Er. PERUMAL MANIMEKALAI COLLEGE OF ENGINEERING (An Autonomous Institution-Affiliated to Anna University, Chennai) Koneripalli, Hosur – 635117.



ACADEMIC REGULATIONS 2023 (R23)

Curriculum and Syllabi

(Version 1)

M.E. Aeronautical Engineering

(Applicable from 2023 -24 onwards)

Er PER SALL MARSHEKALAT COLLECT OF ERCHREST VO. (An Accommus instinction—Afrikand to Anna University, Chemail Manuripalit. House - 433117.



(ESS) TRIAL RECEIVANT AUTORIS (ESS)

Carricotum and Syllabi

(Transferred F)

18. L. A. exchanations Engineering

Character by and 2023 - 24 on which the



Er. PERUMAL MANIMEKALAI COLLEGE OF ENGINEERING AGGREDITED BY NBA & NAAC WITH 'A' GRADE Koneripalli, HOSUR - 635 117.

REGULATIONS 2023 - AUTONOMOUS CHOICE BASED CREDIT SYSTEM M. E. AERONAUTICAL ENGINEERING

CURRICULUM AND SYLLABI FOR I TO IV SEMESTERS

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Graduates of the programme will acquire adequate knowledge both in practical and theoretical

- I. domains in the field of Aeronautical Engineering through rigorous post graduate education.
- II. Graduates of the programme will have successful technical and managerial career in Aeronautical Engineering industries and the allied management.
- III. Graduates of the programme will have innovative ideas and potential to contribute for the development and current needs of the Aviation industries.

PROGRAMME OUTCOMES (POs):

- An ability to independently carry out research/investigation and development work to solve practical problems
- 2. An ability to write and present a substantial technical report/document
 - Students should be able to demonstrate a degree of mastery over the area as per the
- 3. specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
- Post Graduate will be trained towards developing and understanding the importance of design and development of Airplanes from system integration point of view.
 - Post Graduate will exhibit the awareness of contemporary issues focusing on the necessity to
- 5. develop new materials, design and testing methods for the solution of problems related to aircraft industry.
- An understanding of professional and ethical responsibility and also capable of doing doctoral studies in multidisciplinary areas.



PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO1: Professional Skills: An Engineer capable to exploit the knowledge of Aeronautical Engineering to provide solution to real world problems and passion for innovation towards design and development of new products.

PSO2: Problem-solving skills: Use Utilization of Computer-aided Engineering packages and simulation softwares to design analyses and optimize the components of airworthiness for flight vehicles.

PEO/ POs MAPPING:

PEOs/ POs	PO1	PO2	PO3	PO4	PO5	PO6
PEO 1	mio 3 1 1 1	nome 3 m and	egiber acimiya	ad iller samos	2 Sound Sound House	entara) 1 poteruis
PEO 2	3	3	3	1090	2 10 39	2 0 1
PEO 3	3	3	3	2	sp1 gota j	minuted 1





Er. PERUMAL MANIMEKALAI COLLEGE OF ENGINEERING



ACCREDITED BY NBA & NAAC WITH 'A' GRADE Koneripalli, HOSUR - 635 117.

AUTONOMOUS AFFILIATED COLLEGE REGULATION 2023 CHOICE BASED CREDIT SYSTEM M.E AERONAUTICAL ENGINEERING CURRICULUM AND SYLLABI FOR I - IV SEMESTERS

SEMESTER - I

S. N	Course Code	Course Name	Category	Peri	ods Per	Week	Total	C 111
0			Category	L	T	P	- Contact Periods	Credits
TH	EORY		BV - VE	I-gmts	alsa muo	SETTO 1	1 011003	
1	PPCC1FC01	Advanced Mathematics	FC	3	1	2801014	4	4
2	PPAR1PC01	Aerospace Propulsion	PC	3	- 10	gqiber.	3	3
3	PPAR1PC02	Flight Vehicle Aerodynamics	PC	3	1 2	tia-ud	4	4
4	PPAR1PC03	Analysis of Composite Structures	PC	3	i kannar	Continue	3	3
5	PPCC1RM01	Research Methodology and IPR	RM	3	12, 100	19 - 17 Pa	3	3
6	PPAR1PEXX	Professional Elective - I	PE	3		mT-	3	3
7	PPCC1ACXX	Audit Course – I*	AC	2		-	2	
PRA	ACTICALS			CHECK	WAR IST		Leathier, olist	HALLIMIE
8	PPAR1PL01	Aerodynamics Laboratory	PC	-		4	4	2
9	PPAR1PL02	Aircraft Propulsion Laboratory	PC	200	-	4	4	2
	a aistantia a Caratt	Total		20	2	8	30	24

