Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

1. This request is submitted by the Department of Biological and Agricultural Engineering
   BAEN 667 - Entropy Theory and its Application in Water and Environmental Engineering

2. Course prefix, number and complete title of course:
   Catalog course description (not to exceed 50 words): Entropy theory, probability distributions, parameter estimation, hydrologic design, rainfall-runoff, infiltration and soil moisture, frequency analyses, sediment yield, velocity distributions, flow forecasting, hydraulic geometry, geomorphic structure, water distribution reliability and water availability assessment

3. Cross-listed courses require the signature of both department heads.

4. Prerequisite(s): Graduate classification; knowledge of calculus and statistics at the undergraduate level and consent of the instructor

5. Is this a variable credit course? ☐ Yes ☒ No If yes, from ______ to ______

6. Is this a repeatable course? ☐ Yes ☒ No If yes, this course may be taken ______ times.
   Will this course be repeated within the same semester? ☐ Yes ☒ No

7. This course will be:
   a. required for students enrolled in the following degree programs(s) (e.g., B.A. in history)
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

8. MS, MEN, PhD in any engineering program

9. Prefixed Course # Title (excluding punctuation)
   B A E N 6 6 7 T H E R Y A P P H 2 O E N V E N G R

   Lect. Lab SCH CIP and Fund Code Admin. Unit Acad. Year FICE Code
   0 3 0 0 0 3 1 4 0 3 0 1 0 0 0 6 0 4 3 3 1 0 - 1 1 0 0 3 6 3 2

   Approval recommended by:
   Gerald Rinkowski 3/23/09
   Department Head - Type Name & Sign Date

   Department Head - Type Name & Sign Date
   (if cross-listed course)

   Submitted to Coordinating Board by:
   Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Department of Biological and Agricultural Engineering  
BAEN 667-600  
Entropy Theory and its Application in Water and Environmental Engineering  
Fall 2010

**Lectures:** TR 3:55-5:10  
**Location:** PETR 104  
**Instructor:** Professor V. P. Singh  
Phone: 845-7028 (office)  
e-mail: vsingh@tamu.edu  
Office hours: 1:00 – 3:00 (T TH)

**Lecture:** 3 credits

**Prerequisites:** Some knowledge of calculus and statistics at the undergraduate level and consent of the instructor. Graduate classification.

**Catalog Description:** Entropy theory, probability distributions, parameter estimation, hydrologic design, rainfall-runoff, infiltration and soil moisture, frequency analyses, sediment yield, velocity distributions, flow forecasting, hydraulic geometry, geomorphic structure, water distribution reliability and water availability assessment.

**Course Contents:** Entropy theory, principle of maximum entropy, derivation of probability distributions, parameter estimation methods, evaluation and design of networks (rainfall, discharge, water quality, ground water, etc.), derivation of hydraulic geometry and basin geomorphic structure, reliability of water distribution systems, infiltration and soil moisture movement, ground water flow, erosion and sediment yield, velocity distributions, flood and drought frequency analyses, and flow forecasting, and other hydrologic and environmental problems.

**Learning Objectives:**

1. To learn the basic concepts of entropy and entropy theory
2. To learn entropy-based distribution
3. To learn entropy-based parameter estimation
4. To learn application of entropy in water engineering
5. To learn application of entropy in environmental engineering

**Required Text:** None; Class notes will be distributed in class or electronically through e-mail.

**Reference Books:**  


**Homework Assignments and Policy:** There will be 8 to 10 homework assignments, approximately one assignment per chapter. The data for these assignments may be chosen by the students themselves. Homework will be due within the allotted time. Students are required to complete the assignments on time. At the end of the allotted time, the instructor will discuss the assignment. The assignments are to assist the student to grasp the material discussed in the class and will carry 50% weight in formal grading. These assignments will replace midterm examinations.

All homework solutions must be neatly and clearly presented in an orderly fashion. Observe the following guidelines when completing the assignments: (i) Put your name and number on the pages neatly and legibly. (ii) State what is given without copying the entire problem. (iii) Draw needed diagrams/figures neatly. (iv) Specify dimensions/units for dimensional quantities. (v) Mark the final answer clearly. (vi) Staple the pages, but do not fold them.

