AEROSPACE PROPULSION

Course Code		Category	Hours / Week			Credits	Maximum Marks		
AAEB08		Core	L	Т	Р	С	CIA	SEE	Total
			3	1	-	4	30	70	100
Contact Classes: 45		Tutorial Classes: 15	P	ractica	l Class	es: Nil	Tot	al Class	es: 60
OBJECTIVI	ES:								
The course s	hould en	able the students to.							
I. Analyze	parametri	c cyclic analysis, perform	nance p	oaramete	ers, eff	iciency, and	1 specifi	c impuls	se of all
air breath	ing engin	les.	nio ond	launara	onio in	lota typog	of comb	uction of	homborg
and factor	rs affectii	ng the combustors		i supers		liets, types		ustion ci	lamoers
III. Discuss t	he types	of nozzles, flow condition	ons in a	nozzles	, intera	ction of no	zzle flo	w with a	adjacent
surfaces a	ind thrust	reversal types of compressors a	nd turl	hines s	vork d	one veloc	ity diag	rams an	d stage
efficiency	v calculat	ions.	na turi	onics, v	WOIK U		ity ulag	rams an	u stage
COURSE O	TCOM								
COURSE O	Gain kno	ES (COS): wledge about the various t	types o	f gas tu	rbine e	ngine basic	function	and the	ir
001	performa	ince analysis	cypes o	i gub tu			i une tioi	i una ino	
CO 2:	Understa	nd the various inlets and c	ombus	tion cha	umber p	performance	e parame	ters affe	cting
CO 3:	Gain kno	wledge about theory of flo	ow thro	ough ise	ntropic	convergent	, conver	gent-	
CO 4:	divergent	t nozzles and their operation	ng cond	litions	doontri	fugal comm	****	and that	
CO 4:	design	nd basic principle operatio	ons of a	ixiai and	ı centri	lugal comp	ressors,	and then	Ĩ
CO 5:	Understa	nd basic principle operation	ons of a	ixial and	d radial	turbine, an	d their d	esign.	
COURSE LI	EARNIN	G OUTCOMES (CLOs):	:						
1. Apply	y knowled	dge and understand the ess	sential	facts, co	oncepts	and princip	les of th	ermodyr	namics.
2. Unde	rstand the	e basic function of all aircr	aft eng	ine con	nponen	ts and how	they wo	rk.	
3. Analy	ze the er	igine performance paramet	ters and	d param	eters ir	fluencing t	hem.		
4. Unde	rstand the	e impact of performance pa	aramete	ers on e	nduran	ce and rang	e how th	ey affec	t the
aircra	ft perform	nance.							
5. Demo	onstrate d	ifferent type's aircraft eng	ine ope	erating p	princip	le.			
6. Unde	Understand step by step procedure of engine parametric cycle analysis.								
7. Unde	rstand ste	eps involved in performance	ce analy	ysis of a	all aircr	aft engine.			
8. Desci	ibe opera	ational modes of subsonic	inlets a	nd para	meters	influencing	it.		
				nia para			,		

10. Describe supersonic inlets, starting problem in it and their operating modes.							
11. Understand different types of combustion chamber and functions of all the components.							
12. Analyze combustion chamber performance and parameters influencing them.							
13. Describe theory of flow in isentropic nozzle and physics behind nozzle operation.							
14. Understand different nozzle operating conditions for convergent and divergent nozzle.							
15. Descr	ibe principle of operation of axial and centrifugal compressor.						
16. Under	stand different design of compressor and limitations of each method.						
17. Analyze performance characteristics of axial and centrifugal compressor.							
18. Descr	ibe principle of operation of centrifugal and axial flow turbine.						
19. Under	stand different design of axial and centrifugal turbine.						
20. Desig	n of ramjet engine and steps involved in it.						
Module-I	AIR-BREATHING ENGINES	Classes: 10					
Classification, operational envelopes; Description and function of gas generator, turbojet, turbofan, turboprop, turbo shaft, ramjet, scramjet, turbojet/ramjet combined cycle engine; Engine thrust, takeoff thrust, installed thrust, thrust equation; Engine performance parameters, specific thrust, specific fuel consumption and specific impulse, thermal efficiency, propulsive efficiency, engine overall efficiency and its impact on aircraft range and endurance; Engine cycle analysis and performance analysis for turbojet, turbojet with afterburner, turbofan engine, turboprop engine.							
Module -II	INLETS AND COMBUSTION CHAMBERS	Classes: 09					
Internal flow and stall in subsonic inlets, relation between minimum area ratio and eternal deceleration ratio, diffuser performance, supersonic inlets, starting problem on supersonic inlets, shock swallowing by area variation; Classification of combustion chambers, combustion chamber performance, effect of operating variables on performance, flame stabilization.							
Module -III	NOZZLES	Classes: 10					
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.							
Module -IV	COMPRESSORS	Classes: 08					
Principle of op velocity triang performance cascade testin	peration of centrifugal compressor and axial flow compressor, work done a gles, degree of reaction, free vortex and constant reaction designs of axial flow compressors, stage efficien g.	nd pressure rise, low compressor, cy calculations,					
Module -V	TURBINES	Classes: 08					
Principle of o rise, velocity characteristics ram rockets.	peration of axial flow turbines, limitations of radial flow turbines, work do triangles, degree of reaction, free vortex and constant angle design , sample ramjet design calculations, flame stability problems in ramjet com	one and pressure as, performance bustors, integral					
Text Books:							
 Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion", Addison Wesley Longman INC, 1999. Mattingly J.D., "Elements of Propulsion: Gas Turbines and Rocket", AIAA, 1991. 							
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Reference Books:

- 1. Cohen, H.Rogers, G.F.C. and Saravanamuttoo, H.I.H,"Gas Turbine Theory", Longman, 1989.
- 2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.

Web References:

- 1. https://nptel.ac.in/courses/101101002/ 2.
- 2. https://nptel.ac.in/courses/112106073/

E-Text Books:

- 1. https://as.wiley.com/WileyCDA/WileyTitle/productCd-1118806778.html
- 2. https://www.scribd.com/document/63588270/Aerospace-Propulsion-Systems
- 3. https://www.crcpress.com/Aircraft-Propulsion-and-Gas-Turbine-Engines/ElSayed/p/book/ 9780849391965