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<b>DEPARTMENT</b>	Department of Aerospace Engineering
<b>INSTITUTE</b>	Indian Institute Of Technology Madras
<b>COURSE OUTLINE</b>	Introduction to various air breathing and non-air breathing engines, conservation equations & derivation of the thrust equation for air breathing and non-air breathing engines. Efficiencies of air breathing and non-air breathing engines, quasi-one dimensional flow through nozzles. Cycle analysis of air breathing systems, detailed discussion on rocket engines.

**COURSE DETAILS**

S. No	Module ID/ Lecture ID	Lecture Title/Topic
1.	L1	Introduction
2.	L2	Air breathing Engines : Turbojet - I
3.	L3	Air breathing Engines : Turbojet - II
4.	L4	Air breathing Engines : Turboprop & Turbofan
5.	L5	Air breathing Engines : Ramjet & Scramjet
6.	L6	Non-Air breathing Engines - I
7.	L7	Non-Air breathing Engines - II
8.	L8	General Performance Parameters - I
9.	L9	General Performance Parameters - II
10.	L10	Cycle Analysis : Ramjet
11.	L11	Cycle Analysis : Turbojet - I
12.	L12	Cycle Analysis : Turbojet - II

13.	L13	Cycle Analysis : Turbojet - III
14.	L14	Cycle Analysis : Turbojet - IV
15.	L15	Cycle Analysis : Turbojet - V
16.	L16	Cycle Analysis : Turbojet - VI
17.	L17	Cycle Analysis : Turbofan
18.	L18	Rocket Nozzles : 1D Analysis - I
19.	L19	Rocket Nozzles : 1D Analysis - II
20.	L20	Rocket Nozzles : 1D Analysis - III
21.	L21	Rocket Nozzles : Real Effects - I
22.	L22	Rocket Nozzles : Real Effects - II
23.	L23	Rocket Nozzles : Thrust Vectoring
24.	L24	Solid Rockets : Propellants
25.	L25	Solid Rockets : Burn rate
26.	L26	Solid Rockets : Performance
27.	L27	Solid Rockets : Grain
28.	L28	Solid Rockets : Ignition, Quenching
29.	L29	Solid Rockets : Igniter, Depressurization
30.	L30	Propellant Combustion : Combustion Modelling
31.	L31	Liquid Rocket : Propellants
32.	L32	Liquid Rocket : Nozzle Cooling - I
33.	L33	Liquid Rocket : Nozzle Cooling - II
34.	L34	Liquid Rocket : Nozzle Cooling - III
35.	L35	Liquid Rocket : Pressure fed system
36.	L36	Liquid Rocket : Pump fed system
37.	L37	Liquid Rocket : Pumps
38.	L38	Liquid Rocket : Fuel Injection
39.	L39	Hybrid Rocket : Basics
40.	L40	Hybrid Rocket Performance

<b>41.</b>	<b>L41</b>	Hybrid Rocket Combustion
<b>42.</b>	<b>L42</b>	Chemical Equilibrium Analyser : SP 273

**List of reference material/ books:**

Understanding aerospace chemical propulsion-H S Mukunda, Interline publishing.

Rocket propulsion elements-G P Sutton and Oscar Biblarz, John Wiley and sons.

Mechanics and Thermodynamics of Propulsion-Philip Hill and Carl Peterson, Addison Wesley.

Elements of Gas Turbine Propulsion-J D Mattingly, McGraw-Hill.

**Name and contact details of two referees for the course:**