) centre of gravity of the body

(ii) centre of gravity of the submerged part of the body

(iii) metacentre of the body

(iv) centroid of the liquid displaced by the body

(c) The streamline is a line

(i) which is along the path of particle

(ii) which is always parallel to the main direction of flow

(iii) across which there is no flow

(iv) on which tangent drawn at any point gives the direction of the velocity

(d) An orifice is known as large orifice when the head of liquid from the centre of the orifice is

(i) more than the 10 times the depth of the orifice

(ii) less than 10 times depth of the orifice

(iii) less than 5 times depth of the orifice

(iv) None of the above

(e) Bernoulli's theorem deals with the law of conservation of

(i) mass

(ii) momentum

(iii) energy

(iv) None of the above

(f) Irrotational flow means

(i) the fluid does not rotate while moving

(ii) the fluid moves in straight line

(iii) the net rotation of fluid particles about their mass centre is zero

(iv) None of the above

(g) The coefficient of friction of laminar flow through a circular pipe is given by

(i) $f = \frac{0{\cdot}0791}{(R_e)^{1/4}}$

(ii) $f = \frac{16}{R_e}$

(iii) $f = \frac{64}{R_e}$

(iv) None of the above

(h) Models are known undistorted model, if

(i) the prototype and model are having different scale ratios

(ii) the prototype and model are having same scale ratios

(iii) model and prototype are kinematically similar

(iv) None of the above

(i) The geometric similarity between model and prototype means

(i) the similarity discharge

(ii) the similarity of linear dimensions

(iii) the similarity of motion

(iv) the similarity of forces

(j) Poise is the unit of

(i) mass density

(ii) kinematic viscosity

(iii) viscosity

(iv) velocity gradient

2. (a) Define the terms 'buoyancy' and 'centre of buoyancy'. Derive an expression for the metacentric height of a floating body. 9

(b) Find the volume of the water displaced and position of centre of buoyancy for a wooden block of width 2·5 m and of depth 1·5 m when it floats horizontally in water. The density of wooden block is 650 kg/m^3 and its length is 6·0 m. 5

3. (a) The velocity components for a steady flow are given as $u = 0$, $v = -y^3 - 4z$, $w = 3y^2 z$. Determine (i) whether the flow field is one-, two- or three-dimensional, (ii) whether the flow is compressible and (iii) the stream function for the flow. 7

(b) Show that the equation of continuity reduces to Laplace's equation when the liquid is incompressible and irrotational. 7

4. (a) A plate, 0·025 mm distance from a fixed plate, moves at 60 cm/s and requires a force of 2 newton per unit area, i.e., $2\ N/m^2$ to maintain this speed. Determine the fluid viscosity between the plates. 7

(b) A pipe branches into two pipes as shown in Fig. 1 below :

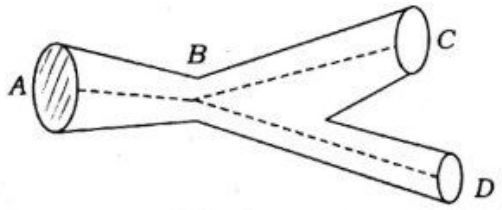

Fig.1

The pipe has diameter of 55 cm at *A*, 25 cm at *B*, 28 cm at *C* and 17 cm at *D*. If the velocity at *A* and *C* be 2 m/sec and 4 m/sec respectively, then find the total quantity of liquid at *A* and velocities at *B* and *D*. 7

5. (a) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation from first principle and state the assumption made for such a derivation. 7

(b) Water is flowing through a pipe of 5 cm diameter under a pressure of $29 \cdot 43\ N/cm^2$ (gauge) and with mean velocity of 2·0 m/s. Find the total head or total energy per unit weight of the water at cross section, which is 5 m above the datum line. 7

6. (a) Discuss the relative merits and demerits of venturimeter with respect to orifice-meter. 7

(b) What is a pitot tube? How will you determine the velocity at any point with the help of pitot tube? 7

7. (a) Discuss the Hardy cross method for pipe network. 7

(b) Calculate the discharge in each pipe of the network shown in the Fig. 2 given below. The pipe network consists of 5 pipes. The head loss h_f in pipe is given by $h_f = rQ^2$. The values of r for various pipes and also the inflow or outflows at nodes are shown in the Fig. 2 below : 7