*Registration for this course is optional to students



S.No	Course Code	Course Name	Category	Pe	riods Weel		Total Contact	Credits
		2002	OFTAGRES	L	T	P	Periods	
THEC	ORY							
i	PPAR2PC04	Advanced Flight Dynamics	PC	3	TU.I	0.8	3	3
2	PPAR2PC05	Aerospace Structures	PC	3	1	-	4	4
3	PPAR2PC06	CFD for Aerospace Applications	PC	3	-	-	3	3
4	PPAR2PC07	FEA for Aerospace Applications	PC	3	W. o.	ing Q	3	3
5	PPAR2PEXX	Professional Elective-II	PE	3			3	3
6	PPAR2PEXX	Professional Elective-III	PE	3	ny=in	d fisc	3	3
7	PPCC2ACXX	Audit Course – II*	AC	2		A	2	199 (5), 64
PRAC	TICALS						unio E	
8	PPAR2PL03	Aircraft Structures Laboratory	PC	207020	a de la compania del compania de la compania del compania de la compania del compa	4	4	2
9	PPAR2PL04	Computational Laboratory	PC	-		4	4	2
10	PPAR2PR01	Mini Project with Seminar	PR			4	4	2
	6 6	Total	30	20	1	12	33	25

*Registration for this course is optional to students SEMESTER

S.N o	Course Code	Course Name	Categ	Pe	riods . Week		Total Contact	Credits
	C + +		ory	L	T	P	Periods	
THE	ORY					- Inte		
1	PPAR3PEXX	Professional Elective-IV	PE	3	on its	çilgə	3	3
2	PPAR3PEXX	Professional Elective-V	PE	3	-	4	3	3
3		Open Elective	OE	3	-	1	3	3
PRA	CTICALS							
4	PPAR3PR02	Project Work Phase - I	PR		1	12	12	6
		Total		9		12	21	15

SEMESTER - IV

S.	Course Code	Course Name	Category	Periods Per Week			Total Contact	Credits
No				L	T	P	Periods	
THE	EORY							
1	PPAR4PR03	Project Work Phase - II	PR	- 10	id . u	24	24	12
		Total		-	-	24	24	12
					ing faceur	Curr	iculum Total	76

SUMMARY

	M.E AERONAUTICAL ENGINEERING											
avo	Subject	I	II	ш	IV	Total Credits						
S.NO	Area		C	Credits Per Sem	ester							
1	FC	4				4						
2	PC	14	17	mad.	ener)	31						
3	PE	3	6	6	viä lämen	15						
4	OE		70	3	A currency	3						
5	PR		2	6	12	20						
6	RM	3		yA bus	eraudhour	3						
	Total	24	25	15	12	76						

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 76

Abbreviations	Category
FC	Foundation Course
RM	Research Methodology and IPR
PC	Professional Core
PE	Professional Elective
OE	Open Elective
PW	Project Work
AC	Audit Course



PROFESSIONAL ELECTIVE COURSES (PEC)

SEMESTER-I, ELECTIVE –I

S No.	Course Code	Course Name	Category	Perio	ds Per	Week	Total Contact	Credits
5.110	Course Code		Category	L	T	P	Periods	
1	PPAR1PE01	Theory of Vibrations	PE	3		-	3	3
2	PPAR1PE02	Rocketry and Space Mechanics	PE	3			3	3
3	PPAR1PE03	Computational Heat Transfer	PE	3	= =	-	3	3
4	PPAR1PE04	Theory of Elasticity	PE	3			3	3
5	PPAR1PE05	Experimental Aerodynamics	PE	3		-	3	3
6	PPAR1PE06	Control Engineering	PE	3		-	3	3

