Welcome to

ME 130 Applied Engineering Analysis Class
Fall 2018

Instructor:

Tai-Ran Hsu
Professor
Department of Mechanical Engineering
San Jose State University
San Jose, California, USA

Available @ links:
www.engr.sjsu.edu/mae/faculty/hsu/index,htm
www.engr.sjsu.edu/mae/greensheets/htm

San Jose State University
Department of Mechanical and Aerospace Engineering
ME 130 Applied Engineering Analysis-1

Semester:	Fall 2018
Course Number:	46683
Prerequisites:**	**Math 133A with grad C- or better**
Co-requisites:	**ME 101 and ME 113**
Class Hours:	TR 09:00 – 10:15 AM
Class Room:	E341, Engineering Building
Instructor:	Dr. Tai-Ran Hsu, E117B, Tel: 924-3905, **E-mail: tai-ran.hsu@sjsu.edu**
Office Hours:	Thursdays 1:00 – 3:00 PM, or by appointment

** Students are **expected** to have learned the math subjects listed in the Table in the next slide.

You are strongly encouraged to become familiar with those underlined topics.

**Prerequisite Math Courses for the Course on Applied Engineering Analysis

SJSU Course No. and Title	Principal Course Syllabi
Math 19 Pre-Calculus	Functions and graphics; Polynomial and rational functions; Exponential, logarithm and trigonometric functions; Analytic trigonometry; Applications of trigonometric functions; Polar coordinates and vectors; Analytic geometry; Systems of equations and inequalities
Math 30 Calculus I	Functions and continuity; Derivatives of polynomials, exponential, trigonometric, logarithm and hyperbolic functions; Maximum and minimum values; The mean value theorem; L'Hopital's rule; Newton's method-an introduction to anti differentiation
Math 31 Calculus II	Areas and distances; The definite integral; Areas between curves; Volumes; Volumes by washers and cylindrical shells; Work; Integration by parts; Arc length; Area of a surface of revolution; Sequences and Series; Power series; Complex numbers
Math 32 Calculus III	Curve defined by parametric equations; Areas and lengths in polar coordinates; 3-D coordinate systems; Vector algebra; Equations of lines and planes; Cylinders and quadric surfaces; Cylindrical and spherical coordinates; Vector functions and space curves; Derivatives and integrals of vector functions; Arc length; Motion in space; Functions of several variables; Partial derivatives. The chain rule; Lagrange multipliers; Double integrals over general regions; Applications of double integrals; surface area; Triple integrals in cylindrical and spherical coordinates
Math 133A Differential Equations	Solution of first order differential equations with application to falling body, terminal velocity; Solution to linear second order differential equations - homogeneous and non-homogeneous equations with applications to vibration of mass-spring systems; Laplace transforms; Series solutions of differential equations-Taylor series method, power series, analytic functions

Mathematics indeed will be the principal TOOL that we will be using in this course.
But NOT this types of math that confuse everybody:!

We will use the math that you have already learned in your 4 previous math courses in the Lower Division to do the following in this course:

To <u>enhance</u> your learning of the following major sub-disciplines of mechanical engineering in:

fluid mechanics (ME 111),
heat transfer (ME 114),
rigid body dynamics (ME 101), and
machine design (CE 112, ME 147, 154, ME 157, 160, 165) **with <u>Analytic models</u> for the engineering processes and systems for these sub-disciplines.**

Problems in these sub-disciplines will be the problems that you will be dealing with after you "walk-out" from this university and join the work force to be a valuable and versatile <u>MECHANICAL ENGINEEERS</u>!!

Course Description

To pick up the right math and solve the math for your problems is NOT enough, you will also need to develop the knowledge and skill to get the: Practical interpretations of analytical and approximate solutions for steady and non-steady state mechanical engineering.

In addition to the course syllabi that you learned from your Lower Division math courses (as in the Table in slide 3 shows), we will also need to learn the linear algebra and statistics and their applications in quality assurance in mass productions- to make you a more contemporary mechanical engineer.

SO, THIS IS AN ENGINEERING COURSE –
NOT ANOTHER MATH COURSE

A side note: I Am aware of one criticism by my class in the 2017 SOTE report:
"*I spent too much time in presenting "**principles**" than I should have in offering more "**examples**" in the class*."

