SYLLABUS

1. TITLE – FLUID MECHANICS AND HEAT TRANSFER CHARACTERISTICS OF NANOFLUIDS, FALL 2011

Course number: ME F443/F643, **Credits:** 3
Department: Mechanical Engineering
Prerequisites: ES 341 and ME 441 or their equivalent from other universities; or the permission of the instructor
Class room location: Duckering XXX
Meeting time: XXXXX, three hours lecture per week
2. Instructor: Dr. Deben K. Das, **Office:** Duckering 327, **Office hours**: XXXXX, three hours per week, Telephone No. 474-6094; E-mail address:dkdas@alaska.edu

3. Course readings/materials:
Textbook: Microscale and Nanoscale Heat Transfer by C. Sobhan and G. Peterson, First edition, CRC Press
Supplementary reading recommended:
(1) Fluid Mechanics by F. M. White, 5th Edition, McGraw-Hill
(2) Heat Transfer by A. Bejan 2nd Edition, John Wiley
(3) Handbook of Nanostructured Materials and Nanotechnology Vol. I and II, by H.S. Nalwa, 1st edition, American Scientific Publishers
(4) Springer Handbook of Nanotechnology by Bharat Bhushan, 1st edition, Springer-Verlag Publication
(5) Journals of Nanoscience and Nanotechnology
(6) Papers from selected journals given as class handouts

4. Course description:

(3) Show through analytical and numerical analyses corroborated by experimental data that heat transfer systems will be smaller and will require less pumping power for the same amount of heat transfer using nanofluids, in comparison to conventional fluids used today.

(4) Guide the students to research on this new topic to design modern mini and microchannel heat exchangers with nanofluids exhibiting much higher thermal efficiency and saving energy.

6. Student learning outcomes:

Upon completion of this course, the student should have learned the following skills.

(i) an ability to apply the knowledge of nanotechnology in fluids and thermal engineering

(ii) an ability to design a system, component, or process to meet desired needs using nanofluids.

(iii) an ability to identify, formulate, and solve fluid dynamic and thermal engineering problems involving nanotechnology

(iv) a knowledge of contemporary issues, e.g., nanoscience and nanotechnology

(v) northern issues such as better building heating systems with modern mini and microchannel heat exchangers, which are energy efficient.

7. Instructional methods: The teaching technique is through lectures.

8. Course Calendar:

WEEK	**TOPIC**
1	Introduction to nanofluids, nanostructured materials, base fluids, dispersion, sonication and stable suspension. Various types of nanofluids. volumetric concentration.
2	Thermophysical properties: Density; principles of measurement and apparatus. Theoretical equations and new empirical correlations to determine the density of different nanofluids.
3	Viscosity: principles of measurement and apparatus. Andrade’s and other theoretical equations and new empirical correlations to determine the viscosity of different nanofluids. Effect of volumetric concentration and temperature. Effect of subzero temperature on nanofluid viscosity.
4	Thermal conductivity: principles of measurement and apparatus. Hamilton-Crosser and other theoretical equations and new empirical correlations to determine the thermal conductivity of different nanofluids. Effect of volumetric concentration and temperature. Effect of Brownian motion on enhancing the thermal conductivity.

15	On university schedule date	**FINAL EXAM**

9. Course Policies:

The grades will be assigned on the basis of absolute scores according to the table below

SCORE:	GRADE:
97-100	A^+
93-96	A
90-92	A^-
87-89	B^+
83-86	B
80-82	B^-
77-79	C^+
73-76	C
70-72	C^-
67-69	D^+
63-66	D
60-62	D^-
Below 60	F

11. Support services: No specialized computational lab is necessary for this course. The students have access to routine computer usage in the ME Dept and CEM computer labs in Duckering building.

12. Disabilities services: The instructor will work with the Office of Disabilities Services to provide reasonable accommodation to students with disabilities.