PC-365-CV-19

M.A./M.Sc. (3rd Semester)

Examination, Dec.-2020

MATHEMATICS

Paper-VI

FLUID MECHANICS-I

Time : Three Hours] **[Maximum Marks : 80**

[Minimum Pass Marks : 29

नोट : दोनों खण्डों से निर्देशानुसार उत्तर दीजिए। प्रश्नों के अंक उनके दाहिनी ओर अंकित हैं।

Note : Answer from both the Sections as directed. The figures in the right-hand margin indicate marks.

Section-A

1. **Answer the following questions:-** 1x10=10

(a) **Define "Turbulent motion".**

(b) **The flow round a closed curve is called.....round the curve.**

(c) **The most general form of Bernoulli's equation for motion of fluid is .....**

(d) **Define strength of a sink.**

(e) **A circular cylinder is placed in uniform stream then the force or couple acting on the cylinder is.....**

(f) **For circulation about a circular cylinder the complex potential W is given by.**

(g) **The equation of stream line is .....**

(h) **Define equation of path line.**

(i) **If the components of spin are all ..... Motion is called irrotational.**

(j) **Define sink of the motion.**

2. **Answer the following questions :-** 2x5=10

(a) **Define "Velocity potential".**

(b) **Define "Beltranic flow".**

(c) **Find the normal component of velocity for the boundary.**

(d) **If** $\phi = A(x^2 - y^2)$ **represents a possible flow phenomenon, determine the stream function.**

(e) **To discuss circulation about a circular cylinder.**

Section-B

12x5=60

Answer any five of the following questions:-

3. **Determine the stream lines and the path of the particles**

$$u = x/(1+t),\ v=y/(1+t),\ w=z/(1+t)$$

OR

Show that $\frac{x^2}{a^2}\tan^2 t + \frac{y^2}{b^2}\cot^2 t - 1 = 0$ **is a possible form of boundary surface and find an expression for normal velocity.**

4. **To obtain general equations of motion for impulsive action.**

OR

Air obeying Boyle's Law is in motion in a uniform tube of small section prove that if e be the density and v the velocity at a distance x from a fixed point at time t

$$\frac{\partial^2 e}{\partial t^2} = \frac{\partial^2}{\partial x^2}[(v^2 + k)e] \quad where\ k = \frac{p}{e}$$

5. **What arrangement of sources and sinks will give rise to the function** $w = \log\left(z - \frac{a^2}{z}\right)$**? Draw a rough sketch of the stream lines in this case and prove that two of than sub-divide into the circle** $r = a$ **and axis of y.**

OR

A velocity field is given by $a = -xi + (y+t)j$ **find the stream function and the stream lines for this field at** $t=2$

6. **To discuss the motion of a circular cylinder moving with velocity** U **along x-axis in an infinite mass liquid at rest at infinity.**

OR

A circular cylinder is placed in a uniform steam find the forces acting on the cylinders.

7. **Determine equation of continuity by vector approach for a non-homogeneous incompressible fluid.**

OR

If w **is the area of cross section of a stream filament, prove that the equation of continuity is**

$$\frac{\partial}{\partial t}(ew) + \frac{\partial}{\partial s}(ewq) = 0$$