8.02 Document #1

8.02 ELECTRICITY & MAGNETISM
SYLLABUS
SPRING 2001

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SYLLABUS

Assignment 1:

Reading: Charge and Matter, Ch 27; Electric Field, Ch 28
Special Mathematics Supplement, pp. 1-18, up to Triple integrals
(**Do problems A1,2 and B1,2,3,5**)
Recitations WILL be held on Tuesday Feb. 6

Lectures			***Recitations****
1A:	Wed 2/7	Static electricity Charging and induction Coulomb's law *Preview* Section 27-4**	Tu: Discuss Math Suppl. W/Th: Discuss Asmt 1
1B	Fri 2/9	Electric fields Field lines Charge distributions Forces on charges *Preview*: 28-(1-3)	

* The plan for the use of the Recitation is given here. The student is expected to arrive prepared. Preparation for the discussion sessions consists of a preview of the material, e.g. perusing the text and doing part (a) of each problem. Preparation for the quizzes should consist of having done the homework problems. The homework will not be collected or graded; the recitation quizzes will suffice for our evaluation of your understanding.

**Lecture preview consists of reading the text section indicated before lecture. Doing this will greatly increase the utility of the lecture for you. See notes under Organization below for more on the Assignments, Recitation Quizzes, etc.

Assignment 2:

Reading: Gauss's Law, Ch. 29-(Sections 1-6) (Charges beget **E** fields!)
Electric Potential. Ch. 30-(1-6)

Lectures:			*Recitations:*
2A	Mon 2/12	Flux Gauss's Law Metals *Preview:* 29-(2-3)	M/Tu: Quiz. on Asmt 1
2B	Wed 2/14	Applications of Gauss's law Electric potential defined *Preview:*30-(1-3)	W/Th: Discuss Asmt 2
2C	Fri 2/16	Electric potential, cont. Various charge configurations Electric dipole *Preview:* 30-(4-6)	

Mon 2/19 HOLIDAY - *Monday classes meet on Tuesday; Tues. sections get a holiday (sort of)*

Assignment 3:

Reading: Electric Potential, Ch. 30-(7-11); Capacitors, Ch. 31-(1-4)

Lectures:			*Recitations:*
3A	**Tue 2/20!**	Potential Energy **E** = – **grad** *V* Metals Electrostatic Accelerators *Preview:* 30-(7-9)	Tu: Gauss's law exercises Discuss Assmt 3
3B	Weds 2/21	High voltage breakdown Capacitance Fields and charges Stored energy Parallel and series capacitors *Preview:* 30-(1-2)	W/Th Quiz Assmt 2. Discuss Asmt 3

Assignment 4

Reading: Capacitors and dielectrics, Ch. 31-(5-7)
This assignment is intended to be cultural enrichment; you will not be tested on it.

Lectures:		
4A	Fri 2/23	Dielectrics and Capacitors Charge and Polarization Atomic view Polarization and displacement vectors Gauss's law modified *Preview:* 31-(5-6)

Assignment 5:

Reading: Current and Resistance, Ch. 32-(1-6); [Optional: 32-(7-8)]
EMF and Circuits, Ch. 33; Magnetic Fields, Ch. 34-1, 2, 3

Lectures:			*Recitations:*
5A	Mon 2/26	Conductors Ohm's Law Energy losses *Preview:* 32-(1-3)	M/Tu: Quiz Assmt. 3
	Weds 2/28	Review Test #1	W/Th: Review for Test
	Fri 3/2	**TEST #1**: ***Covers Assmts 1, 2 and 3.***	
5B	Mon 3/5	Electromotive Force (EMF) Batteries Circuits: examples *Preview:* 33-(1-2)	M/Tu: Discuss Asmt 5
5C	Wed 3/7	Magnetic fields Magnetic field vector, **B** Force on a moving charge Particle accelerators *Preview:* 34-(1-2)	W/Th: Quiz on Asmt 5 (Approx. concurrent w. last lecture covering assmt.)

<u>Assignment 6:</u>

Reading: Magnetic Field, Ch. 34-(4-7)
Ampere's Law, Ch. 35-(1-6)
(Currents beget magnetic fields!)

Lectures:			*Recitations:*
6A	Fri 3/9	Magnetic force on a current Torque on a current loop Electrical measurement instruments *Preview:* 34-5	
6B	Mon 3/12	Ampere's law Symmetry requirements Solenoids *Preview:* 35-(5-6)	M/Tu: Discuss Asmt 6
6C	Wed 3/14	Applications of Ampere's law Biot-Savart law *Preview:* 35-(1-2)	W/Th: Quiz on Asmt 6 (Approx. concurrent w. last lecture covering assignmt.)

<u>Assignment 7:</u>

Reading: Faraday's Law of Induction, Ch. 36-(1-4)
(Changing magnetic flux begets currents!)

