

UG Mech				
Topics	Number	Problem	Page	Comments
small oscillations	S98-1	array of springs		also F99-5
	F98-2	3 charges		
	F00-2	two bodies		
	S05-2	sliding mass w/hanging pendulum	p.5	set up matrices (typo in sol.)
torque/angular mom.	S01-2	spining and rotating hanging axel	p.3	
	S02-2	slanted coin rolling in a circle		recommended
central force	F01-1	comet going around sun		zero of energy at ∞
	S07-2	harmonic potential	p.4	
rotating ref. frame	F03-2	shooting a cannon	p.5	
	F04-1	dropping a cannon	p.2	
Lagrangian	S05-1	sliding wedge w/disk rolling down	p.2	possible sign error in sol.
	F06-2	spinning disk with extra masses	p.2	
	S07-1	Attwood machine	p.1	
Hamiltonian	F01-2	constraints		
	S06-2	Noether's Thm	p.3	
relativity collisions	F99-6	two γ rays collide		
	F04-2	$\pi^+ + n \rightarrow K^+ + \Lambda^0$	p.5	very hard
force balance	S01-1	Drum down incline		
	F07-2	Bead down incline		
Misc (energy)	S01-2	bowling ball with friction		hard, also F03-1
	S03-1	spinning mass pulled through hole	p.3	
	F06-1	ropes	p.1	also S03-2/S98-2
	S06-1	clock with pendulum	p.2	Q factor
	F98-9	rotational inertia	p.20	long problem

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central force	S98-11	$U(r) = U_0 \ln(\frac{r}{a})$		small oscil. recommended
	S05-11	$U(r) = \frac{k}{r} + \frac{C}{2r^2}$	p.29	
	F06-11	given a force, find ω	p.17	
Euler eqns	S98-12	ellipsoid		awesome
	F98-11	astroid hits earth	p.28	
system of springs	S99-13	three springs two masses		very hard
	F99-11	infinite 2D array		
	F03-12	infinite 1D alternating k	p.16	
	F04-11	two springs two masses	p.28	
Lagrangian	F00-11	mass falls off sphere	p. 24	use lagrange mult. action angle small oscil. write hamil. "a must" small oscil recommended recommended
	S01-12	particle on parametric curve	p.18	
	S02-14	bead on rotating hoop	p. 34	
	F02-13	pendulum in B field	p. 34	
	S03-11	stick falling in corner	p.17	
	F03-15	mass on periodic surface	p.19	
	F04-12	particle in B field	p.30	
	F06-17	mass at bottom of rolling hoop	p.34	
	F06-12	marble in spherical bowl	p.21	
	F05-11	falling stick	p.17	
F05-12	Lagrange multipliers	p.19		
Hamiltonian	S02-13	canonical transformation	p. 31	
	S03-12	Liouville thm.	p.18	
	S07-12	rotations in phase space	p.17	
Calc. of Var.	F98-12	geodesic on weird surface		
Waves	S05-12	bead on wire	p.32	

UG E & M				
Topics	Number	Problem	Page	Comments
Ampere's Law	S98-3	hole drilled in rod w/current	p.6	recommended
	F02-3	find mag energy	p.8	
Relativity	S98-4	magnetic flux invariant	p.8	
	S99-2	transform E and B	p.5	
Solenoid	F98-3	find inductance	p.7	
Capacitors	S99-1	cyllind. cable w/dielectric	p.6	
	F01-3	piston with charged top/bottom		
	S07-3	round plates, imperfect medium		
Image charge	F01-4	dipole above conductor, find τ	p.6	awesome
	F03-3	charged wire above conductor	p.9	recommended
	F04-4	charge near grounded sphere		
BC's	S05-4	dielectric hemisphere in E field	p.11	
	F06-3	conducting sphere in E field	p.3	
	S07-4	sphere w/weird charge density in conductor	p.8	
Stress tensor	F04-3	toriodal magnets pulled apart	p.7	recommended
	S05-3	find tension in wire of solenoid	p.9	awesome
Misc	F00-4	E&M wave find B and k	p.5 p.6 p.7	free current fun
	F02-3	magnetic sphere w/charge, find ang. mom.		
	S03-3	variable σ , find ρ		
	S03-4	insulating gap in wire		
	F03-4	lenz's law with mechanics		

