MAE-118: Introduction to Energy & Environment, Winter 2016

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<u>TA Session</u>: TBD

<u>Reader:</u> TBD

TEXT: R. A. Ristinen, J. J. Kraushaar, "Energy and Environment" (2nd Edition Wiley.; ISBN: 978-0-471-73989-0) and additional material (e.g. R. D. Dunlap, "Sustainable Energy", Cengage Learning, ISBN: 978-1-133-10868-9; etc.)

COURSE FORMAT: MAE-118 covers fundamentals of present-day primary energy sources and availability, overview of renewable energy sources and technologies, introduction to nuclear energy, air pollution and control, introduction to climate change.

HOMEWORK ASSIGNMENT: See class website (<u>no grading</u>).

EXAMINATION: Three closed-book, no-notes mid term exams (on Jan. 26, Feb. 13, and March 8) and closed-book, no-notes comprehensive final examination (March. 17). All exams are based on the homework assignments.

GRADING POLICY: mid term exams 3x20%, and final exam 40%.

ACADEMIC POLICY: Students are encouraged to discuss course topics and homework problems with each other. However each student **must submit his or her own work** on exams. Refer to Student Link website: UCSD Policy on Integrity of Scholarship.

LECTURE SCHEDULE (<u>subject to change</u>) CENTR 109, Tu. Th., 11 am-12.20 pm

Week	Topic (subject to change)	Homework assignment
1	Math, Ch.1, Ch.2	Website + Q/P: 1. 7, 1.11, 1.12; MCQ: 1.2, 1.3, 1.4, 1.11, 1.12
2	Ch.2, Ch. 3	Q/P: 2.7, 2.11, 2.12; MCQ: 2.1, 2.2, 2.4, 2.6, 2.13, 2.14, 2.17, 2.18
3	Ch. 3, Ch. 4	Q/P: 3.2, 3.4, 3.5, 3.10, 3.14; MCQ: 3.3, 3.6, 3.9, 3.10, 3.20
4	1st mid term, Ch. 4	Q/P: 4.2, 4.8, 4.9, 4.10; MCQ: 4.3, 4.6, 4.7, 4.13
5	Ch. 5	Q/P: 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.9, 5.11, 5.12
6	Ch. 6	Q/P: 6.1, 6.2, 6.3, 6.4, 6.9, 6.13, 6.14, 6.15, 6.16
7	2nd mid term, Ch. 7	Q/P: 7.1, 7.3, 7.5, 7.6, 7.8, 7.10, 7.14, 7.17
8	Ch. 8	Q/P: 8.2, 8.5, 8.7, 8.8; MCQ: 8.1, 8.2, 8.3, 8.4, 8.5, 8.9
9	Ch. 9	Q/P: 9.1, 9.5, 9.6, 9.7, 9.9, 9.12; MCQ: 9.2, 9.5, 9.12, 9.14
10	3rd mid term, Ch. 10	Q/P: 10.1, 10.2, 10.4; MCQ: 10.1, 10.3, 10.4, 10.5

Math

I. First order ordinary differential equation (require one boundary condition)

$$\frac{dy}{dx} = \frac{f(x)}{\varphi(y)}, \text{ with boundary condition } y(x_0) = y_0.$$

Solution $\varphi(y)dy = f(x)dx \Rightarrow \int_{y_0}^{y(x)} \varphi(y')dy' = \int_{x_0}^{x} f(x')dx'$

II. Second order ordinary differential equations (require two boundary conditions)

$$\frac{d^2f(x)}{dx^2} = a^2f(x) \quad \text{and} \quad \frac{d^2f(x)}{dx^2} = -a^2f(x) \quad \text{(where a is a constant) have the solutions:}$$

$$\frac{d^2f(x)}{dx^2} = a^2f(x) \Rightarrow f(x) = C_1 e^{ax} + C_2 e^{-ax},$$

$$\frac{d^2f(x)}{dx^2} = -a^2f(x) \Rightarrow f(x) = C_1 \sin(ax) + C_2 \cos(ax),$$

where C_1 and C_2 are the constants which suppose to be found from boundary conditions at $f(x = x_1) = f_1$ and $f(x = x_2) = f_2$

Problems:

M1) Find the solution, $y(x)$, of the equation $dy/dx = y^2 x$, which satisfies the boundary condition

$$y(x = 1) = 1$$

M2) Find the solution, $y(x)$, of the equation $d^2y/dx^2 = H$ (where H is the constant), which satisfies the boundary conditions $y(x = L/2) = y(x = -L/2) = 0$

M3) Find the solution, $y(x)$, of the equation $d^2y/dx^2 = -y/\alpha^2$ (where α is the constant), which satisfies the boundary conditions $y(x = \pi\alpha/2) = y(x = -\pi\alpha/2) = 0$ and $y(0) = 1$