**Project Report:** In consultation with the instructor, each student will be required to work on a project. The project will entail several components which will have to be completed, based on a schedule discussed in the class. At the end of the semester, the final project report will have to be submitted both electronically and in hard copy form. Each student will be required to present the report in the class. The final exam will be replaced by the project report and its oral presentation in the class. This issue will be finalized in the class. The project report will carry 35% of the weight and oral presentation will carry 15% of the weight in formal grading.

**Examination:** There will be no midterm examination in this course. However, students will be required to achieve milestones discussed and defined in the class in a timely manner. The final examination will be replaced by the project report and student presentations in the class at the end of the semester. It is expected that the student presentations will be open to the public.

**Incentive:** The students are strongly encouraged to ask questions. As an added incentive, there will be a bonus for asking a lot of questions, attending all the classes, and doing homework assignments and submitting them on time. This is over and above 100% weight of the assignments and project. Those who do not ask questions and do not do the aforementioned things will not get any bonus.

**Grading:**

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<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A Grade</td>
<td>90 - 100</td>
</tr>
<tr>
<td>B Grade</td>
<td>80 - 89</td>
</tr>
<tr>
<td>C Grade</td>
<td>70 - 79</td>
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<tr>
<td>D Grade</td>
<td>60 - 69</td>
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<tr>
<td>F Grade</td>
<td>&lt; 60</td>
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</tbody>
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**Computer Usage:** Significant, needed for solving homework problems and doing the project

**Communications Requirements:** Significant, for each student is required to prepare and submit his or her project in a professional manner and present the project in the class. The student presentations are open to faculty and students.
Lecture Schedule The lectures will follow a sequence of topics which are divided into different sections. Emphasis on a particular section or a chapter will vary with the make-up of the class and students’ interests.

Section 1: Preliminaries (First four weeks)

1. Entropy Theory
2. Principal of maximum Entropy
3. Derivation of Probability Distributions
4. Parameter Estimation Method

Section 2: Evaluation and Design of Sampling Networks (Three weeks)

5. Rainfall Networks
6. Discharge Networks
7. Water Quality Networks
8. Groundwater Networks

Section 3: Geomorphology (One week)

9. Hydraulic Geometry
10. Geomorphic Structure

Section 4: Water Resources (One week)

11. Reliability of Water Distribution Systems
12. Assessment of Water Resources Availability

Section 5: Hydraulic Applications (Two weeks)

13. One Dimensional Velocity Distributions
14. Two Dimensional Velocity Distributions
15. Sediment Concentration
16. Bridge Pier Scour
Section 6: Flow Forecasting (Two weeks)

17. Univariate Flow Forecasting

18. Bivariate Flow Forecasting

BAEN 667 Project Schedule

Choose a project of your choice using some aspects of the entropy theory discussed in the class. The focus should be on formulation of the problem using the entropy concept and its application to develop a methodology to solve the problem. You may choose to work on a research topic of your thesis or any other subject. You then will have to have your own data and do the analysis. You will be required to prepare a report on your project and present it in the class. The report should be prepared using the following topics: 1. Introduction to the problem, 2. Problem statement, 3. Objective of analysis, 4. Problem formulation using the entropy-based approach, 4. Data, 5. Methodology used, 6. Analysis of data, 7. Discussion of results, and 8. Conclusions. Tentatively the following milestones and their corresponding weights are set:

1. Definition of project problem and outline of the project (5%)

2. Review of literature: Critique of methods (15%)

3. Acquisition of relevant data and maps (10%)

4. Analysis/design: Preliminary (10%)

5. Final analysis/design (20)

6. Submission of final project report (30%)

7. Presentation of final project report (10%)

Academic Integrity:

“An Aggie does not lie, cheat, or steal, or tolerate those who do.” Please see the Aggie Honor System Office web site at http://www.tamu.edu/aggiehonor for rules and procedures regarding academic integrity.

Students with Disabilities

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life Disability Services in Room B118 of Cain Hall, or call 845-1637. Also, as a courtesy, please advise me as soon as possible if you need accommodations for a disability.