While I share this feeling by the student(s) who offered this criticism, and I wish we had enough time to do both, my reason for spending more time on principles over examples was solely because I want to educate you to be **ENGINEERS** but not TECHNICIANS.

Textbook: **1)** Bonded printed lecture notes on "**Applied Engineering Analysis**," by Tai-Ran Hsu, San Jose State University, Spring 2018 (printed and sold at the Spartan Book Store)

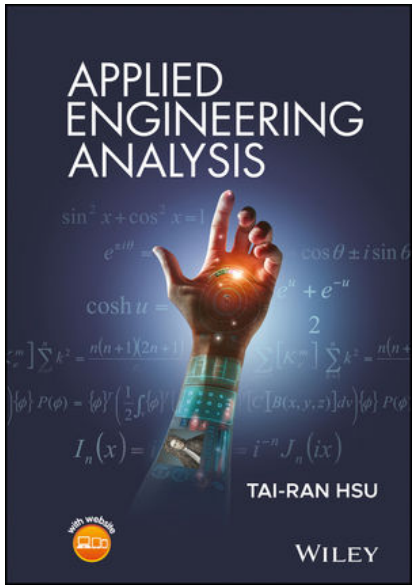
2) Slides for class instructions (copies available in instructor's SJSU web page)

References: 1) "Applied Engineering Analysis" by Tai-Ran Hsu, John Wiley & Sons, Feb 2018 (ISBN 978-1-119-07119-8). Prices: $104.99 (e-version), $130 hardcover. (see the cover picture below)

2) Avallone, Eugene A., Theodore Baumeister III and Alvan Sandegh, "Marks' Standard Handbook for Mechanical Engineers," 11th edition or newer, McGraw-Hill, 2006, ISBN 0071428674

3) CRC Standard Mathematical Tables, CRC Press, Inc., or similar mathematical and mechanical engineering handbooks.

My latest book publication
By John Wiley & Sons:



Intended for both
ME 130 and ME 230

Grading Scheme:

Homework: **25%** (account for the **Best** of 5 from 6 assigned sets)

Mid-term exam*: **30%** (Thursday, November 8, 2018)*

Final examination: **45%** (Thursday, December 13, 2018, 07:15-9:30 AM Room E341)

Bonus quizzes: **6%** on TWO (2) take-home assignments on specific topics (may include building class demonstration units) by teams of 2 or 3 students on VOLUNTARY BASIS (marks will be based on satisfaction to the specific requirements of the assignments).

(see examples below)

* This date for the mid-term exam will be finalized on August 31, 2018 by the class - the last class date before voluntary withdrawal of this course.

- Answers (but not solutions) to homework problems are posted in the instructor's webpage.

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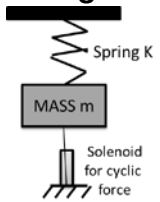
4 Examples of Bonus quizzes related to engineering analysis:

1) on "**Gas Pipeline burst in San Bruno, CA in September 2010?"**

2) Crash of a DC 10 jumbo jet passenger plane over the Chicago O'Hare airport on May 25th, 1979 as shown in the picture:

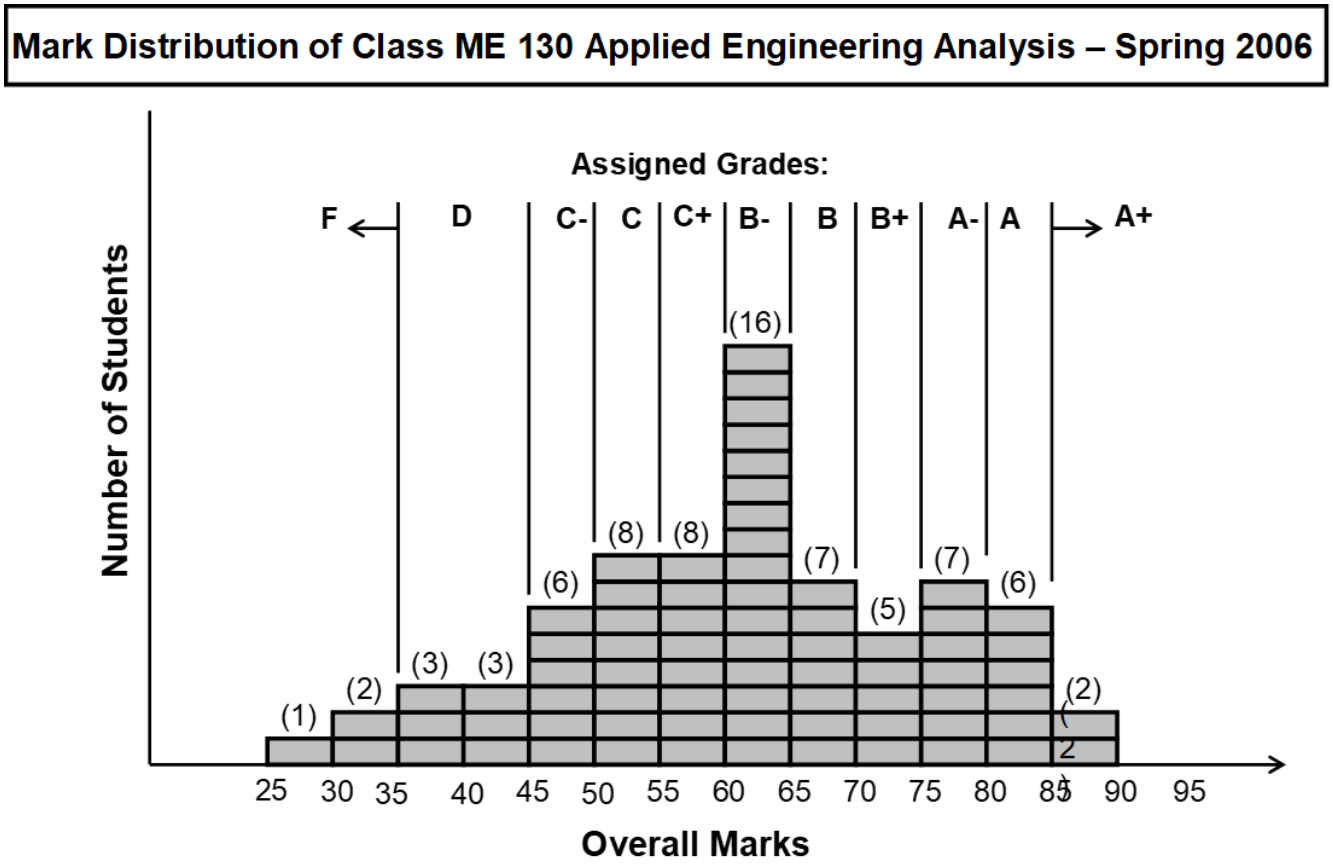
3) Experiment with the cooling of a small solid of known surface area (A) at an initial temperature (T_0) to the desired lower temperature T in a cooling chamber at T_f.

4) Design and construct an experimental set-up for class demonstrations of resonant and near-resonant vibration of a solid mass supported by an elastic spring,



GRADING SYSTEM

Letter grades will be assigned based on **overall class performance**, with Grade C+ or B- to be the median of the overall mark distribution of the class.



Important NOTE to the class:

(1) There will be **NO** make-up mid-term and final examinations, except for students with serious medical reasons. A medical doctor's certificate is required to support such request. Request for make-up exams under this circumstance must be sent to the Instructor for approval within three days after the event.
REASON for this stipulation is to be **fair** to the rest of the class.

(2) **In all open-book exams,** only **calculators, reference books** and **bonded printed notes** are allowed but **NOT** notebook computers and any wireless phones or device.

(3) ***Late submission of homework past the due dates and time will not be accepted***. *This stipulation is necessary in order to be **fair** to the rest of the class, which respects and abides by the assigned deadlines for submission.*
Students are encouraged to use on-line solution methods in their home works. However, they must indicate the precise website address from which they obtained these solution methods. The Grader will not give credits for homework solutions without such disclosures.

(4) Students are encouraged to ask questions at all times in the classroom and during the assigned office hours.

It will be your responsibility to let the Instructor know if he did not answer your questions to your satisfaction.