Grad E& M				
Topics	Number	Problem	Page	Comments
BC's (moving)	S03-13	uncharged Cu sphere in B	p.19	(no sol?)
	S06-14	spinning charged thin shell in B	p16	recommended
BC's (time dep.)	F03-13	EM wave hits plasma	p.17	
	S05-13	Ampere's law, variable J	p.35	tricky
	F01-15	B field hits conducting magnet		recommended
	S02-16	decaying B field in conductor		recommended
BC's (static)	S98-13	charge in spherical hole of dielec.	p.35	recommended
	F98-13	metal sphere, dielec coat in E	p.32	
	S00-19	dielec. spheres in E, find radiation		rainbows
	F00-14	super cond. sphere in B		
	S01-15	magnetic sphere in B		
	F01-16	EM wave hits dielc sphere → dipole	p.34	recommended
	S02-15	hemisphere boss in parallel plate cap.		
Relativity	F02-12	B and H from perm. magnet	p.32	easy
	S05-14	transform E and B	p.37	
Radiation	F00-13	rad. pressure on moving plate		
	F06-14	stress tens., reflect EM wave at angle	p.21	
	S98-14	relativistic Larmor	p. 38	
	F02-15	non relativistic Larmor	p.41	
	S01-16	dipoles		
image	S06-13	electron hits electron or positron	p.15	
	F03-14	wire with current above super cond.	p18	recommended
displ. current	F04-13	wire with current to antenna	p.33	
waveguides	F04-14	rectangular disper. for TM and TE	p.36	
stress tensor	S99-12	super cond wire in B		
magnetic mirror	F02-16	inhomo B, conserve $\frac{mv_{\parallel}^2}{2B}$		

UG Quant				
Topics	Number	Problem	Page	Comments
Proofs	S98-5	Schrod. Eqn	p. 10	problem in sol?
	S98-6	HO(a, a^\dagger)	p.13	
	F99-3	HO(a, a^\dagger)		
TIPT	F98-5	$s=1, H' = S_1 \cdot S_2$	p.11	recommended easy recommended needs better sol coord. trans. (trick!) recommended
	F99-6	3DHO $H' = \lambda(x^2 + y^2 - 2z^2)$		
	S99-9	Hydrogen atom, $m_p \rightarrow 2m_p$	p.20	
	S01-5	HO(a, a^\dagger) $H' = Ca^3(a^\dagger)^3$	p.7	
	F01-8	$s=1/2 H = AS_1 \cdot S_2 + \Lambda \cdot (S_1 - S_2)$	p.12	
	S02-8	same as above, hyperfine and Zeeman	p.17	
	S07-5	1DHO, not (a, a^\dagger)	p.10	
	S03-6	2×2 (quantum zeno) matrix	p.8	
	F06-6	H.O.(a, a^\dagger) with $H' = \lambda x^4$	p.8	
	F03-5	3DHO in E field	p.8	
potential barrier	S99-8	step up to the right	p.16	(typo)
	S00-7	one and two delta fn. wells		
	F00-6	step up step down		
	F06-5	step down to the right		
spin	F99-4	$s=1/2$ in B	p.18 p.9 p.7	good problem (also F04-5) hard
	S02-8	$s=1$ in Stern-Gerlach		
	F03-6	$s=1/2$ in B, rotate angle θ		
	S06-5	$s=1/2$ in B given initial spinor		
Misc	S03-5	allowable photon transitions for atoms	p.7	(density of states)
	F02-8	ang. mom. ops.		
	F02-7	Fermi Golden Rule (free an electron)	p.18	
	S01-6	uncertainty principle		
	F00-5	double slit experiment		
	S00-8	3D Variational method and Virial thm.	p.20	