SEMESTER-II, ELECTIVE-II

S.No	Course Code	Course Name	Category	Perio	ds Per	Week	Total Contact	Credits
Dirio				L	T	P	Periods	7.0
1	PPAR2PE07	Structural Dynamics	PE	3	- 4	=	3	3
2	PPAR2PE08	Hypersonic Aerodynamics	PE	3	-		3	3
3	PPAR2PE09	Advanced Propulsion Systems	PE	3	-	-	3	3
4	PPAR2PE10	Aerospace Materials	PE	3	-	-	3	3
5	PPAR2PE11	Airworthiness and Air Regulations	PE	3			3	3
6	PPAR2PE12	Experimental Methods of Stress Analysis	PE	3	-	-	3	3

SEMESTER-II, ELECTIVE-III

S No	Course Code	Course Name	Category	Perio	ods Per	Week	Total Contact	Credits
5.110	Course code	ourse I mine	caregory	L	T	P	Periods	
1	PPAR2PE13	Aeroelasticity	PE	3	m5		3	3
2	PPAR2PE14	Theory of Boundary Layers	PE	3	3 2 L		3	3
3	PPAR2PE15	Combustion in Jet and Rocket Engines	PE	3			3	3
4	PPAR2PE16	Gas Dynamics	PE	3		(6 - 10	3	3
5	PPAR2PE17	Fatigue and Fracture Mechanics	PE	3	-	-	3	3



SEMESTER-III, ELECTIVE-IV

S.No	Course Code	Course Name	Category	Periods Per Week			Total Contact	Credits
				L	T	P	Periods	
1	PPAR3PE18	Vibration Isolation and Control	PE	3	-	T	3	3
2	PPAR3PE19	Non-Destructive Evaluation	. PE	3	-	W-1	3	3
3	PPAR3PE20	Component Design of Aircraft Engines	PE	3	-		3	3
4	PPAR3PE21	Aircraft Systems Engineering	PE	3	-	-	3	3
5	PPAR3PE22	Aircraft Design	PE	3	-		3	3
6	PPAR3PE23	Composite Product Processing Methods	PE	3	-	-	3	3

SEMESTER-III, ELECTIVE-V

S.No Course Code		Course Name	Category	Periods Per Week			Total Contact	Credits
				L	L T P		Periods	
1	PPAR3PE24	Helicopter Aerodynamics	PE	3			3	3
2	PPAR3PE25	High Speed Jet Flows	PE	3			3	3
3	PPAR3PE26	Health Monitoring	PE	3	-		3	3
4	PPAR3PE27	Artificial Intelligence and Machine Learning	PE	3			3	3
5	PPAR3PE28	Aircraft Guidance and Control	PE	3			3	3

AUDIT COURSES (AC) Registration for any of these courses is optional to students

s.No	Course Code	Course Name	Category	Periods Per Week			Total Contact	Credits	
				L	T	P	Periods		
1	PPCC1AC01	English for Research Paper Writing	. AC	2			2	0	
2	PPCC1AC02	Disaster Management	AC	2	-	-1	2	0	
3	PPCC2AC01	Constitution of India	AC	2			2	0	
4	PPCC2AC02	நற்றமிழ் இலக்கியம்	AC	2			2	0	



THE RESERVE AND A STREET OF THE STREET, TH

THE TERMS IN STREET

		Ismiaone but elejeshik mete (1864-9749 6
		Line somegall-smit Intelligent (1998/2499) 1.