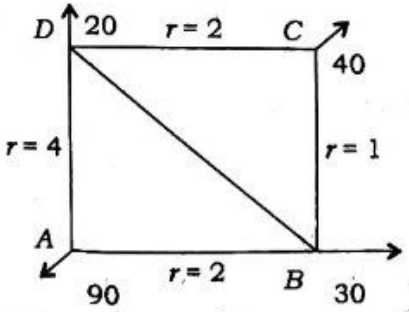

Fig. 2

8. *(a)* Define laminar flow. Discuss generalized plane Couette flow between parallel plates. Determine the volumetric flow rate, shear stress and coefficient of friction. 7

(b) Oil flows between two parallel plates, one of which is at rest and the other moves with a velocity U. If the pressure is decreasing in the direction of the flow at a rate of 0·10 lbf/ft^3, the dynamic viscosity is 10^{-3} lbf-sec/ft^2, the spacing of the plates is 2 inches and volumetric flow Q per unit width is 0·15 ft^2/sec, what is the value of U? 7

9. *(a)* Discuss types of similarity and explain each of them. 7

(b) Using Buckingham's π theorem, show that the frictional torque T of a disk of diameter D rotating at a speed N in a fluid of viscosity μ, density ρ in a turbulent flow is given by

$$T = D^5 N^2 \rho \phi \left(\frac{\mu}{D^2 N \rho} \right)$$ 7

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Fluid mechanics weekly test

1. Relative density of mercury is
(A) 1 (B) 9.8 (C) 13.6 (D) 1000
2. Newtonian fluid is defined as the fluid which
(A) Obeys Hook's law (B) Is compressible (C) Obeys Newton's law of viscosity (D) Is incompressible
3. If the Reynolds number is less than 2000, the flow in a pipe is
(A) Turbulent (B) Laminar (C) Transition (D) None of the above
4. The dynamic viscosity of a liquid is 1.2×10^{-4} Ns/m^2, whereas, the density is 600 kg/m^3. The kinematic viscosity in m^2/s is
(A) 72×10^{-3} (B) 20×10^{-8} (C) 7.2×10^{3} (D) 70×10^{6}
5. Which fluid does not experience shearing stress during flow?
(A) Pseudo plastic (B) Dilatant (C) Newtonian (D) Inviscid
6. Stress strain relationship for Newtonian fluid is
(A) Parabolic (B) Hyperbolic (C) Linear (D) Inverse type
7. Bulk modulus is the ratio of
a. shear stress to volumetric strain b. volumetric strain to shear stress
c. compressive stress to volumetric strain d. volumetric strain to compressive stress
8.The sum of components of shear forces in the direction of flow of fluid is called as
a. shear drag b. friction drag c. skin drag d. all of the above
9. The s.i unit of kinematics viscosity is
a. m^2/sec b. Kg/m-sec c. m/ sec^2 d. m^3/ sec^2
10. The s.i unit of surface tension is
a. N/m^2 b. J/m c. J/m^2 d. w/m

Fluid mechanics weekly test

1. According to Archimede's principle, if a body is immersed partially or fully in a fluid then the buoyancy force is _____ the weight of fluid displaced by the body.
a. equal to b. less than c. more than d. unpredictable
2. What is the correct formula for absolute pressure?
a. $P_{abs} = P_{atm} - P_{gauge}$ b. $P_{abs} = P_{vacuum} - P_{atm}$ c. $P_{abs} = P_{vacuum} + P_{atm}$ d. $P_{abs} = P_{atm} + P_{gauge}$
3. One litre of a certain fluid weighs 8N. What is its specific volume?
a. 2.03×10^{-3} m^3/kg b. 20.3×10^{-3} m^3/kg c. 12.3×10^{-3} m^3/kg d. 1.23×10^{-3} m^3/kg
4. When is a liquid said to be not in a boiling or vaporized state?
a. If the pressure on liquid is equal to its vapour pressure
b. If the pressure on liquid is less than its vapour pressure
c. If the pressure on liquid is more than its vapour pressure
d. Unpredictable
5. Relative density of mercury is
(A) 1 (B) 9.8 (C) 13.6 (D) 1000
6. The unit of pressure one bar is
(A) 1 Pascal (B) 1 kilo Pascal (C) 100 kPascal (D) 1000 kPascal
7. Property of fluid that describes its internal resistance is known as:
(A) Viscosity (B) Friction (C) Resistance (D) Internal energy
8. Which of the following is a dimensionless equation?
a. Reynold's equation b. Euler's equation c. Weber's equation d. All of the above
9. Kinematic eddy viscosity (ε) is the ratio of
a. eddy viscosity (η) to dynamic viscosity (μ) b. eddy viscosity (η) to kinematic viscosity (ν)
c. kinematic viscosity to eddy viscosity (η) d. eddy viscosity (η) to mass density (ρ)
10. Blood circulation through arteries is
a. a laminar flow b. a turbulent flow