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? (CO1,K1) 1

(a) Study of fluid behaviour at rest

(b) Study of fluid behaviour in motion

(c) Study of fluid behaviour at rest and in motion

(d) None of the mentioned

1-b. Which of the following is the basic principle of fluid mechanics? (CO1, K2) 1

(a) Momentum principle

(b) Energy equation

(c) Continuity equation

(d) All of the mentioned

1-c. For compressible flow specific gravity ..... (CO2,K1) 1

(a) Increases

(b) remains same

(c) decreases

(d) not mentioned

1-d. The continuity equation is based on the principle of (CO2,K1) 1

(a) Conservation of mass

(b) Conservation of momentum

(c) Conservation of energy

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(d) Conservation of force

1-e. Based on which non-dimensional number the flow can be said laminar or turbulent?(CO3,K2) 1

(a) Reynold's number
(b) Mach number
(c) Froude number
(d) Knudsen number

1-f. The swirl caused due to eddies are called as _ (CO3,K2) 1

(a) Vortices
(b) Vertices
(c) Volume
(d) Velocity

1-g. What is the physical principle behind momentum equation? (CO4,K1) 1

(a) Newton's second law of motion
(b) Newton's first law of motion
(c) Zeroth law of thermodynamics
(d) First law of thermodynamics

1-h. The impulse equation is defined as (CO4,K2) 1

(a) $F\Delta t = m\Delta v$
(b) $F\Delta t = mu$
(c) $F\Delta t = mT$
(d) $F\Delta t = mRT$

1-i. Centrifugal pump is a (CO5.K1) 1

(a) Turbomachinery
(b) Flow regulating device
(c) Drafting device
(d) Intercooling device

1-j. The main function of nozzle is to (CO5,K2) 1

(a) Varying temperatures
(b) Pressure variations
(c) Load variations
(d) Heat variations

2. Attempt all parts:-

2.a. What is capillarity? (CO1,K1) 2

2.b. Explain Steady and unsteady flows. (CO2,K1) 2

2.c. What is meant by water hammer? (CO3,K1) 2

2.d. Explain important characteristic curves in turbine. (CO4,K2) 2

2.e.	What is slip of reciprocating pump? (CO5,K1)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Define the terms: density, specific volume, specific gravity, vacuum pressure, compressible and incompressible fluids (CO1,K1)	6
3-b.	Enunciate Newton's law of viscosity. Explain the importance of viscosity in fluid motion. What is the effect of temperature on viscosity of water and that of air? (CO1,K2)	6
3-c.	Define the following co-efficients: (i) Co-efficient of velocity, (ii) Co-efficient of contraction and (iii) Co-efficient of discharge (CO2,K1)	6
3-d.	Explain Buckingham's-Pi method.What is application of Buckingham's-Pi theorem (CO2,K2)	6
3.e.	Derive an expression for the loss of head due to : (i) Sudden enlargement and (ii) Sudden contraction of a pipe (CO3,K3)	6
3.f.	What is the difference between impulse turbine and reaction turbine? Explain with neat diagram. (CO4,K2)	6
3.g.	Define cavitation. What are the effects of cavitation ? Give the necessary precautions against cavitation. (CO5,K2)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Define the equation of continuity. Obtain an expression for continuity equation for a three-dimensional flow. (CO1,K3)	10
4-b.	A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s(CO1,K3)	10

5. Answer any one of the following:-

5-a.	Derive Euler's equation of motion along a stream line for an ideal fluid stating clearly the assumptions. Explain how this is integrated to get Bernoulli's equation along a stream-line.(CO2,K3)	10
5-b.	Explain the principle of venturimeter with a neat sketch. Derive the expression for the rate of flow of fluid through it. (CO2,K3))	10

6. Answer any one of the following:-

6-a.	The pressure difference Δp in a pipe of diameter D and length l due to turbulent flow depends on the velocity V, viscosity, density p and roughness k. Using Buckingham's π-theorem, obtain an expression for Δp.(CO3,K3)	10
6-b.	Two tanks are connected with the help of two pipes in series. The lengths of the pipes are 1000 m and 800 m whereas the diameters are 400 mm and 200 mm respectively. The co-efficient of friction for both the pipes is 0.008. The difference of water level in the two tanks is 15 m. Find the rate of flow of water through the	10

pipes, considering all losses. Also draw the total energy line and hydraulic gradient lines for the system (CO3,K3)

7. Answer any one of the following:-

7-a. Define the specific speed of a turbine ? Derive an expression for the specific speed. What is the significance of the specific speed (CO4,K2) 10

7-b. Obtain an expression for the work done per second by water on the runner of a Pelton wheel. Hence derive an expression for maximum efficiency of the Pelton wheel giving the relationship between the jet speed and bucket speed. Draw inlet and outlet velocity triangles for a Pelton turbine and indicate the direction of various velocities (CO4,K3) 10

8. Answer any one of the following:-

8-a. 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

8-b. A single-acting reciprocating pump has a plunger diameter of 250 mm and stroke of 450 mm and it is driven with S.H.M. at 60 r.p.m. The length and diameter of delivery pipe are 60 m and 100 mm respectively. Determine the power saved in overcoming friction in the delivery pipe by fitting an air vessel on the delivery side of the pump. Assume friction factor = 0.01. (CO5,K3) 10