ACCEPTAGE (AC) Segretration (at long of these country is optional to students



PPFC1AS01		ADVANCED MATHEMATICS	L ka 1080	T.	P	C
		Managain sweeter recommended of Anton ale	3	F 31	0	4
COUI	RSE OBJEC	CTIVES:	a		en es inte	
1	To attain	the knowledge of solving Partial Differential Equations using Laplace tra	nsform	a yasan ahlail l		260
2	To apply	Fourier Transform to solve boundary value problems	19	ACCUP!	33/12	aryan .
3	To achiev	ve maxima and minima of a functional	AND UNI	- J. 4-2W	sibin/A	
. 4	To acquir	e knowledge on using conformal mapping to fluid flow and heat flow pro	oblems			
5	To unders	stand the tensor analysis as a tool to solve problems arising in engineering	g discipl	ines		
UI	NIT – I	LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFF EQUATIONS	ERENT	ΓIAL	Bartis	12
functi	ons – Convo	n: Definitions – Properties – Transform error function – Bessel's function obtains theorem – Inverse Laplace transform: Complex inversion formula quation – Wave equation.				
UNIT - II FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS						
uicoic	III - I alsev	al's identity - Solutions to partial differential equations: Heat equation				
Poisso UN Conce		CALCULUS OF VARIATIONS ion and its properties – Euler's equation – Functional dependant on fi	irst and	higher o	order de	12
UN Conce Funct Isoper	NIT – III ept of variat	CALCULUS OF VARIATIONS	irst and	higher o	order de	12
Poisso UN Conce Funct Isoper	ept of variationals deperimetric prob	CALCULUS OF VARIATIONS ion and its properties – Euler's equation – Functional dependant on findant on functions of several independent variables – Variational prololems – Direct methods – Ritz and Kantorovich methods.	irst and blems v	higher c	order de	rivatives - undaries - 12 rmation o
Conce Funct Isoper	ept of variationals deperimetric prob	CALCULUS OF VARIATIONS ion and its properties – Euler's equation – Functional dependant on findant on functions of several independent variables – Variational problems – Direct methods – Ritz and Kantorovich methods. CONFORMAL MAPPING AND APPLICATIONS onformal mappings and bilinear transformations – Schwarz Christoffel to	irst and blems v	higher c	order de ving bo	rivatives - undaries - 12 rmation o
Poisso UN Conce Funct Isoper UN Introd bound	ept of variationals deperrimetric prob	CALCULUS OF VARIATIONS ion and its properties – Euler's equation – Functional dependant on findant on functions of several independent variables – Variational problems – Direct methods – Ritz and Kantorovich methods. CONFORMAL MAPPING AND APPLICATIONS onformal mappings and bilinear transformations – Schwarz Christoffel to ametric form – Physical applications: Fluid flow and heat flow problems.	ransform	higher ovith mov	order de ving bo	rivatives - undaries - 12 rmation o
Conce Funct Isoper UN Introd bound	ept of variationals deperrimetric prob	CALCULUS OF VARIATIONS ion and its properties – Euler's equation – Functional dependant on findant on functions of several independent variables – Variational problems – Direct methods – Ritz and Kantorovich methods. CONFORMAL MAPPING AND APPLICATIONS onformal mappings and bilinear transformations – Schwarz Christoffel trametric form – Physical applications: Fluid flow and heat flow problems. TENSOR ANALYSIS ention – Contravariant and covariant vectors – Contraction of tensors	ransform	higher ovith movement of the control	order de ving bo	rivatives - undaries - 12 rmation o
Poisso UN Conce Funct Isoper UN Introd bound UI Summ Metri	ept of variationals deperrimetric prob	CALCULUS OF VARIATIONS ion and its properties – Euler's equation – Functional dependant on findant on functions of several independent variables – Variational problems – Direct methods – Ritz and Kantorovich methods. CONFORMAL MAPPING AND APPLICATIONS onformal mappings and bilinear transformations – Schwarz Christoffel trametric form – Physical applications: Fluid flow and heat flow problems. TENSOR ANALYSIS ention – Contravariant and covariant vectors – Contraction of tensors thristoffel symbols – Covariant differentiation – Gradient- Divergence and	ransform	higher ovith movement of the control	order de ving bo	12 rivatives - undaries - 12 rmation of
Poisso UN Conce Funct Isoper UN Introd bound UI Summ Metri	ept of variationals dependent ionals dep	CALCULUS OF VARIATIONS ion and its properties – Euler's equation – Functional dependant on findant on functions of several independent variables – Variational problems – Direct methods – Ritz and Kantorovich methods. CONFORMAL MAPPING AND APPLICATIONS onformal mappings and bilinear transformations – Schwarz Christoffel trametric form – Physical applications: Fluid flow and heat flow problems. TENSOR ANALYSIS ention – Contravariant and covariant vectors – Contraction of tensors thristoffel symbols – Covariant differentiation – Gradient- Divergence and	ransform	higher ovith movemation —	Transford L: 60	12 rivatives - undaries - 12 rmation o
Poisso UN Conce Funct Isoper UN Introd bound Summ Metri	ept of variationals deperrimetric probes in parametric sin parametric probes in parametric sin parametric sin parametric sin parametric tensor – Compare tensor – Compare ic tensor – Comp	CALCULUS OF VARIATIONS ion and its properties – Euler's equation – Functional dependant on findant on functions of several independent variables – Variational problems – Direct methods – Ritz and Kantorovich methods. CONFORMAL MAPPING AND APPLICATIONS onformal mappings and bilinear transformations – Schwarz Christoffel trametric form – Physical applications: Fluid flow and heat flow problems. TENSOR ANALYSIS ention – Contravariant and covariant vectors – Contraction of tensors hristoffel symbols – Covariant differentiation – Gradient- Divergence and COMES ion of Laplace and Fourier transforms to initial value, initial–boundary	ransform	higher ovith movement of the product	Transford: -Quo	12 rivatives - undaries - 12 rmation o 12 tient law -



