ESG 420: FLUID FLOW, HEAT & MASS TRANSPORT (REQUIRED)

Credit: 3

COURSE CATALOG DESCRIPTION:

This course introduces the description of phenomena associated with fluid statics and fluid flow and the unifying principles and analytical description of phenomena of momentum transport (viscous flow), energy transport (heat conduction and convection) and mass transport (diffusion) in continuous media; similarities and differences in these phenomena.

PRE- REQUISITE(S): PHY 127/134 or 132/ 134 or 142 and AMS361 or MAT 303

TEXT(S) OR OTHER REQUIRED MATERIAL: FE Review Manual,, ,Michael R Lindeburg, PE latest edition

COURSE LEARNING OUTCOMES	SOS	ASSESSMENT TOOLS
Understanding the concept of viscous flow	a,e,k	Exam Homework, Problem Sets
Applying Bernoulli Theorem	a,e,k	Exam Homework, Problem Sets
Explain the physical origins of heat and mass transfer, identify important modes of heat transfer in a given situation, and make appropriate assumptions	a,e,k	Exam Homework, Problem Sets
Calculate heat transfer rate and temperature distribution in steady-state one-dimensional heat conduction problems	a,e,k	Exam Homework, Problem Sets
Sketch temperature profiles in one-dimensional heat transfer, showing the qualitative influence of energy generation, non-planar geometry, or time dependence	a,e,k	Exam Homework, Problem Sets
Calculate the rate of mass diffusion in one-dimensional problems	a,e,k	Exam Homework, Problem Sets

COURSE TOPICS:

Week1. Introduction which includes density, specific wt, specific gravity, viscosity, etc

Week 2. Fluid statics which includes Manometers , Forces on submerged surfaces, Buoyancy

Week 3. Fluid flow: Laminar and turbulent, viscosity, Momentum transfer

Week 4. Fluid flow :momentum transfer correlations, mechanical energy balance

Week 5.	Intro to heat transfer: Conduction , Convection, Fourier's law, thermal boundary layer, heat transfer coefficient
Week 6.	Flow in pipes, laminar and turbulent ,frictional losses , Moody diagram
Week 7.	Overall energy balance equation, Bernoulli, differential energy balance equation
Week 8.	Turbulence, Heat transfer Correlations, Radiation
Week 9.	Intro to mass transfer, diffusion and convection, Fick's law of diffusion, thermal diffusion ,diffusion boundary layer
Week 10.	Diffusion mechanisms, non-steady-state diffusion, and Fick's second law
Week 11.	Fluid flow, heat transfer, and mass transfer similarities and coupling. Basic laws
Week 12.	Boundary layer conditions ;solid /liquid interface, Liquid/gas interface, solid/gas interface , solid/solid interface
Week 13.	Applications to heat exchangers and heat exchanger design
Week 14	Industrial applications of transport phenomena and review

CLASS/ LABORATORY SCHEDULE

ESG	420	Fluid Flow, Heat & Mass Transport	Lecture	L01	TU	7:00 PM	8:30 PM

CURRICULUM

This course contributes 1 credit hour toward meeting the required 48 hours of engineering topics.

STUDENT OUTCOMES (SCALE 1-3):

A	B	C	D	E	F	G	H	I	J	K
3				3				3		

3 – Strongly supported **2 – Supported** **1- Minimally supported**

LEAD COORDINATOR(S) WHO PREPARED THIS DESCRIPTION AND DATE OF PREPARATION:

Frank Szalajda, PE 5-27-2010