Unit 4 - Week 2

Assignment 2

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) For an incompressible flow, $\mathbf{u}(1,1,2) = (2i, c, -3i)$. The constant c is given by *1 point*

- $-2i$
- i
- $4i$
- None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
$4i$

2) Velocity mode corresponding to the vorticity mode $\omega(1,1,-1) = (-2i, 3i, i)$ is *1 point*

- $\mathbf{u}(1,1,-1) = (-2i/3, i, i/3)$
- $\mathbf{u}(1,1,-1) = (-4/3, -1/3, -5/3)$
- $\mathbf{u}(1,1,-1) = (-3i, 4i, i)$
- Not possible to obtain from the given information

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\mathbf{u}(1,1,-1) = (-4/3, -1/3, -5/3)$

3) Temperature equation for incompressible fluid flow is $\partial_t T + (\mathbf{u}\cdot\nabla)T = \alpha\nabla^2 T$. Corresponding equation in Fourier space would be *1 point*

- $\partial_t T(\mathbf{k}) + i\sum_{\mathbf{p}} \mathbf{k}\cdot\mathbf{u}(\mathbf{k}-\mathbf{p})T(\mathbf{p}) = -\alpha k^2 T(\mathbf{k})$
- $\partial_t T(\mathbf{k}) + i\sum_{\mathbf{k}} \mathbf{k}\cdot\mathbf{u}(\mathbf{k}-\mathbf{p})T(\mathbf{p}) = \alpha k^2 T(\mathbf{k})$
- $\partial_t T(\mathbf{k}) + i\sum_{\mathbf{p}} \mathbf{k}\cdot\mathbf{u}(\mathbf{p}-\mathbf{k})T(\mathbf{p}) = i\alpha k^2 T(\mathbf{k})$
- None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\partial_t T(\mathbf{k}) + i\sum_{p} \mathbf{k}\cdot\mathbf{u}(\mathbf{k}-\mathbf{p})T(\mathbf{p}) = -\alpha k^2 T(\mathbf{k})$

4) Which one of the following quantities can also be negative? *1 point*

- Energy
- Helicity
- Enstrophy
- None of these

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

5) All the active Fourier modes in the velocity field $\mathbf{u}(x,y) = \hat{x}2A\sin x + \hat{y}2B\sin y + (\hat{x}-\hat{y})4C\cos(x+y)$ are *1 point*

- $(1,0)$ and $(1,-1)$
- $(\pm1,0)$, $(0,\pm1)$, $(1,1)$ and $(-1,-1)$
- $(0,\pm1)$, and $(1,1)$
- $(\pm1,0)$, $(0,\pm1)$, $(\pm1,\pm1)$, and $(\mp1,\pm1)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$(\pm1,0)$, $(0,\pm1)$, $(1,1)$ *and* $(-1,-1)$

6) Modal energy and enstrophy corresponding to $\mathbf{k} = (1,1)$ for the velocity field $\mathbf{u}(x,y) = \hat{x}2A\cos y + \hat{y}2A\cos x + (\hat{x}-\hat{y})4A\cos(x+y)$ are *1 point*

- $4A^2$ and $2A^2$
- A^2 and A^2
- $4A^2$ and $8A^2$
- $2A^2$ and 0

No, the answer is incorrect.
Score: 0
Accepted Answers:
$4A^2$ *and* $8A^2$

7) Spectral methods are superior than finite difference, finite element, and finite volume in following aspects: *1 point*

- Higher accuracy
- Better way to understand energy distribution and transfer among different scales
- Both first and second options
- None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
Both first and second options

8) How many triads are formed for the velocity field *1 point*
$\mathbf{u} = 4C(\hat{x}\sin x\cos z - \hat{z}\cos x\sin z) + 4B(\hat{y}\sin y\cos z - \hat{z}\cos y\sin z) + 8A(-\hat{x}\sin x\cos y\cos 2z - \hat{y}\cos x\sin y\cos 2z + \hat{z}\cos x\cos y\sin 2z)$?

- 4
- 5
- 3
- No triads are formed

No, the answer is incorrect.
Score: 0
Accepted Answers:
3

9) Evolution equation of A, B and C for the velocity field $\mathbf{u} = \hat{x}2B\cos y + \hat{y}2C\cos x + (\hat{x}-\hat{y})2A\sin(x+y)$ (Assuming $\nu = 0$) are *1 point*

- A=constant, $B = c\cos(At)$, and $B = c\sin(At)$
- $A = c\exp(-Bt)$, B=constant, and $B = c\sin(At)$
- $A = c\sin(At)$, $B = c\cos(At)$, and $B = c\sin(At)$
- None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
A=constant, $B = c\cos(At)$, *and* $B = c\sin(At)$

10) Velocity field constructed using the Fourier modes $\mathbf{u}(1,0) = (0,1,-i)$, $\mathbf{u}(-1,0) = (0,1,i)$, $\mathbf{u}(0,1) = (-1,0,-i)$, and $\mathbf{u}(0,-1) = (-1,0,i)$ is *1 point*

- $\mathbf{u} = -\hat{x}2\cos y + \hat{y}2\cos x + \hat{z}2(\sin x + \sin y)$
- $\mathbf{u} = \hat{x}2\sin y + \hat{y}2\sin x + \hat{z}2(\cos x + \sin y)$
- $\mathbf{u} = -\hat{x}2\cos y + \hat{y}2\sin x + \hat{z}2(\sin x + \cos y)$
- $\mathbf{u} = -\hat{x}\sin x + \hat{y}\cos y + \hat{z}\sin z$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\mathbf{u} = -\hat{x}2\cos y + \hat{y}2\cos x + \hat{z}2(\sin x + \sin y)$