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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2023 - 2024)

Subject: Fluid Mechanics & Fluid 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. For an incompressible fluid does density vary with temperature and pressure? (CO1) 1
- (a) It varies for all temperature and pressure range
 - (b) It remains constant
 - (c) It varies only for lower values of temperature and pressure
 - (d) It varies only for higher values of temperature and pressure
- 1-b. The specific gravity of a liquid has (CO1) 1
- (a) the same unit as that of mass density
 - (b) the same unit as that of weight density
 - (c) the same unit as that of specific volume
 - (d) no unit
- 1-c. The flow of fluid along curvilinear or curved path is known as... (CO2) 1
- (a) Curvilinear Flow
 - (b) Circular Flow

- (c) Sink Flow
- (d) Vortex Flow
- 1-d. Total acceleration has the same value as convective acceleration in case of unsteady flow. (CO2) 1
- (a) True
- (b) False
- (c) Not evaluated
- (d) None of the mentioned
- 1-e. Reynolds number defined as? (CO3) 1
- (a) Ratio of pressures in the inlet to the outlet of a pipe
- (b) The product of velocity of the flow and the diameter of the pipe, divided by the kinematic viscosity of fluid
- (c) The product of density of the fluid, velocity of the flow and the diameter of the pipe, divided by the dynamic viscosity of fluid
- (d) Ratio of inertia force to viscous force
- 1-f. The turbulent boundary layer is a... (CO3) 1
- (a) Non-uniform with swirls
- (b) Uniform
- (c) Less stable
- (d) Smooth
- 1-g. The impulse equation is defined as (CO4) 1
- (a) $F\Delta t = m\Delta v$
- (b) $F\Delta t = mu$
- (c) $F\Delta t = mT$
- (d) $F\Delta t = mRT$
- 1-h. Which of these statements hold true? (CO4) 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-i. Centrifugal pumps are used to transport (CO5) 1
- (a) Pressure
 - (b) Speed
 - (c) Power
 - (d) Fluid
- 1-j. Turbomachines work under... (CO5) 1
- (a) Newtons first law
 - (b) Newtons second law
 - (c) Newtons third law
 - (d) Kepler's law

2. Attempt all parts:-

- 2.a. Define Bernoulli's equation with assumptions. (CO1) 2
- 2.b. Explain Steady and unsteady flows. (CO2) 2
- 2.c. What is meant by water hammer? (CO3) 2
- 2.d. What is mixed flow reaction turbine? Give an example. (CO4) 2
- 2.e. Why are the vanes curved radially backward? (CO5) 2

SECTION B

30

3. Answer any five of the following:-

- 3-a. What is the difference between dynamic viscosity and kinematic viscosity? State their units of measurements. (CO1) 6
- 3-b. Define the terms: density, specific volume, specific gravity, vacuum pressure, compressible and incompressible fluids (CO1) 6
- 3-c. Explain the classification of orifices and mouthpieces based on their shape, size and sharpness? (CO2) 6
- 3-d. Define the following co-efficients: (i) Co-efficient of velocity, (ii) Co-efficient of contraction and (iii) Co-efficient of discharge (CO2) 6
- 3.e. What are the advantages of triangular notch or weir over rectangular notch? (CO3) 6
- 3.f. What do you understand by the term's boundary layer, and boundary layer theory? (CO4) 6
- 3.g. How does the specific speed of a centrifugal pump differ from that of a turbine? (CO5) 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) 10
- 4-b. What do you understand by the terms: (i) Total acceleration, (ii) Convective acceleration, and (iii) Local acceleration (CO1) 10

5. Answer any one of the following:-

- 5-a. Derive Bernoulli's equation for the flow of an incompressible frictionless fluid from consideration of momentum. (CO2) 10
- 5-b. Discuss the relative merits and demerits of venturimeter with respect to orifice-meter. (CO2) 10

6. Answer any one of the following:-

- 6-a. Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow. (CO3) 10
- 6-b. How will you determine the loss of head due to friction in pipes by using (i) Darcy Formula and (ii) Chezy's formula? (CO3) 10

7. Answer any one of the following:-

- 7-a. 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) 10
- 7-b. What is a draft-tube? Why is it used in a reaction turbine? Describe with sketch two different types of draft-tubes. (CO4) 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) 10
- 8-b. Define indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by the reciprocating pump? (CO5) 10