(5) In preparing for future professional practices, students are expected to be ***concise*** **in answers to problems in home works and examinations**.

- **Some** partial marks will be given to the examinations ***based on Examiner's judgment on student's comprehensions of the problems in the exams with incorrect answers***

- In the spirit **of fairness**, the instructor will do his best in imposing **uniform** criteria in assigning partial marks to quizzes and exams with incorrect answers.

Please refrain yourself from arguing for more generous allowance on the marks from the instructor for incorrect answers to problems in exams.

(6) Class instructions will be handled exclusively by slide projections. Copies of the slides are posted in the instructor's webpage

(7) Materials for quizzes and exams will include: (a) printed lecture notes (b) slide projections in class teaching, and (c) verbal presentations by the instructor.

Academic Integrity – with Absolute ZERO TOLERANCE

Students are expected to have read the University Policy, which is available at:
http://www2.sjsu.edu/senate/S04-12.pdf

Course Goals

- To learn the relationships between engineering (the “master”) and mathematics (the “servant”) and how they work together in solving engineering problems
- To learn how to derive mathematical (analytical) models for the solution of engineering problems
- To learn how to formulate mathematical models, e.g. calculus and differential equations for mechanical engineering problems involving various sub-disciplines
- To learn how to interpret mathematical solutions into engineering terms and senses

Student Learning Objectives

- To fully understand the physical (engineering) interpretations of fundamentals of mathematical terms such as variables, functions, differentiation and derivatives, integration, differential equations

- To acquire experience and skill in basic methodologies in differentiation, integration and solving ordinary and partial linear differential equations

- To be able to relate special tools such as Laplace transform and Fourier series for modeling engineering phenomena and facilitate the mathematical solutions

- To be able to establish mathematical models, such as differential equations and appropriate boundary and initial conditions for fundamental mechanical engineering problems in fluid mechanics, vibration and heat conduction of solids and find ways to solve these equations

- To be proficient in finding solutions of integrals and related information from "**tools**" such as mathematical handbooks, spreadsheets and computer software such as Mathcad and Matlab

- To learn the basic principles of linear algebra and statistics and their applications in engineering design analysis and productions

Instruction Schedule

Focus: Math and physics (engineering):

Week 1: Chapter 1: The basic principles of engineering analysis and its applications
Week 2: Chapter 2: The principles and terms in mathematical modeling

Focus: Application of 1st order DEs in fluid dynamics and heat transfer:

Week 3: Chapter 3: Derivation and solutions of first order ordinary differential equations
Week 4: Chapter 3: Application of first order ordinary differential equations in fluid mechanics, heat conduction in solids and kinematics of rigid body

Focus: Application of 2nd order DEs in mechanical vibration analyses:

Week 5: Chapter 4: Solution of homogeneous, second-order linear differential equations
Week 6, 7: Chapter 4: Application of ordinary differential equations in mechanical vibration

Focus: Useful tools for engineering analysis:

Week 7, 8: Chapter 5: Laplace transform and its physical meaning, and applications
Week 9: Chapter 6: Fourier series and its engineering applications
Week 10: Chapter 7: Introduction to partial differential equations
Week 11: Chapter 8: Linear algebra and its application in engineering analysis
Week 12: Chapter 9: Introduction to finite difference method

Focus: Application of statistics in quality control in mass productions:

Week 13-15: Chapter 10: Introduction to statistics and applications to manufacturing process and quality control

NOTE: The above schedule may be modified as needed

"It is my passion to educate you the best I can,
but it is your responsibility to try hard to learn from me"

If you:

- Attend all classes, and **listen attentively** to what the Instructor says in the lectures,
- Do not hesitate to ask questions in the classes, or after the classes. and never pretend that you understand what is being said in the lectures but the matter of fact is that you did not.
- Do all homework problems if possible, and understand how they are done
- Make sure to let the Instructor know your problems in learning the various subjects of this class whenever they occur
- Make use of Instructor's office hours for questions and advice
- Form a **study group** with 2 or 3 favored fellow students in the same class to work on: exchange class notes, doing home works, review returned and exam papers, and exchange speculations on possible exam problems.
- Above all; take a proactive attitude of ENJOYING what you are learning from this course

♦ **You will do well and be successful if you do all the above!**