Turbo Machines
Examination 2071 Guidelines

Chapter One

1. Turbomachine basic definition and types (focus on turbines and compressors)
2. Static and stagnation properties (basic thermodynamics, first law, second law used in turbomachines)
3. Turbine and compressor isentropic efficiency and sources of losses, types of losses
4. Importance of Reynolds Number

Chapter Two

1. Euler's equation and derivation for both turbine and compressor
2. Velocity diagram of turbines and compressors blades (no numerical, only diagram— see Saeed Farokhi book)
3. Type of turbines (impulse, reaction and impulse- reaction and their basic working principle)

Chapter Three (This is the most important chapter for Numerical and theory)

1. Gas turbine schematic
2. Brayton cycle and Numerical from ideal Brayton cycle
3. Regenaration, intercooling, reheating, and their effect in cycle, efficiency of ideal Brayton cycle, actual gas turbine cycle
4. Inlet, compressor, combustor, turbine and exhaust in detail including their thermodynamics, graphs, construction, working principle (follow slides for theory and numerical)
   Inlet: types of inlets (supersonic, subsonic, variable area, construction), losses, thermodynamic diagram
   Compressor: compressor types (axial, centrifugal, configuration and their difference), construction and blade geometry, thermodynamics, losses, efficiency, numerical, operation, compressor stall and surge
   Combustor: working principle, combustor types, construction, characteristics and their differences, thermodynamics, combustion parameters, numerical
   Turbine: types of turbine, working principle, construction and blade geometry, thermodynamics, numerical
   Exhaust/ Nozzle: construction and working principle

Chapter Four

1. Nozzle(definition, construction and types- convergent, divergent, convergent-divergent, variable area nozzle)
2. Parameters (Mach Number, pressure ratios, critical ratios, expansion area ratio and their significance)
3. Flows in nozzles (subsonic, transonic, supersonic) , change of velocity, pressure and mass flow with area with relevant relations, graphs,
4. Nozzle efficiency, losses, energy equation, nozzle thermodynamics
5. Use of nozzle air mixer, noise suppressor, thrust reverser, after-burner to improve nozzle performance

Chapter Five

1. Turbine powered jet engines (turbojet, turbo fan — see in chapter six)
2. Ramjet Engine (basic construction, working principle, difference with other aircraft engines, limitation and advantages), basic introduction to scramjet
3. Intermittent combustion engine – Pulsejets, Pulse detonation engine (basic construction, working principle, advantages and limitations)

4. Rocket engine-(basic construction of rocket engine, working principle and differences with other engine)
5. Hybrid engines – Combined cycle engines(rocket based combined cycle engine, turbine based combined cycle engines, their need and advantages compared to other engines), introduction to advanced propulsion

Chapter Six (This chapter is also important for numerical and theory)

1. Different types of turbine powered engines (turbojet, turbofan , turbo prop, turboshaft), basis of their classification
2. Gas turbine engine parameters (all parameters taught in class, Numerical—consult Saeed Farokhi book chapter 3)
3. Turbojet- construction, uses, propulsive efficiency, advantages and limitations
4. Turboprop engine- construction, direct and reverse flow, propulsive efficiency, advantages and limitations, differences with other engines
5. Turbofan engine- construction, by-pass ratio, need of bypass, propulsive efficiency, advantages and limitaions
6. Turboshaft engine- construction, propulsive efficiency, advantages and limitations, uses
7. Overall comparison of above four types of engines on the basis of performance parameters
8. Types of engines used in aircraft, name of aircrafts in Nepal using among these four engine types – see group project