6.014 – Electrodynamics – Spring 2002

Wireless Communications 4/29/02

#	Date	Topic		
1	2/5	Conservation of energy, power, $G(\theta,\phi)$, A_e, R_r, V_{Th}; r.f. links	L1	New
2	2/6	RF link examples, square-law detectors, $E=hf$, optical examples	R1	New
3	2/7	Maxwell Eq.(t), E, H, uniform plane wave	L2	1.1-3
4	2/8	Complex #'s, phasors, complex Max. Eq., **E, H**	R2	1.4, Appdx A,B
5	2/12	Uniform plane wave, polarization; DEMO: slinky	L3	1.4-5
6	2/13	Poynting Theorem derivation (time, frequency), UPW example	R3	1.6
7	2/14	Radiation by charges ρ, current **J**: static, dynamic; DEMO video	L4	2.1-2
8	2/15	Radiation by current elements, near & far fields, patterns	R4	2.3, 9.2<414
	2/19	MONDAY SCHEDULE – NO 6.014		
9	2/20	Radiation by arrays, slits (r.f. and optical)	R5	2.4, 9.4<p425
10	2/21	Electromagnetic fields in media, uniaxial media, QWP; DEMO stressed media	L5	3.1-3
11	2/22	Plasmas, lossy media, skin depth. Derive v_p, v_g for 2 sines	R6	3.4-6<103
12	2/26	Examples: multipath, arrays, frequency reuse, satellites; DEMO array video	L6	New, Exmpl 9.4.1-2
13	2/27	Integral Max. Eq., boundary conditions, $\sigma = \infty$, VSWR	R7	4.1-2<131
14	2/28	**k•r**, phase match, NUPW, Snell's law; DEMO laser/prism	L7	4.3<151
15	3/1	Examples, wireless communications	R8	New
16	3/5	TE at planar boundary, TM by duality, Brewster's angle; DEMO Brewster's angle	L8	4.3
17	3/6	Lenses, apertures, diffraction	R9	9.8?474-5
18	3/7	Receiving antennas: V_{Th} induced in dipoles and loops; $d<<\lambda/2\pi$, Mirror images	L9	9.4 p430-6, 9.5
19	3/8	Link examples: communications, radar	R10	9.4 p430-6(9.7)9.8

Circuits

#	Date	Topic		
20	3/12	Kirchoff's current, voltage laws, electroquasistatics, relaxation	L10	3.4<88;95-6,New
21	3/13	Poisson, superposition; examples, resistors R, capacitors C	R11	4.2R<9
22	3/14	Inductors: solenoidal, toroidal, L, R, Q; DEMO 8.2.1	L11	New
23	3/15	QUIZ REVIEW		Up through 3/8
	3/19	QUIZ 1 (Covers through 3/8)		
24	3/20	Transformers: air, iron, imperfect coupling, B-H curves, memory; DEMO 1.6.1, 9.4.1?	R12	New,1.2R,3.2R

Limits to Computation Speed

#	Date	Topic		
25	3/21	Device and line delays; TEM parallel-plate line, telegraphers' eqn.; DEMO fluorescent	L12	5.1-2
26	3/22	TEM transients, graphical solution	R13	5.5, 6.5<267
27	4/2	Transients: Thevenin equivalent; L, C, diode loads; DEMO MacTEM	L13	6.5, 267-273
28	4/3	Transients: initial conditions, analytic expressions, examples	R14	6.5>273

Microwave Communications and Radar

#	Date	Topic		
29	4/4	Applications, systems, circuits, communications, sensing, radar	L14	New
30	4/5	Examples for computers, transients, etc.	R15	6.5
31	4/9	Generalized TEM line, $\underline{Z}(z)$	L15	6.1
32	4/10	Gamma plane, Smith chart, VSWR	R16	6.3<243
33	4/11	Smith chart, $Y_n(z)$, $\lambda/4$ transformer, stub tuner; DEMO MacTEM	L16	6.3>243
34	4/12	RLC resonators, series, parallel, $\Delta\omega$, α, Q_L, Q_I, Q_E, coupling	R17	8.4
	4/16	PATRIOTS' DAY VACATION		
35	4/17	TEM resonators, $w_e(t)$, $w_m(t)$, Q, $\Delta\omega$, examples	R18	8.5
36	4/18	TE, TM parallel plate waveguide, k_x, k_y, **E, H**, λ_g	L17	7.1
37	4/19	QUIZ REVIEW		Through 4/12
	4/23	QUIZ 2 (Covers through 4/12)		
38	4/24	TE_{10} waveguide mode, system examples	R19	New

Optical Communications

#	Date	Topic		
39	4/25	Fiber optics, applications, dielectric slab waveguide DEMO μW fiber DROP DATE	L18	7.2
40	4/26	Optical devices, systems, applications	R20	New
41	4/30	Optical devices, systems, applications	L19	New
42	5/1	Optical amplifiers, lasers, quantum systems	R21	New

MEMS

#	Date	Topic		
43	5/2	Examples, Lorentz forces on e-beams, C plates, force from $\partial w/\partial z$; generators	L20	New
44	5/3	Examples: force via system energy derivatives, electric-field motors, generators	R22	L20 notes

Forces, Power Generation and Transmission

#	Date	Topic		
45	5/7	Magnetic forces: electron optics, motors and generators, Hall effect	L21	New
46	5/8	Review, electric and magnetic forces, motors and generators	R23	L20, 21 notes
47	5/9	Reluctance motors, permanent magnets, wave forces	L22	New
48	5/10	Examples, forces, solenoids	R24	L22 notes
49	5/14	Power transmission lines and systems	L23	New
50	5/15	Review of 6.014, emphasizing material after Quiz 2		
51	5/16	Course Philosophy, Acoustics; DEMO He resonator and keys	L24	New (10)