	TENTATIVE SCHEDULE FOR PHYSICS 798C, SPRING 2024, Prof. Anlage							
Date	**Mtg.#**	**Tinkham**	**Annett**	**Waldram**	**Orlando+Delin**	**Ketterson+Song**	**Topics**	**HW Due Dates**
Week 1							Review of solid state physics	
25-Jan	1	1.1-1.9	3.1-3.6	1.1-1.6, 3.1, 3.4	1.1-1.4	1, 4	Introduction to the course, 3 Hallmarks of SC, phenomenology, thermodynamics	
Week 2								
30-Jan	2	1.2, 2.1, 2.2	3.8	2.1-2.6	2.4-2.6, 3.1-3.2	2	London's Eqs., penetration depth, screening of a magnetic field	
1-Feb	3	1.3, 2.5		2.1, 2.2, 10.12	3.4-3.5, 4.1-4.2	3	SC electrodynamics, Two-fluid model, complex conductivity, SRF and QC microwave cavities	
Week 3								
6-Feb	4	1.7		2.6-2.7	5.1-5.5	7	Macroscopic Quantum Model of SC, fluxoid quantization	
8-Feb	5	1.4, 3.1, 3.2	6.3	7.1-7.3		25	Cooper pairing instability	**1**
Week 4								
13-Feb	6	3.2, 3.3, 3.4	6.1-6.2	7.2, 7.10, 16.11-16.13	10.4	31	Origin of the attractive interaction, dynamic screening	
15-Feb	7	3.3	5.1-5.4	Appendix		26	Isotope effect, Coulomb repulsion, BCS Theory I, creation/annihilation operators	**2**
Week 5								
20-Feb	8	3.3, 3.4	5.7, 6.4	7.3-7.5			BCS Theory II, Coherent States, Ground State WF, BCS Pairing Hamiltonian	
22-Feb	9	3.4, 3.5	6.5	7.6-7.7		27	BCS Theory III, variational calculation, self-consistent gap equation, excitations	**3**
Week 6								
27-Feb	10	3.6	6.6	7.8		28	BCS Theory IV, condensation energy, finite temperature	
29-Feb	11	3.6		7.9, 8.1	10.5	28	BCS Theory V, gap function, Tc, thermodynamic properties	**4**
Week 7: Also APS March Meeting								
5-Mar	12	3.7	6.7	8.2-8.7		50	BCS Theory VI, Treatment of perturbations, coherence effects	
7-Mar	13	3.8; 10.1		8.8-8.10; 10.1 - 10.8		29; 36, 45	Tunneling; Inhomogeneous SCs - The Bogoliubov-de Gennes Equations	**5**
Week 8								
12-Mar	14	4.1	4.1-4.4	4.1-4.2	10.1-10.2	9, 45	Ginzburg-Landau (GL) Theory, free energy expansion	
14-Mar	15	4.2	4.5-4.7	4.3-4.6	10.3	12	GL differential equation, boundary conditions, coherence length	
17-24 March		**SPRING BREAK**						
Week 9								
26-Mar	16	4.3, 4.4, 11.6		4.7, 4.9	6.1	6	GL: Domain wall energies, Type I, II SCs, critical current, SC nanowires, kinetic inductance, single photon detectors	
28-Mar	17	4.8, 4.11	4.8-4.9	4.10, 5.5-5.6	6.5	10, 14	GL: H_c2 and Abrikosov vortices	**6**
Week 10								
2-Apr	18	5.1			6.2-6.3	7, 8	GL: H_c1 and structure of an isolated vortex	
4-Apr	19	5.2, 5.4	4.11	5.7-5.11	7.1-7.5	20	GL: Vortex energy, theory of vortex interactions, flux flow resistivity, pinning	**7**
Week 11								
9-Apr	20	5.2, 5.4	4.11	5.7-5.11		20	Forces on vortices, vortex pinning, Gittleman-Rosenblum model of vortex dynamics	
11-Apr	21	6.1, 6.2, 6.4	5.8	6.1-6.8, 8.8-8.10	8.1-8.2; 8.5-8.6	15, 30	The Josephson Effect, gauge-invariant phase, current-phase relationship, Josephson vortices	**8**
Week 12								
16-Apr	22	6.3		6.1-6.3	9.1-9.4	15	Josephson effect, magnetic diffraction, the RSJ model	
18-Apr	23	6.5	5.9	18.3-18.7	8.4, 9.5		JJ: Tilted washboard potential, I-V relation for JJs	**9**
Week 13								
23-Apr	24	6.5	5.9	18.3-18.7	8.4, 9.5		Shapiro steps, RF SQUID, DC SQUID, SC QuBits	
25-Apr	25	.1, 8.3, 8.4, 8.6, 8.	4. 10	15.9-15.12		21, 22	Fluctuations in superconductors (GL treatment)	**10**
Week 14								
30-Apr	26	8.2		17.6			Fluctuation conductivity, TDGL, Kosterlitz-Thouless phase transition theory	
2-May	27	6.6				18	KT in 2D superconductors	**11**
Week 15								
7-May	28		7.1-7.4			53	Superfluidity in He-3 and Unconventional SCs	
9-May	29	9.1 - 9.9	7.5	16.1-16.13, 17.1-17.11		31.2	HTS Pairing, Overview of Superconductivity	