Lectures:			*Recitations:*
7A	Fri 3/16	Currents induced by a magnet Moving coils Faraday's law of induction Lenz's Law *Preview:* 36-1,2	
	Mon 3/19	REVIEW for Test	M/Tu: Review for Test
	Wed 3/21	**TEST 2**. ***Covers Assmts 1-6 with emphasis on 3–6***.	W/Th: Discuss Asmt 7
	Fri 3/23	*Special Lecture: Studies of Neutron Stars & Black Holes from Space*	

SPRING VACATION: ENJOY IT; YOU DESERVE IT!

<u>Assignment 8:</u>

Reading: Faraday's law, cont., Ch. 36-(5-6); 36-7 optional; Inductance, Ch. 38-(1-4)
(We do Ch. 37 next week.)

Lectures:			*Recitations:*
8A	Mon 4/2	Faraday's Law (more) Changing magnetic fields The Betatron Relative motion *Preview:* 36-5	M/Tu: Quiz on Asmt 7
8B	Wed 4/4	Inductance LR circuits *Preview:* 38-(1-2)	W/Th: Discuss Asmt 8
8C	Fri 4/6	Magnetic energy density Mutual Inductance *Preview:* 38-4	

<u>Assignment 9:</u>

Reading: Magnetic Properties of Matter, Ch. 37-(1-4); [Optional: 37-5]
Electromagnetic Oscillations, Ch. 38-(5-7) up to "Forced Oscillations" p. 834

Lectures:			*Recitations:*
9A	Mon 4/9	Magnetic poles/dipoles Gauss's Law for magnetism Four kinds of magnetism *Preview:* 37-1	M/Tu: Quiz on Asmt 8
9B	Wed 4/11	Three magnetic vectors: **B**, **M**, **H** Boundary conditions (not in text) *Preview:* 37-3	W/Th: Discuss Asmt 9
9C	Fri 4/13	Free (LC) oscillations RCL circuit *Preview:* 38-(5-6)	

<u>Assignment 10:</u> *Assignment #10 consists of review problems for Ch. 35 - 38; it is optional.*

Mon/Tu 4/16-17 -*HOLIDAY*

<u>Assignment 11A:</u>

Reading: Alternating Currents, Ch. 38-7; Ch. 39-(1-4); [Optional: 39-5]

Lectures:			*Recitations:*
11A	Weds 4/18	Alternating currents Driven RCL Circuit Power in RCL Circuits *Preview:* 39-(1-2)	W/Th: Quiz on Asmt 9 Discuss Ch. 11A
11B	Fri 4/20	Alternating currents Resonance Rectifiers *Preview:* 38-7, 39-3	

<u>Assignment 11B:</u>

Reading: Maxwell's Equations, Ch. 40-(1-2) (Changing **E** field begets **B** field!)

			Recitations:
11C	Mon 4/23	Induced Magnetic fields Displacement current *Preview:* 40-2	M/Tu: Quiz on Asmt 11A
	Weds 4/25	REVIEW for Test	W/Th: Review for test
	Fri 4/27	**TEST #3**. ***Covers entire course through Ch. 39 with emphasis upon Chapters 36-39. Less emphasis on Ch. 37.***	

<u>Assignment 12:</u>

Reading: Maxwell's Equations, Ch. 40-3; [Optional: 40-4] (Pulling it all together)
Electromagnetic Waves, Ch. 41. (41-5 *is* required)

Lectures:			*Recitations:*
12A	Mon 4/30	MAXWELL'S FOUR EQUATIONS - WE DID IT! *Preview:* 40-3	M/Tu: Quiz on Asmt 11B
12B	Wed 5/2	EM waves consistent with Max. Eqs. Coax transmission line (not in text) *Preview:* 41-3	W/Th: Discuss Asmt 12
12C	Fri 5/4	Energy and Momentum of Light *Preview*: 41-(4-5)	

<u>Assignment 13:</u>

Reading: Differential versions of Maxwell's equations; in *Notes Assignment 13*
Wave equation; in *Notes Assignment 13*
Full use of M.E. to obtain EM waves; in *Notes Assignment 13*
Nature of Light, Ch. 42 (optional reading)

Lectures:			*Recitations:*
13A	Mon 5/7	Advanced Maxwell's equations Differential form Wave Equation *Preview:* Notes pp. 13-2,3,4	M/Tu: Quiz on Asmt 12
13B	Wed 5/9	Radiation by Accel. Charge Moving sources; special relativity *Preview:* None	W/Th: Discuss Asmt. 13 (Do problems 13-1,2,3)
13C	Fri 5/11	Full Use of Maxwell's Equations to obtain the wave properties. *Preview*: Notes pp. 13-7 to 13-11	

<u>Final Week:</u>

	Mon 5/14	REVIEW for Final Exam pt. 1	M/Tu: Discuss Asmt 13 Begin review for final exam.
	Wed 5/16	REVIEW for Final Exam pt. 2	W/Th: Review

THE FINAL EXAM *will be a 2 hour exam (with 3 hours allowed). There will probably be six problems of which 3 or 4 will cover the material of Chapters 27-39. The others will be based on Chapters 40-41 and the Notes of Assignment 13.*