

PAE41104 PROPULSION – I

UNIT I FUNDAMENTALS OF AIR BREATHING ENGINES

Operating principles of piston engines – thermal efficiency calculations – classification of piston engines - illustration of working of gas turbine engine – the thrust equation – factors affecting thrust – effect of pressure, velocity and temperature changes of air entering compressor – methods of thrust augmentation – characteristics of turboprop, turbofan and turbojet – performance characteristics.

UNIT II SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES

Internal flow and Stall in subsonic inlets – Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and external deceleration ratio – Diffuser performance – Supersonic inlets – Starting problem on supersonic inlets – Shock swallowing by area variation – External declaration – Models of inlet operation.

UNIT III NOZZLES

Theory of flow in isentropic nozzles – nozzles and choking – Nozzle throat conditions – Nozzle efficiency – Losses in nozzles – Over expanded and under – expanded nozzles – Ejector and variable area nozzles – Interaction of nozzle flow with adjacent surfaces – Thrust reversal

UNIT IV COMPRESSORS

Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of prewhirl, rotation stall and surge – Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional –Compressor blade design – Centrifugal and Axial compressor performance characteristics

UNIT V COMBUSTION CHAMBERS

Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – Use of flame holders – Numerical problems.

TEXT BOOKS:

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 1999.
2. James Award, "Aerospace Propulsion System"

REFERENCES:

1. Cohen, H. Rogers, G.F.C. and Saravana muttoo, H.I.H. "Gas Turbine Theory", Longman, 1989.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
3. Rolls Royce, "Jet Engine", 5th Edition, Rolls Royce Technical Publications, 2005.
4. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 1999.