

AE 4453 Outline

This is a *tentative* outline of the material that will be covered. Helpful readings from the supplementary texts are also indicated (HP = Hill and Peterson, F= Farokhi, DH=Dixon and Hall, L=Lefebvre, e.g. HP7 means Hill and Peterson, Chapter 7).

	# Hours	Readings
I. Syllabus and Aircraft Propulsion Review	1.5	
A. Engine architectures	½	
B. Performance characteristics and single-point cycle design	¾	
C. Component design and unconventional architectures	¼	
II. Turbomachinery Design and Analysis	15.5	
A. Axial turbomachines, Euler equations and cascade nomenclature	2	
B. Mean line design of compressors and compressor performance		HP7, F7, DH3,5
1. Cascade flow angles and velocity triangles	1	
2. Single-stage compressor characteristics	2	
3. Blade design considerations and cascade performance	3	
4. Multistage compressors	1	
C. Mean line design of turbines and turbine performance		HP8, F9,DH3,4
1. Overview, Euler equations and turbine characteristics (maps)	1½	
2. Degree of reaction	1	
3. Nozzle design considerations	1	
4. p₀ losses and optimum solidity	1	
5. Blade and disk stresses, and vibrations	1	
D. Compressor and turbine design process	1	
III. Engine Off-Design Performance	3.5	HP8.7,F10
A. Gas turbine matching requirements and map scaling	½	
B. Gas generator off-design performance	1½	
1. Overview		
2. Unchoked operation and matching procedure		
3. Choked turbine matching analysis		
4. Operating lines and pumping characteristics		
C. Engine off-design performance	1	
D. Engine transient response	½	
IV. Combustor Design	9	HP6,F6,L1-6
A. Overview: requirements and rationale for typical features	1½	
B. Diffuser sizing & losses, combustor length	2	
C. Aerodynamics and swirl	1½	
D. Fuel injection and atomization	1½	
E. Ignition	1	
F. Heat transfer and liner cooling	1½	
V. Advanced Propulsion Architectures	7.5	
A. Scramjets	2	
B. Pressure gain combustion approaches	2	
C. Electric and hybrid electric propulsion	3.5	
Reviews, Project Discussions and Exams	5	