COURSE CONTENT

FUNDAMENTALS OF AEROSPACE PROPULSION								
III Semester: OE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BAEE31	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite:								

I. COURSE OVERVIEW:

The Fundamentals of Aerospace Propulsion is a crucial course in aerospace engineering that covers the principles and technologies related to propulsion systems used in aircraft and spacecraft. This course provides students with a comprehensive understanding of the key concepts, components, and operating principles of propulsion systems.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Historical evaluation of propulsion systems.
II. The different component systems in gas turbine engines and their functions.
III. The various types of power plants used in aircraft propulsion.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1 Classify the various gas turbine engines for their suitable section.
CO 2 Understand the basic concepts of propeller theory for calculating thrust generated by the propeller.
CO 3 Understand the basic concepts of inlet and nozzle operation under different operating conditions.
CO 4 Classify the various combustion chambers used in gas turbine engines for their suitable selection.
CO 5 Explain the operating principles of compressor and turbine for their efficient design.
CO 6 Illustrate thermal and electric rocket motors for describing their operating principle.

IV. COURSE CONTENT:

MODULE-I: **ELEMENTS OF AIRCRAFT PROPULSION (9)**
Classification of power plants – Methods of aircraft propulsion – Propulsive efficiency – Specific fuel consumption – Thrust and power- Factors affecting thrust and power- Illustration of working of piston engines and Gas turbine engines – Characteristics of piston engine, turboprop, turbofan and turbojet engines, Ram jet, Scram jet – Methods of Thrust augmentation.

MODULE-II: PROPELLER THEORY (09)
Momentum theory, Blade element theory, combined blade element and momentum theory, propeller power losses, propeller performance parameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted propellers, propeller noise, propeller selection, propeller charts.

MODULE-III: INLETS, NOZZLES AND COMBUSTION CHAMBERS (09)
Subsonic and supersonic inlets – Relation between minimum area ratio and external deceleration ratio- Starting problem in supersonic inlets - Modes of inlet operation, jet nozzle- Efficiencies - Over expanded, under and optimum expansion in nozzles - Thrust reversal.

Classification of Combustion chambers - Combustion chamber performance - Flame tube cooling – Flame Stabilization

MODULE-IV: AXIAL FLOW COMPRESSORS, FANS AND TURBINES (09)
Introduction to centrifugal compressors- Axial flow compressor- geometry- twin spools- three spools- stage analysis- velocity polygons- degree of reaction - radial equilibrium theory performance maps- axial flow turbines- geometry- velocity polygons- stage analysis- performance maps- thermal limit of blades and vanes.

MODULE-V: ROCKET AND ELECTRIC PROPULSION (09)
Introduction to rocket propulsion – Reaction principle - Thrust equation - Classification of rockets based on propellants used - solid, liquid and hybrid - Comparison of these engines with special reference to rocket performance - electric propulsion - classification- electro thermal – electro static - electromagnetic thrusters- geometries of Ion thrusters- beam/plume characteristics - hall thrusters

V. TEXT BOOKS:

1. Cohen, H, Saravanamuttoo, HIH., Rogers, GFC, Paul Straznicky and Andrew Nix, “Gas Turbine Theory”, Pearson Education Canada; 7th edition, 2017.
2. Gill,WP, Smith, HJ & Ziurys, JE, “Fundamentals of Internal Combustion Engines as applied to reciprocating, Gas turbine & Jet Propulsion Power Plants”, Oxford & IBH Publishing Co., 1980.
3. Hill, PG. & Peterson, CR. “Mechanics & Thermodynamics of Propulsion” Pearson education, 2nd edition, 2014.

VI. REFERENCE BOOKS:

1. Oates, GC, “Aerothermodynamics of Aircraft Engine Components”, AIAA Education Series, 2007.
2. Sutton, GP, “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 9th edition, 2017.

VII. ELECTRONICS RESOURCES:

1. http://memberfiles.freewebs.com/94/47/55224794/documents/airport%20planning%20and%20management.pdf
2. https://books.google.co.in/books?id=RYR6cu4YSBcC&dq=Planning%20and%20Design%20of%20Airports&source=gbs_similarbooks

VIII. MATERIALS ONLINE

1. Course template.
2. Assignments.
3. Tutorial question bank.
4. Model question paper – I.
5. Model question paper – II.
6. Lecture notes.
7. Power point presentations.