

**AE8404 PROPULSION – I**

DETAILED SYLLABUS

**OBJECTIVE:**

To establish fundamental approach and application of jet engine components. Also analysis of flow phenomenon and estimation of thrust developed by jet engine.

**UNIT I PRINCIPLES OF AIR BREATHING ENGINES**

Operating principles of piston engines – thermal efficiency calculations – classification of piston engines - illustration of working of gas turbine engines – factors affecting thrust – methods of thrust augmentation – performance parameters of jet engines.

**UNIT II JET ENGINE INTAKES AND EXHAUST NOZZLES**

Ram effect, Internal flow and Stall in subsonic inlets – relation between minimum area ratio and external deceleration ratio – diffuser performance – modes of operation - supersonic inlets – starting problem on supersonic inlets – shock swallowing by area variation – real flow through nozzles and nozzle efficiency – losses in nozzles – ejector and variable area nozzles – interaction of nozzle flow with adjacent surfaces – thrust reversal.

**UNIT III JET ENGINE COMBUSTION CHAMBERS**

Chemistry of combustion, Combustion equations, Combustion process, classification of combustion chambers – combustion chamber performance – effect of operating variables on performance – flame stabilization, Cooling process, Materials, Aircraft fuels, HHV, LHV, Orsat apparatus

**UNIT IV JET ENGINE COMPRESSORS**

Euler's turbo machinery equation, Principle operation of centrifugal compressor, Principle operation of axial flow compressor– Work done and pressure rise – velocity diagrams – degree of reaction – free vortex and constant reaction designs of axial flow compressor – performance parameters axial flow compressors– stage efficiency.

**UNIT V JET ENGINE TURBINES**

Principle of operation of axial flow turbines– limitations of radial flow turbines- Work done and pressure rise – Velocity diagrams – degree of reaction – constant nozzle angle designs – performance parameters of axial flow turbine– turbine blade cooling methods – stage efficiency calculations – basic blade profile design considerations – matching of compressor and turbine

**TEXT BOOK:**

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Pearson education (2009)

**REFERENCES:**

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Pearson Education Canada; 6th edition, 2008.

2. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 2nd edition 2014.

3. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.

4. "Rolls Royce Jet Engine", Rolls Royce; 4th revised edition, 1986.