

(FOR THE CANDIDATES ADMITTED

21PMS415

DURING THE ACADEMIC YEAR 2021 ONLY)

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : MAY - 2023

COURSE NAME: M.Sc.-MATHEMATICS

MAXIMUM MARKS: 70

SEMESTER: IV

TIME : 3 HOURS

**FLUID DYNAMICS****SECTION - A (10 X 1 = 10 MARKS)****ANSWER THE FOLLOWING QUESTIONS.****MULTIPLE CHOICE QUESTIONS.****(K1)**

- Stream line and path lines always coincide in case of \_\_\_\_\_.  
a) Steady flow      b) Laminar flow      c) Uniform flow      d) Turbulent flow
- In steady flow of a field, the acceleration of any fluid particle is \_\_\_\_\_.  
a) Constant      b) Variable      c) zero      d) Never zero
- What is the value of derivative of flow field along characteristic line?  
a) Zero      b) indeterminate      c) one      d) 0.5
- Which of the following is not a type superimposed flow?  
a) Source and sink pair in uniform flow      b) double flow  
c) A source and sink pair in turbulent flow      d) A place source in uniform flow
- If the ratio of the stress and rate of strain is linear, the material is ideally \_\_\_\_\_.  
a) Plastic      b) Liquid      c) Elastic      d) fluid

**ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)**

- If the velocities at two points of the stream line and pressure at only one point, How to find the unknown pressure at only one point? Then how to find the unknown pressure at the other point of the fluid?
- Which equation is a result of momentum conservation for inviscid steady flow?
- What is the viscosity of inviscid fluid?
- What is the characteristic of stagnation Point?
- What is the basic concept of the Von-Karman- Pohlhausen method?

**SECTION – B****(5 X 4 = 20 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)**

- a) Explain Eulerian method.

**(OR)**

- Given the velocity field  $q = iAx^2y + jBy^2zt + kCzt^2$ , determine the acceleration of a fluid particle of fixed identity.

- Calculate the force exerted by a jet of water  $3/4$  in. in diameter which strikes a flat plate at an angle of  $30^\circ$  to the normal of the plate with a velocity of 30 ft/sec, if (i) the plate is stationary (ii) the plate is moving in the direction of the jet with a velocity of 10ft/sec.

**(OR)****(CONTD.....2)**

- 12 b) Give example of irrotational and rotational flows.
- 13.a) Show that the velocity potential  $\Psi = \frac{a}{2}(x^2 + y^2 - 2z^2)$  satisfies the Laplace equation and represents the flow against a fixed plane wall.  
(OR)
- b) Explain Source and Sink -flow.
- 14.a) If  $\psi_1, \psi_2$  are solution of the Laplace equations, show that  $\psi_3 = \psi_1 + \psi_2$  is a solution of the Laplace equation.  
(OR)
- b) Discuss Three - Dimensional motion -sphere in uniform stream.
- 15.a) Water at 70° F flows two large parallel plates at a distance of  $\frac{1}{16}$  in. apart . If the average velocity is 0.5 ft/sec, find (i) the maximum velocity, (ii) the pressure drop (iii) the wall shearing stress and (iv) the frictional co-efficient.  
(OR)
- b) Explain flow between two concentric rotating cylinders.

**SECTION - C****(4 X 10 = 40 MARKS)****ANSWER ANY FOUR OUT OF SIX QUESTIONS****(16<sup>th</sup> QUESTION IS COMPULSORY AND ANSWER ANY THREE QUESTIONS  
(FROM Qn. No : 17 to 21) (K4 (Or) K5)**

16. Derive Navier-stoke's equations.
17. Consider a two-dimensional incompressible steady flow field with velocity components in rectangular co-ordinates given by,  $u(x, y) = \frac{k(x^2 - y^2)}{(x^2 + y^2)^2}, v(x, y) = \frac{2kxy}{(x^2 + y^2)^2}$  with k an arbitrary non-zero constant. Is the equation of continuity satisfied?
18. Write applications of the Bernoulli equations.
19. Explain Three-Dimensional axially symmetric flow with examples.
20. Explain Super position of source and rectilinear flow in Two-Dimensional case.
21. Discuss the boundary layer equations in Two-Dimensional flow.

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