جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Advanced Transport Phenomena - CBE 202

Division	Physical Science and Engineering Division
Course Number	CBE 202
Course Title	Advanced Transport Phenomena
Academic Semester	Fall
Academic Year	2018/2019
Semester Start Date	08/26/2018
Semester End Date	12/11/2018
Class Schedule (Days & Time)	01:00 PM - 02:30 PM | Mon Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
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Teaching Assistant(s)

Name	Email
TBA	

Course Information

Comprehensive Course Description	This class will discuss the basic principles of transport of mass, heat and momentum mainly in chemical , fluid flow, environmental and biological processes. The class will teach students how to analyze a transport process in a systamic way and how to identify the main issue(s) in complicated systems.
Course Description from Program Guide	The aim of this course is to enable students to i) derive appropriate differential balances for specific material properties, including momentum, thermal energy, and mass species, accounting appropriately for property flux by convective and diffusive (molecular-scale) processes, along with property generation or loss in the material continua; ii) write the Thermal Energy Equation, the Species Continuity Equation, and the Navier-Stokes Equations and pose (simplify) them appropriately for specific transport problems; iii) know appropriate boundary conditions that can be applied to specific transport problems; iv) conduct scale or dimensional analyses of transport problems, using the analyses to help simplify or enhance understanding of underlying transport processes; v) solve and physically interpret one-dimensional steady state conduction and species diffusion problems in rectangular, cylindrical, and spherical geometries, with and without zero-order and first-order generation/loss; vi) use separation of variables technique to solve and physically interpret two-dimensional steady-state conduction and species diffusion problems; vii) use similarity methods to solve and physically interpret unsteady state conduction and diffusion problems in unbounded material regions; viii) use the finite Fourier transform method to solve and interpret unsteady state conduction and diffusion problems in bounded material regions; ix) solve and physically interpret unidirectional steady and unsteady viscous flows in unbounded regions and in bounded regions (i.e. flow conduits or ducts); and x) solve and physically interpret simultaneous convection and diffusion (conduction) problems involving the interaction of thermal or concentration boundary layers with developing or developed velocity profiles.

Goals and Objectives	The aim of this course is to enable students to i) derive appropriate differential balances for specific material properties, including momentum, thermal energy, and mass species, accounting appropriately for property flux by convective and diffusive (molecular-scale) processes, along with property generation or loss in the material continua; ii) write the Thermal Energy Equation, the Species Continuity Equation, and the Navier-Stokes Equations and pose (simplify) them appropriately for specific transport problems; iii) know appropriate boundary conditions that can be applied to specific transport problems; iv) conduct scale or dimensional analyses of transport problems, using the analyses to help simplify or enhance understanding of underlying transport processes; v) solve and physically interpret one-dimensional steady state conduction and species diffusion problems in rectangular, cylindrical, and spherical geometries, with and without zero-order and first-order generation/loss; vi) use separation of variables technique to solve and physically interpret two-dimensional steady-state conduction and species diffusion problems; vii) use similarity methods to solve and physically interpret unsteady state conduction and diffusion problems in unbounded material regions; viii) use the finite Fourier transform method to solve and interpret unsteady state conduction and diffusion problems in bounded material regions; ix) solve and physically interpret unidirectional steady and unsteady viscous flows in unbounded regions and in bounded regions (i.e. flow conduits or ducts); and x) solve and physically interpret simultaneous convection and diffusion (conduction) problems involving the interaction of thermal or concentration boundary layers with developing or developed velocity profiles.
Required Knowledge	Basic knowledge of fluid mechanics, heat & mass transfer, vector analysis, and differential equations
Reference Texts	Analysis of Transport Phenomena, WM Dean, Oxford University Press, 1998
Method of evaluation	**20.00**% - Quiz(zes) **40.00**% - Midterm exam **40.00**% - Final exam
Nature of the assignments	Homework Assigned reading Case Study Group project
Course Policies	It is compulsory to attend all the classes. Absence of more than 2 lectures may be considered failure of the course.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Mon 08/27/2018	Introduction
1	Thu 08/30/2018	Review of Matrix, Vector and ODEs
2	Mon 09/03/2018	Review of Matrix, Vector and ODEs
2	Thu 09/06/2018	Review of Matrix, Vector and ODEs
3	Mon 09/10/2018	Constitutive Equations
3	Thu 09/13/2018	Constitutive Equations
4	Mon 09/17/2018	Constitutive Equations
4	Thu 09/20/2018	Conservation Equations
5	Mon 09/24/2018	Conservation Equations
5	Thu 09/27/2018	Conservation Equations
6	Mon 10/01/2018	Applications
6	Thu 10/04/2018	Applications
7	Mon 10/08/2018	Applications
7	Thu 10/11/2018	Applications
8	Mon 10/15/2018	Homework Reviews
8	Thu 10/18/2018	Midterm Exam
9	Mon 10/22/2018	Scaling and Normalization
9	Thu 10/25/2018	Scaling and Normalization
10	Mon 10/29/2018	Boundary Layer Theory
10	Thu 11/01/2018	Boundary Layer Theory
11	Mon 11/05/2018	Forced Mass and Heat Transfer
11	Thu 11/08/2018	Forced Mass and Heat Transfer
12	Mon 11/12/2018	Conduction
12	Thu 11/15/2018	Conduction
13	Mon 11/19/2018	Dimension Analysis
13	Thu 11/22/2018	Analogies
14	Mon 11/26/2018	Revew of Homeworks
14	Thu 11/29/2018	Project Presentation
15	Mon 12/03/2018	Project Presentation
15	Thu 12/06/2018	Final Exam (TBA)
16	Mon 12/10/2018	Final Exam (TBA)

Note

The instructor reserves the right to make changes to this syllabus as necessary.