Printed Page:- 04 Subject Code:- BME0302

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - THEORY EXAMINATION (2024- 2025)

Subject: Fluid Mechanics & Machines

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. What is fluid mechanics used for? (CO1,K1) 1

(a) Fluid mechanics enables to comprehend the behaviour of solid fluids under pressure

(b) None of the mentioned

(c) Fluid mechanics enables to comprehend the behaviour of fluids under a variety of forces & atmospheric conditions

(d) Fluid mechanics enables to comprehend the behaviour of fluids under various temperatures only

1-b. If a person studies about a fluid which is at rest, what will you call his domain of study? (CO1,K2) 1

(a) Fluid Dynamics

(b) Fluid Mechanics

(c) Fluid Statics

(d) Fluid Kinematics

1-c. In which method of fluid flow analysis do we describe the motion parameters at a point? (CO2,K2) 1

(a) Langragian method

(b) Eulerian Method

(c) Control volume analysis

(d) None of the mentioned

1-d. What will be the shape of the path-line for an one-dimensional flow be like? (CO2,K1) 1

(a) Straight line

(b) Parabolic

(c) Hyperbolic

(d) Elliptical

1-e. Which among the following is a device that converts a laminar flow into a turbulent flow (CO3,K1) 1

(a) Dead Weight Gauge

(b) Vacuum Gauge

(c) Turbulator

(d) Ionization Gauge

1-f. How does a turbulent boundary layer produce swirls? (CO3,K2) 1

(a) Due to random motion

(b) Collision of molecules

(c) Due to eddies

(d) Due to non-uniform cross section

1-g. Which of these statements hold true? (CO4,K1) 1

(a) Momentum conservation is applicable to neither individual directions nor the whole system

(b) Momentum conservation is applicable to the whole system but not individually

(c) Momentum conservation is applicable to both individual directions and the whole system

(d) Momentum conservation is applicable only to the three directions individually

1-h. Momentum is a quantity (CO4,K2) 1

(a) Scalar

(b) Vector

(c) Infinite

(d) Zero

1-i. Turbomachines work under... (CO5,K1) 1

(a) Newtons first law

(b) Newtons second law

(c) Newtons third law

(d) Kepler's law

1-j. The main function of centrifugal pumps are to (CO5,K2) 1

(a) Transfer speed

(b) Transfer pressure

(c) Transfer temperature

(d) Transfer energy

2. Attempt all parts:-

2.a.	What is momentum equation? (CO1,K1)	2
2.b.	Expain One, two and three dimensional flows (CO2,K1)	2
2.c.	What is force of buoyancy? (CO3,K2)	2
2.d.	Give example for a low head, medium head and high head turbine. (CO4,K2)	2
2.e.	What does indicator diagram indicates? (CO5,K2)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Explain the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid. (CO1,K3)	6
3-b.	What is the difference between dynamic viscosity and kinematic viscosity? State their units of measurements. (CO1,K1)	6
3-c.	Describe with the help of sketch the construction, operation and use of Pitot-static tube. (CO2,K2)	6
3-d.	What is velocity potential? Also derive the Laplace equation for velocity potential. (CO2,K3)	6
3.e.	What do you understand by the terms : Major energy loss and minor energy losses in pipes ? (CO3,K2)	6
3.f.	Define the following non-dimensional numbers : Reynold's number, Froude's number and Mach's number. What are their significances for fluid flow problems ? (CO4,K1)	6
3.g.	What do you understand by characteristic curves of a pump? What is the significance of the characteristic curves? (CO5,K2)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Distinguish between : (i) Steady flow and un-steady flow, (ii) Uniform and non-uniform flow, (iii) Compressible and incompressible flow, (iv) Rotational and irrotational flow, (v) Laminar and turbulent flow. (CO1,K1)	10
4-b.	The velocity vector in a fluid flow is given $V = 4x^3 i - 10x^2 yj + 2tk$. Find the velocity and acceleration of a fluid particle at (2, 7, 3) at time t = 7. (CO1,K3)	10

5. Answer any one of the following:-

5-a.	What is a venturimeter ? Derive an expression for the discharge through a venturimeter. (CO2,K3)	10
5-b.	Derive Bernoulli's equation for the flow of an incompressible frictionless fluid from consideration of momentum. (CO2,K3)	10

6. Answer any one of the following:-

6-a.	Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by a propeller. Assume that the thrust P depends upon the	10

angular velocity w speed of advance V, diameter D, dynamic viscosity μ, mass density p, elasticity of the fluid medium which can be denoted by the speed of sound in the medium C. (CO3,K3)

6-b. Derive the expression for head loss in pipe flow due to friction. (CO3,K3) 10

7. Answer any <u>one</u> of the following:-

7-a. What is a draft-tube? Why is it used in a reaction turbine? Describe with sketch two different types of draft-tubes. (CO4,K2) 10

7-b. A Pelton turbine develops 3000 kW under a head of 300 m. The overall efficiency of the turbine is 83%. If speed ratio = 0.46, C_v = 0.98 and specific speed is 16.5, then find: (i) Diameter of the turbine, and (ii) Diameter of the jet. (CO4,K3) 10

8. Answer any <u>one</u> of the following:-

8-a. Define indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by the reciprocating pump? (CO5,K2) 10

8-b. What is a reciprocating pump? Describe the principle and working of a reciprocating pump with a neat sketch. Why is a reciprocating pump not coupled directly to the motor? Discuss the reason in detail. (CO5,K2) 10