NPTEL » Physics of Turbulence

Unit 8 - Week 6

Course outline

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Week 2

Week 3

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Week 6

Transfers

Examples

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Quiz : Assignment 6

Assignment 6 Solution

Feedback For Week 6

How to access the portal?

Lecture 21: Energy Transfers:

Lecture 22: Energy Transfers:

Lecture 23: Energy Transfers:

Lecture 24: Energy Transfers:

Shell-to-Shell Energy Transfer

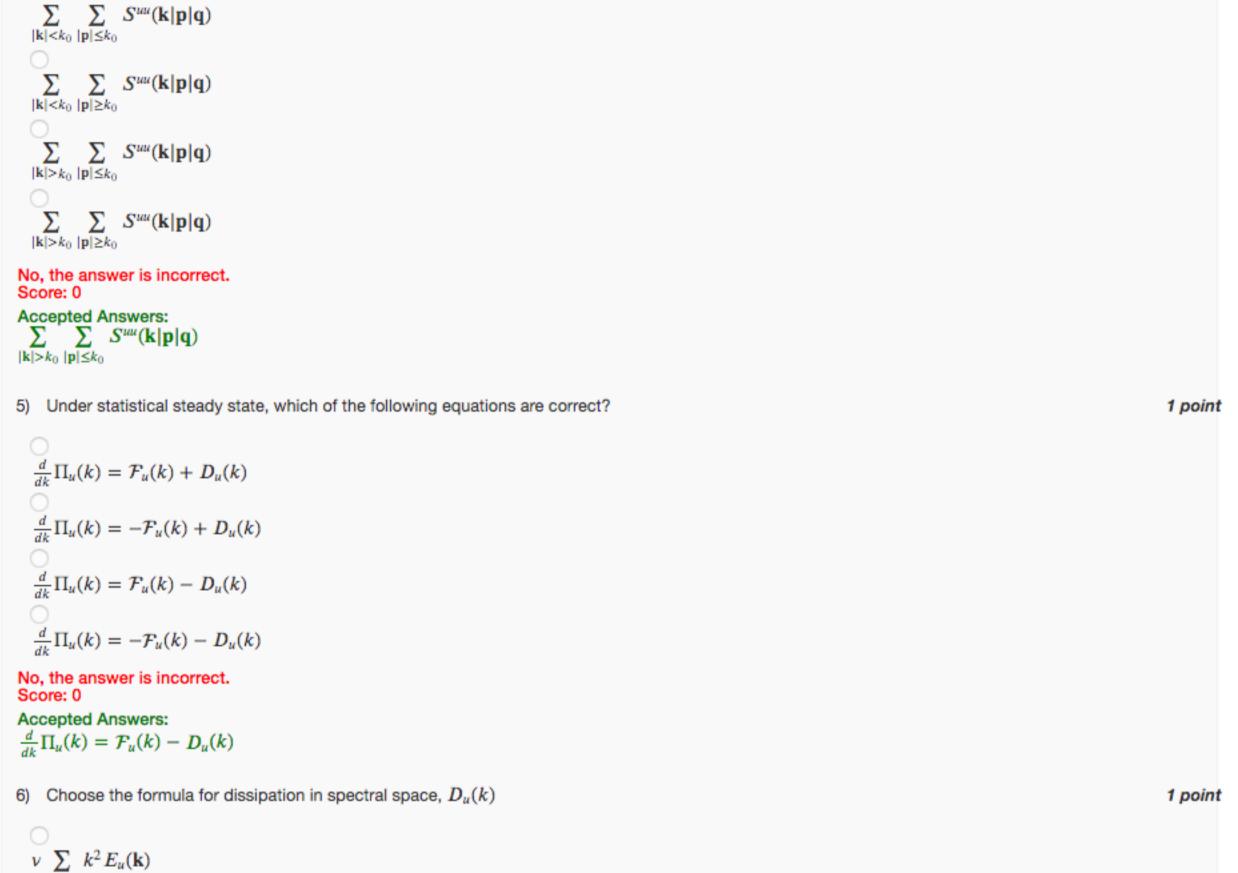
Spectral Energy Flux and

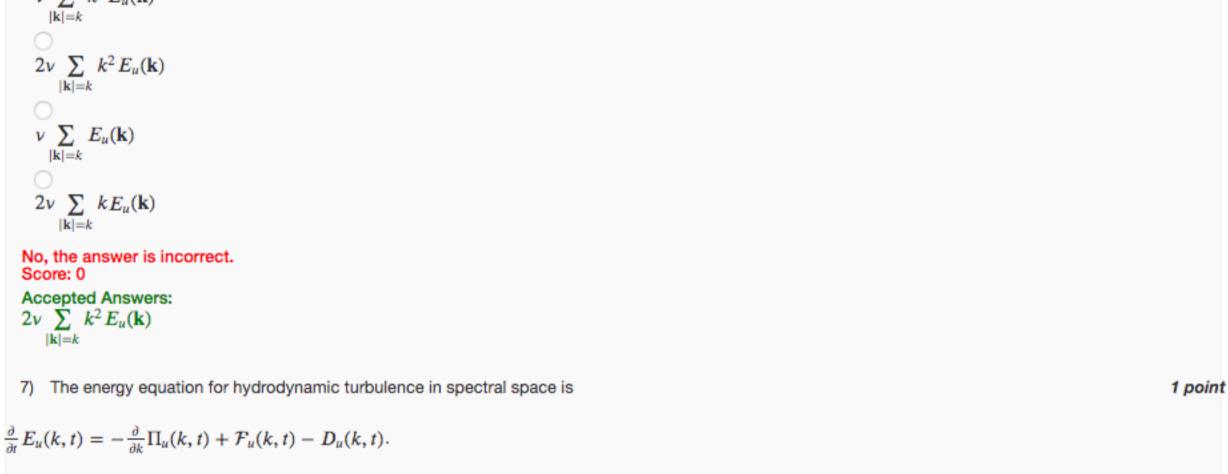
Mode-to-mode Energy

Mode-to-mode Energy

Transfers (continued)

Assignment 6 The due date for submitting this assignment has passed. Due on 2019-09-11, 23:59 IST. As per our records you have not submitted this assignment. 1) Choose the correct expression for mode-to-mode energy transfer $S^{uu}(\mathbf{k}'|\mathbf{p}|\mathbf{q})$. 1 point $-\mathfrak{T}[\{k'\cdot u(p)\}\{u(q)\cdot u(k')\}]$ $-\mathfrak{F}[\{k'\cdot u(q)\}\{u(p)\cdot u(k')\}]$ $-\mathfrak{T}[\{k'\cdot u(k')\}\{u(q)\cdot u(p)\}]$ $\mathfrak{F}[\{k'\cdot u(k')\}\{u(p)\cdot u(q)\}]$ No, the answer is incorrect. Score: 0 Accepted Answers: $-\mathfrak{T}[\{k'\cdot u(q)\}\{u(p)\cdot u(k')\}]$ 2) Which of the following assumptions on $S^{uu}(\mathbf{k}'|\mathbf{p}|\mathbf{q})$ is incorrect? 