GIET UNIVERSITY, GUNUPUR – 765022

Ph.D. (Second Semester) Examinations, April – 2024

PPEMT2039 - Fluid Dynamics

(Mathematics)

Time: 3 hrs Maximum: 70 Marks

(The figures in the right hand margin indicate marks.)

(14 x 5 = 70 Marks)

Answer ***ANY FIVE*** questions Marks

1. a. Define the equation of motion for fluid flow, including its derivation from Newton's second law. 7

b. Define 2-D flow and explain its significance in fluid dynamics. 7

2.a. The two scalar components of velocity field are given for two flow system. Find the third component of the velocity. For case: 10

i. $U = x^3 + 2y^2 + z^2$ and $V = -x^2y - yz - xy$

ii. $U = \log(y^2 + z^2)$ and $W = \log(x^2 + y^2)$

b. Differentiate between boundary surface streamlines, path lines, and streak lines 4

3. a. State Bernoulli's equation for steady. Explain how Bernoulli's equation can be applied to analyze fluid flow problems, including its limitations. 7

b. Calculate the material acceleration for a given velocity field. 7

4.a. Compare and contrast Blasius theorem and Milne's theorem in terms of their assumptions and limitations. 7

b. State the Navier-Stokes equation of motion for viscous fluid flow and its physical interpretations 7

5. a. Derive the equations governing the behavior of a Newtonian fluid, including the continuity equation and the Navier-Stokes equation. 7

b. Discuss the role of viscosity in modeling blood flow in arteries, veins, lungs, and the heart 7

6. Two boats sail from the opposite sides of river. They meet at a distance ll1 (for example 1000) meters from bank A. The boats reach the opposite side respectively and continue back to their original bank. The boats meet for the second time at ll2(for example 500) [m] from bank B. What is the river width? What are the dimensional parameters that control the problem? 14

7. a Provide examples illustrating the use of dimensionless constants to establish similarity between different flow situations. 7

b	Define dimensionless constants and explain their significance in fluid dynamics	7
8. a	Derive the equation of incompressible MHD flow starting from the conservation equations of mass, momentum, and magnetic induction.	7
b.	Discuss the temperature distribution in the MHD approximation and its importance in plasma physics.	7

--- End of Paper ---