Gas Dynamics and Jet Propulsion - Web course

COURSE OUTLINE

COURSE OVERVIEW

- This undergraduate level course teaches the principles of jet propulsion.
- The primary focus of the course is on the teaching of thermodynamics and Gas dynamics in aircraft engines.
- The course provides information that will enable the engineering analysis of ramjets and turbine engines and its separate components including inlets, nozzles, combustion chambers, compressors.

COURSE OBJECTIVES

Students successfully completing this course will get:

- A basic understanding of thermodynamic cycles of jet engines.
- A basic understanding of the compressible fluid flow in inlets and compressors and turbines.
- A basic understanding of the combustion physics in combustion chambers.
- A basic understanding of the rational behind several types of jet engines.
- The ability to analyze jet engines; determine propulsion efficiency and design inlets and nozzles.

COURSE DETAIL

<table>
<thead>
<tr>
<th>Module</th>
<th>Topics</th>
</tr>
</thead>
</table>
| 1.     | PROPULSION  
  - Aircraft propulsion theory: thrust, thrust power, propulsive and overall efficiencies - Problems. |
| 2.     | THERMODYNAMIC ANALYSIS OF IDEAL PROPULSION CYCLES  
  - Thermodynamic analysis of turbojet engine - Study of subsonic and supersonic engine models - Identification and Selection of optimal operational parameters. Need for further development - Analysis of Turbojet with after burner.  
  - Thermodynamic analysis of turbo-prop engine - Identification |
and selection of optimal operational parameters.

3. **GAS DYNAMICS OF PASSIVE COMPONENTS OF TURBO ENGINES**
   - **ANALYSIS OF DIFFUSERS AND NOZZLES:** Introduction - study of intakes for subsonic and supersonic engines - Comparison of isentropic and adiabatic processes - Mach number variation - Area ratio as function of Mach numbers - Impulse function - Mass flow rates - Flow through nozzles - Flow through diffusers - Effect of friction - Analysis of intakes for supersonic engines - intakes with normal shock - oblique shocks - Study of special supersonic nozzles and diffusers.

4. **STUDY OF COMPRESSORS**
   - Design and Analysis of compressors - Classification - analysis of centrifugal compressors - velocity triangles - design of impellers and diffusers - analysis of axial flow compressor - analysis of stage - characterization of stage - design of multistage axial flow compressor - Performances analysis of centrifugal and axial flow compressors.

5. **GAS DYNAMICS OF COMBUSTORS**
   - Stoichometry of combustion - calculation air-fuel ratio - gas dynamics of combustors - thermal loading factors - design and selection of combustors.

6. **STUDY OF TURBINES**
   - Concept of gas turbine - analysis of turbine stage - velocity triangles and characterization of blades and stages - Design of multistage axial flow turbine - Performance analysis of turbines.

7. **ADDITIONAL TOPICS**
   - Thermodynamic analysis real turbo en cycles - performance analysis and thermodynamic optimization.
   - Introduction to ramjets - study of rocket engines - study of missile engines.