1 point $S^{uu}(\mathbf{k}'|\mathbf{p}|\mathbf{q})$ is real $S^{uu}(\mathbf{k}'|\mathbf{p}|\mathbf{q})$ is linear w.r.t. $\mathbf{u}(\mathbf{k}'),\ \mathbf{u}(\mathbf{p})$ and $\mathbf{u}(\mathbf{q})$ $S^{uu}(-\mathbf{k}'|\mathbf{p}|\mathbf{q}) = S^{uu}(\mathbf{k}'|\mathbf{p}|\mathbf{q})$ $S^{uu}(-\mathbf{k}'|-\mathbf{p}|-\mathbf{q}) = S^{uu}(\mathbf{k}'|\mathbf{p}|\mathbf{q})$ No, the answer is incorrect. Score: 0 Accepted Answers: $S^{uu}(-\mathbf{k}'|\mathbf{p}|\mathbf{q}) = S^{uu}(\mathbf{k}'|\mathbf{p}|\mathbf{q})$ 3) Consider the nonlinear interaction among three wavenumbers $\mathbf{p}=(1,1,1)$, $\mathbf{q}=(0,1,1)$ and $\mathbf{k}=(1,2,2)$. The Fourier amplitudes of the velocity **1 point** fields are $\mathbf{u}(\mathbf{k}) = (2i, -1, 1 - i)$, $\mathbf{u}(\mathbf{p}) = (1, 3i, -1 - 3i)$, and $\mathbf{u}(\mathbf{q}) = (4i, 1, -1)$. What is the value of $S^{uu}(\mathbf{k}|\mathbf{p}|\mathbf{q})$? 8 O-8 16 **-16** No, the answer is incorrect. Score: 0 Accepted Answers: 4) What is the expression for kinetic energy flux $\Pi_u(k_0)$ from all modes \mathbf{p} within a sphere of radius k_0 to the modes \mathbf{k} outside it? 1 point





