

ME 522  
**Building Energy Dynamics and Technology**

Wed., 4:00PM\_Lib. W4530

Instructor: Prof. Lin-Shu Wang  
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Office Hours: Mon. and Wed. \_\_11AM to 1PM

Text or required materials: Heating Ventilating and Air Conditioning – Analysis and Design 6th Edition  
By **F. C. McQuiston**, J.D. Parker and J.D. Spitler (Wiley)  
The Function of Heat, Thermodynamics as a predicative entropic theory of heat.  
By **Lin-Shu Wang** (2017, Springer International) \_\_file will be made available  
Heating Cooling Lighting. By **Norbert Lechner** (Wiley) \_\_Chapter 1 file will be made available  
**R. de Dear**, “Thermal counterpoint in the phenomenology of architecture, a psychophysiological explanation of Heschong’s *Thermal Delight*,” *PLEA-2014-Keynote* (Ahmedabad, India) \_\_file will be made available  
“VAV vs. Radiant,” *ASHRAE Journal* (May 2014). By Sastry and Rumsey \_\_will be made available

Supplemental Reading:

- ASHRAE Handbook of Fundamentals 2013
- Radiant Heating and Cooling Handbook. By R. D. Watson and K. S. Chapman (McGraw-Hill)
- Thermally Active Surfaces in Architecture. By Kiel Moe (Princeton Architectural Press)

Grading: Homework 5%  
5 points [I will collect the homework but will not return them back to students (keep a copy for yourself).]  
First Midterm 25%  
Second Midterm 25%  
Final 35%  
MATLAB/Essay 10%  
Total 100%

COURSE CONTENT

**Topic 1** – Is building energy an architectural problem or an engineering problem? (de Dear, “Thermal counterpoint...”; Heating Cooling Lighting\_Chapter 1) [01/25](#)

**Topic 2** – Heat transmission and thermal mass in building structures (McQuiston: Chapter 5) [02/01](#)

**Topic 3** –

**Engineering solution\_Air conditioning:** Introduction to HVAC and air conditioning systems (McQuiston: Chapters 1, 2)

**Engineering solution\_Space conditioning:** Introduction to hydronic radiant systems (HRSs) applied to a building (Advantages of Radiant Heating and Cooling Systems; Kim and Olesen, “Radiant heating and cooling systems”; “VAV vs. Radiant”) [02/08](#)

**Topic 4** – Mechanical equivalent of heat and the first law of thermodynamics (LSW: Chapter 3) 02/15

**Topic 5** – The second law of thermodynamics (LSW: Chapters 4, 5) 02/22

**Topic 6** – Mechanical Vapor Compression Refrigeration Components and Cycles (McQuiston: Chapter 15) 03/08

**Topic 7** – Flow Pumps and Piping Design (McQuiston: Chapter 10) 03/22

**Topic 8** – Fans and building air distribution (McQuiston: Chapter 12) 03/29

**Topic 9** – The second law of thermodynamics and the concept of entropy growth potential (LSW: Chapter 7) 04/05

**Topic 10** – **Archi-engineering solution**\_Mechanical equipment applied to HRS buildings for the management of natural EGP (LSW: Chapter 11) 04/19

**Topic 11** – A case study of applying archi-engineering solution to a 2300  $ft^2$  structure in Stony Brook 04/26

#### IMPORTANT DATES AND DEADLINE

Assignment	Date
Midterm 1	3/01/17
Midterm 2	4/12/17
Final-Exam	5/3/17
Essay (see LO #7)	5/10/17

#### LEARNING OBJECTIVE (LO)

1. Describe a building as a dynamic thermal system with elementary understanding of its envelope heat loss/gain, its built-in structural thermal mass, and its indoor space environment
2. Mechanical equipment 1\_Describe how *all-air* HVAC systems work and their implication to energy efficiency in buildings.
3. Mechanical equipment 2\_Describe how *hydronic radiant systems* (HRSs) work
4. Explain the first law of thermodynamics by paraphrasing the *mechanical equivalent of heat* (MEH)
5. Explain the second law of thermodynamics by identifying: What are expended in making things happen? How we pay for what are expended? and How we differentiate different kinds of expenditures by how we pay for them?
6. Apply various design procedures of flow pumps, piping.
7. Appraise the synergy of HRSs and natural EGPs (based on a short essay [including the option of MATLAB modeling] with suggested themes: (1) All-air HVAC systems vs. hydronic radiant systems, a comparison of their energy efficiency; (2) How a revolution of hydronic radiant system buildings will contribute to economic growth? These are only suggested titles; you can create your own variation of which.).



### **Americans with Disabilities Act**

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services at (631) 632-6748 or <http://studentaffairs.stonybrook.edu/dss/>. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

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If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information, go to the following website: <http://www.stonybrook.edu/ehs/fire/disabilities>.

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Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Academic dishonesty in general is the presentation of intellectual work that is not originally yours. Examples include, *but are not limited to*, copying or plagiarizing class assignments including homework, reports, designs, and other submitted materials; copying or otherwise communicating answers on exams with other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to academic dishonesty will be prosecuted to the fullest via the CEAS CASA committee. For you, the honest student, academic dishonesty results in lower class curves, hence a depression in your GPA and class standing, while cheapening the degree you earn.