Grad Quant				
Topics	Number	Problem	Page	Comments
Born approximation	S98-15	H atom in ground state	p.40	bad sol
	F99-17	$V(r) = V_0 e^{-r/a}$	p.45	
	F03-16	Yukawa	p.20	recommended
confined particle	S98-16	on a sphere	p.43	easy
	S00-13	in a double cylinder in B field	p.30	hard (Bessel fn.)
Hydrogen atom	F98-15	prob of transition		
	F00-16	Stark Effect	p.38	(error in sol?)
	S03-16	shift due to size of proton	p.25	also F06-16
	F04-15	Fermi Gold. Rule for Stark Effect	p.39	recommended
HO	F98-16	3DHO write gauge with $(a^\dagger a)$	p.38	(FGR)
	S06-16	TIPT for $H' = ax_1x_2$	p.18	trans. coords.(F06-6)
spin	S99-15	H atom Hyperfine and Zeeman	p.30	also F06-15
	S00-14	$s=3/2, H = AS_z^2 + B(S_x^2 - S_y^2)$		hard (but fun)
	F04-17	$s=1/2$ Stern Ger. rot. to θ	p.45	also F03-6
Time evolve	F00-15	2×2 Ham.		
	S01-14	$s=1/2$ in B field		recommended
	S02-17	neutrino oscillations		
	F04-16	2 state system	p.42	
Partial waves	S01-13	spherical delta function		error in sol
	F01-17	hard sphere	p. 37	recommended

UG Stats				
Topics	Number	Problem	Page	Comments
PV heat engine	S98-8	find work and entropy	p.19	recommended
	F99-2	photon gas, adiabatic exp.		
	S00-2	$P \propto V$		
	S01-4	sterling engine, work entropy		
	F01-5	isotherm. adiab.	p.7	
	S03-8	strange curve	p.11	
Quantum	F98-8	s=1 in B field adiab. demag.	p. 18	recommended
	S01-3	3 level system	p.4	
	F02-6	hanging rope, 4 states		
	F03-8	zipper, n links	p.11	
	F05-4	sideways rope, horizontal/vertical		
	S05-6	random walk based on dice	p.15	
Pistons	S99-6	explosion, find T, C_V , and ΔS		recommended
	F00-7	measure $\gamma = C_P/C_V$		
	S06-7	2 chambers	p.9	
Canonical partition	S99-7	classical free part.		also S02-5
	F01-6	find v_{rms} of particles in room		recommended
	S05-5	classical, potential \propto position	p.13	recommended
Heat capacity	F99-1	air bubbles		also F02-5
	F03-7	$\Delta Q = mc\Delta T$	p.10	
	S06-7	two blocks	p.9	
	F06-7	efficiency	p.10	
Work	S02-6	$W = FdX$		
	F04-7	$W = \sigma dA$	p.17	
Misc	F98-7	weird state function, find P,W, κ		
	S00-1	Van der Waals adiabatic		
	S03-7	BB radiation	p.10	
	S06-8	HO, find fluctuations	p.10	
	F06-8	Latent heat of evap.	p.11	
	S02-5	cylinder of gas	p.11	
	F05-8	isothermal expansion	p.14	
	F05-7	2nd law, heat transfer	p.11	

Grad Stats				
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Ising model	S98-17		p.46	recommended
	S00-11		p.25	
	S05-15		p.17	recommended
	S06-18		p.20	
Bosons	S98-7	find pressure		(actually undergrad)
	S05-16	condense, mean field	p.41	
	S99-16	dispers./dens. of states/spec.heat	p.39	recommended
	F04-17	dispersion/condensation	p.45	recommended
	F06-17	dispersion	p.34	
Fermions	S00-11	white dwarf stars	p.27	
	F00-17	gas confined to volume	p.40	easy
	F01-20	trap that forms droplets	p.44	hard
	F03-18	white dwarf star	p.22	(no sol)
Grand Canonical	F00-18	expansion	p.48	
	S02-19	adsorption sites, find μ	p.47	recommended
	S03-18	classical $Z \rightarrow$ script Z	p.29	
Canonical	S03-17	reaction $2A \rightarrow A_2$ find Z, A	p.27	
	F04-18	$s=1/2$ adsorption sites	p.48	
Van der Waals	F06-18		p.35	
Fluctuations	S07-18	Energy fluct. with heat cap.	p.30	