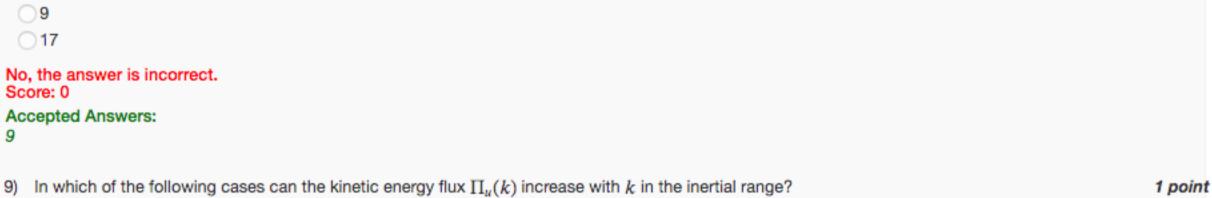
 $D_u(k,t)$ \bigcirc $\mathcal{F}_u(k,t)$

For a flow forced at large scales, which terms are dominant in the inertial range? [Here Π_u , \mathcal{F}_u and D_u denotes the flux, forcing and dissipation respectively.]

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\mathcal{F}_{u}(k,t)
\frac{\partial}{\partial k}\Pi_{u}(k,t)
Both D_{u}(k,t) and \mathcal{F}_{u}(k,t)
No, the answer is incorrect. Score: 0
Accepted Answers: \frac{\partial}{\partial k}\Pi_{u}(k,t)

8) Consider the nonlinear interaction among three wavenumbers \mathbf{p}=(1,1,1), \mathbf{q}=(0,1,1), and \mathbf{k}=(1,2,2). The Fourier amplitudes of the velocity 1 point fields are \mathbf{u}(\mathbf{k})=(2i,-1,\ 1-i), \mathbf{u}(\mathbf{p})=(1,\ 3i,-1-3i), and \mathbf{u}(\mathbf{q})=(4i,\ 1,-1). What is energy flux across the wavenumber sphere of radius 2?
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_-17 _-9



1 point



10) What is the expression for shell-to-shell kinetic energy transfer from modes in shell m to modes in shell n ?
$T_{u,m}^{u,n} = \sum_{k \in m} \sum_{p \in n} S^{uu}(\mathbf{k} \mathbf{p} \mathbf{q})$

$$T_{u,n}^{u,m} = \sum_{k \in n} \sum_{p \in m} S^{uu}(\mathbf{k}|\mathbf{p}|\mathbf{q})$$

$$T_{u,n}^{u,n} = \sum_{k \in n} \sum_{p \in m} S^{uu}(\mathbf{k}|\mathbf{p}|\mathbf{q})$$

$$T_{u,n}^{u,m} = \sum_{k \in m} \sum_{p \in n} S^{uu}(\mathbf{k}|\mathbf{p}|\mathbf{q})$$

Accepted Answers:
$$T_{u,n}^{u,m} = \sum_{k \in n} \sum_{p \in m} S^{uu}(\mathbf{k}|\mathbf{p}|\mathbf{q})$$

Score: 0

No, the answer is incorrect.

Score: 0

Accepted Answers: Thermal convection