

Guide to A. P. French, “Vibrations and Waves” Sept 16, 2011 Ph2a – Prof. Martin

Week	Lecture	French (missing sections may be skipped)
1	1 Harmonic oscillators, differential equations	CH. 1 – PERIODIC MOTIONS -- ALL CH. 3 – FREE VIBRATIONS OF PHYSICAL SYSTEMS The Basic Mass-Spring Problem <ul style="list-style-type: none"> • Solving SHO using complex exp. * Elasticity & Young’s Modulus * Floating objects * Pendulums * Water in a U-tube * Torsional oscillations * The Spring of Air
	2 Coupled Oscillators	CH. 5 -- COUPLED OSCILLATORS AND NORMAL MODES <ul style="list-style-type: none"> • Two coupled pendulums • Symmetry considerations Superposition of normal modes <ul style="list-style-type: none"> * Other examples of CO ¶ Normal frequencies: general approach
2	3 Normal Modes	CH. 5 -- COUPLED OSCILLATORS AND NORMAL MODES <ul style="list-style-type: none"> ¶ Normal frequencies: general approach Many coupled oscillators <ul style="list-style-type: none"> ¶ N coupled oscillators ¶,§ Finding normal modes for N coupled osc. Properties of normal modes, N coupled osc. <ul style="list-style-type: none"> * Longitudinal oscillations N very large
	4 Wave equation	CH. 6 – NORMAL MODES OF CONTINUOUS SYSTEMS, FOURIER ANALYSIS <ul style="list-style-type: none"> • Free vibrations of stretched string Superposition of modes on a string <ul style="list-style-type: none"> * Longitudinal vibrations of a rod * Vibrations of air columns * Elasticity of a gas A complete spectrum of normal modes Normal modes of a 2D system
3	5 Fourier Series	CH. 6 – NORMAL MODES OF CONTINUOUS SYSTEMS, FOURIER ANALYSIS <ul style="list-style-type: none"> • Fourier Analysis • Fourier Analysis in action Normal models and orthogonal functions
	6 Travelling Waves	CH. 7 -- PROGRESSIVE WAVES What is a wave <ul style="list-style-type: none"> • Normal modes and travelling waves • Progressive waves in one direction Waves in specific media <ul style="list-style-type: none"> • Superposition * Wave pulses Motion of wave pulses of constant shape Superposition of wave pulses

4	7 Dispersion	CH. 7 -- PROGRESSIVE WAVES • Dispersion, phase and group velocity § Energy in a mechanical wave Transport of energy by a wave § Momentum flow & mechanical radiation press.
	8 Reflection & Transmission	CH. 8 -- BOUNDARY EFFECTS AND INTERFERENCE • Reflection of wave pulses • Impedences: non-reflecting terminations Longitudinal vs. transverse waves Waves in 2D • Huygens-Fresnel principle Reflection and refraction of plane waves Doppler effect
5	9 Diffraction & Interference	CH. 8 -- BOUNDARY EFFECTS AND INTERFERENCE • Double-slit interference • ¶, § Multiple slit interference • ¶ Diffraction patterns by a single slit Interference patterns of real slit systems

Notes:

• Key discussion of basic principles.

* Useful or interesting application that we may not get to in lecture, but could appear in homework and/or quizzes.

¶ French uses one approach, we use a different (simpler?) approach in Lecture. It may be useful to see how it is done by French, but not absolutely required.

§ Useful principle we may not have time to review in lecture.

No symbol: interesting section that is worth reading, may be useful.

Missing section: not required reading, but may be interesting if you have time.