Unit 5 - Week 3

Assignment 3

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-08-21, 23:59 IST.

1) A stream function is given by $\psi = 3x^2y + (2+t)y^2$. The x component of velocity (u) is given by *1 point*

- $6xy$
- $3y$
- $3x^2 + 2(2+t)y$
- $-3x^2 - 4y$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$3x^2 + 2(2+t)y$

2) In a 2D incompressible flow over a flat solid plate, the velocity component perpendicular to the plate is $v = 3x^2y^2 + 2y^3x$, where x is the coordinate along the plate and y is perpendicular to the plate.Hence, the velocity component along the plate is given by *1 point*

- $2x^3y + 3x^2y^2$
- $-2x^3y - 3x^2y^2$
- $6x^2y + 6xy^2$
- $6xy^2 + 2y^3$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$-2x^3y - 3x^2y^2$

3) In a 2D incompressible flow over a flat solid plate, the velocity component perpendicular to the plate is $v = 3x^2y^2 + 2y^3x$, where x is the coordinate along the plate and y is perpendicular to the plate
Find the stream function ψ *1 point*

- $\psi = -2x^3y - 3x^2y^2$
- $\psi = -x^3y^2 - x^2y^3$
- $\psi = x^3y^2 - x^2y^3$
- $\psi = 6xy^2 + 2y^3$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\psi = -x^3y^2 - x^2y^3$

4) In a 2D incompressible flow over a flat solid plate, the velocity component perpendicular to the plate is $\vec{u} = 3x^2y^2\hat{i} + 2y^3x\hat{j}$, where x or $\hat{i}$ is the coordinate along the plate and y or $\hat{j}$ is perpendicular to the plate. Find whether the flow is rotational or not *1 point*

- Irrotational flow
- Rotational flow

No, the answer is incorrect.
Score: 0
Accepted Answers:
Rotational flow

5) If the stream function is given by $\psi = x^2y$, the velocity components (u-component along x axis and v - component along y axis) are given by *1 point*

- $u = 2xy, v = x^2$
- $u = 2xy, v = -x^2$
- $u = x^2, v = -2xy$
- $u = x^2, v = 2xy$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$u = x^2, v = -2xy$

6) The stream function representing the fluid flow is given by $\psi = x^2y$. Is the fluid flow rotational or irrotational? *1 point*

- Irrotational flow
- Rotational flow

No, the answer is incorrect.
Score: 0
Accepted Answers:
Rotational flow

7) The stream function for an incompressible flow around a circular cylinder of radius R, is given by *1 point*

$$\psi = -Vr\sin\theta + \frac{VR^2\sin\theta}{r}$$

where V is the free stream veloctiy. Find v_r and v_θ if r = R.

- $v_r = VRcos\theta, v_\theta = 0$
- $v_\theta = VRcos\theta, v_r = 0$
- $v_\theta = 2VRsin\theta, v_r = 0$
- $v_\theta = 2Vsin\theta, v_r = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$v_\theta = 2Vsin\theta, v_r = 0$

8) Which of the following combination of elementary flows will describe the flow field shown in the plot below. *1 point*

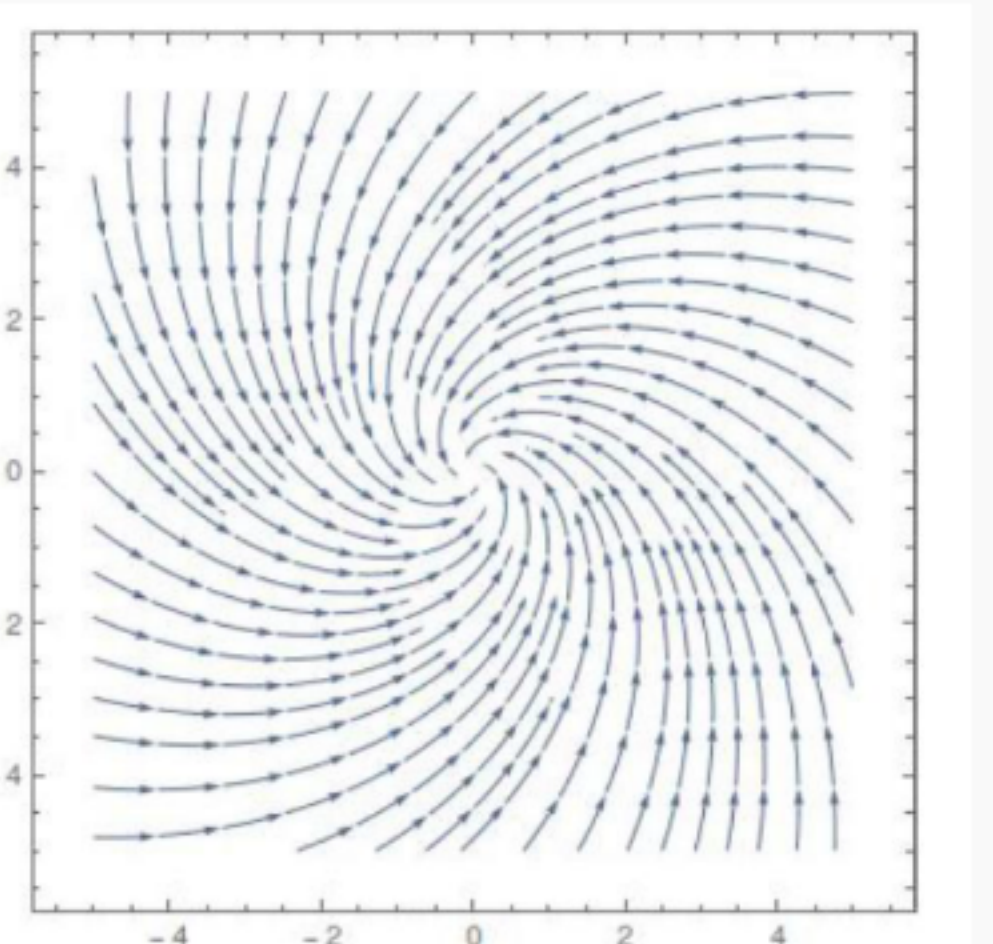

Figure 1: Fluid flow fields

- source + vortex
- uniform flow + vortex
- doublet + vortex
- sink + vortex

No, the answer is incorrect.
Score: 0
Accepted Answers:
sink + vortex

9) If the velocity potential is given by $\phi = x^2 - y^2 + xy$, then the velocity components are given by *1 point*

- $u = x^2 + xy, v = y^2 + xy$
- $u = 2y - x, v = -2x - y$
- $u = -2x - y, v = 2y - x$
- $u = 2y + x, v = 2x + y$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$u = -2x - y, v = 2y - x$

10) Consider a radially outward planar flow from a source of strength $Q = 20m^2/s$. The radial velocity of the flow at a radii of 0.2m and 0.3m respectively, are ... *1 point*

- 4.77 m/s, 9.55 m/s
- 15.91 m/s, 10.61 m/s
- 3.83 m/s, 5.12 m/s
- 100 m/s, 66.67 m/s

No, the answer is incorrect.
Score: 0
Accepted Answers:
15.91 m/s, 10.61 m/s

11) The Jacobian matrix (J) relating the spatial coordinate system (x_i) to the advected coordinate system (ξ_j) is given by: *1 point*

- $J = \xi_j \cdot x_i$
- $J = x_i \times \xi_j$
- $J_{ij} = \frac{\partial x_i}{\partial \xi_j}$
- $J_{ij} = \frac{\partial \xi_i}{\partial x_i}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$J_{ij} = \frac{\partial x_i}{\partial \xi_j}$

12) When the function in Reynold's transport theorem is assumed to be density (ρ), then the equation obtained is *1 point*

- Stokes' Law
- Laplace equation
- Navier-Stokes equation
- Continuity equation

No, the answer is incorrect.
Score: 0
Accepted Answers:
Continuity equation

13) Find the driving force that does not appear as a body force term in the governing equation for fluid flow as described in this course. *1 point*

- Gravity
- Surface Tension
- Centrifugal force
- Electromagnetic force

No, the answer is incorrect.
Score: 0
Accepted Answers:
Surface Tension

14) The theorem which relates total flux through the surface with volume integral is *1 point*

- Taylor's theorem
- Green's theorem
- Gauss divergence theorem
- Reynold's transport theorem

No, the answer is incorrect.
Score: 0
Accepted Answers:
Gauss divergence theorem

15)
Given the stress tensor $\sigma_{ij} = \begin{bmatrix} 2 & -3 & 4 \\ -3 & -5 & 1 \\ 4 & 1 & 6 \end{bmatrix}$ MPa, determine the magnitude of pressure (|p| in MPa) as defined in this course.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 1

1 point

16)
Given the stress tensor $\sigma_{ij} = \begin{bmatrix} 2 & -3 & 4 \\ -3 & -5 & 1 \\ 4 & 1 & 6 \end{bmatrix}$ MPa.The deviatoric stress tensor given by $d_{ij} = \begin{bmatrix} p & -3 & 4 \\ -3 & q & r \\ 4 & 1 & 5 \end{bmatrix}$ p,q,r are given respectively. *1 point*

- 1,-6,0
- 1,-6,1
- 2,-5,1
- 1,1,-6

No, the answer is incorrect.
Score: 0
Accepted Answers:
1,-6,1

17) Stokes' assumption postulates that *1 point*

- All fluids are incompressible
- Rate of dilation of a Newtonian fluid is zero
- Bulk viscosity of monoatomic fluids can be assumed to be zero
- Newtonian fluids are compressible

No, the answer is incorrect.
Score: 0
Accepted Answers:
Bulk viscosity of monoatomic fluids can be assumed to be zero

18) Which of the following statements defines a Newtonian fluid? *1 point*

- Viscosity increases with stress
- Flow starts above a critical shear stress which is then linear with the strain rate
- The strain rate is proportional to the shear stress
- The fluid is thixotropic in nature

No, the answer is incorrect.
Score: 0
Accepted Answers:
The strain rate is proportional to the shear stress

19) The trace of deviatoric stress tensor is always *1 point*

- 3 × pressure
- 0
- -3 × pressure
- Varies according to the stress tensor

No, the answer is incorrect.
Score: 0
Accepted Answers:
0

20) What are the dimensions of $\rho \times \mu \times \nu$ where ν, μ, ρ are kinematic viscosity, dynamic viscosity and density respectively *1 point*

- $[M^2L^{-2}T^2]$
- $[M^2L^{-2}T^{-2}]$
- $[ML^{-3}]$
- $[ML^{-3}T]$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$[M^2L^{-2}T^{-2}]$