	flow and he	at flow problem								
CO4	1 2	Ī	d sciences and slems involving	Analy	vzing					
CO5	Competentl related field	armet stant o	alysis as a tool in	the field of appli	ed sciences and	Analy	yzing			
REFE	RENCE BOO	OKS:	- 10	SHOW THEY KIND	that sylve to make	2000 L 15/06/01 (8g)	JE 01 1 - 1			
1	Andrews L. 2013	C. and Shivamo	oggi, B., "Integral T	Transforms for En	gineers", Prentice	Hall of IndiaPvt. 1	Ltd., New Delh			
2	Elsgolc, L.	D., "Calculus of	f Variations", Dove	er Publications In	c., New York, 200	7				
3		Mathews, J. H., and Howell, R.W., "Complex Analysis for Mathematics and Engineering", 6th Edition, Jones and Bartlett Publishers, 2012								
4	Kay, D. C.	., "Tensor Calc	ulus", Schaum's C	Outline Series, Ta	ta McGraw Hill	Edition,2014	izen) zaige L			
5	Naveen Ku	mar, "An Eleme	entary Course on V	ariational Problen	ns in Calculus ", N	Jarosa Publishing	House, 2005			
3	det - annoli	in avasa, - nam	ksirat/PDE/chapte		40	Chinaba a tersas inalia	ner marchille mes e energy			
4	https://www	w.britannica.com	n/science/tensor-ar	nalysis	CI	in has notice	ov to moone of w			
CO-F	O MAPPINO	<u> </u>	stroffe	TANGER P	O IXX (IXX)	TT David emalskap	isoperment ve			
. \$	COs	PO1	PO2	PO3	PO4	PO5	PO6			
ROLLES	CO1	Attack probable states	2	emonsky roleman Land Land South	ings and binness Physical applicat	mem, leatratics e e encl. streamin	Introduction in			
4	CO2			2 2						
	CO2	3	2	. 1	<u>-</u>	1	-			
	CO2	3	2	1	AWALINS	1	C- FIFTS			
				1	Canada Company	ROSALT	C- Farma			



ARIO

PPAR1	PC01	AEROSPACE PROPULSION	L	T	P	С
			3	0	0	3
COURS	SE OBJ	ECTIVES:	OUR S	11/12	GERT STATE	25
Tog	gain kno	wledge on fundamental principles of aircraft and rocket propulsion	rayou v	329	tiers.	
Too	describe	various types of propulsion system with their merits and challenges.	eraner.	ii so	10.2	M
То g	gain ade	quate knowledge on propellers and its characteristics.	No. driva?	YW.		
prop	pulsion s				her]	
		ficient information about compressors and turbines. Students also will get an exposi	ureon el	ectric	propu	118101
	thods	or Propulsion Elements', John Wiley & Sensings, May York, 9" Edition, 1957	bell' A	0-,00	1818	
UNIT	Γ – I	ELEMENTS OF AIRCRAFT PROPULSION			eli i	9
	ntation.	of piston engine, turboprop, turbofan and turbojet engines, Ram jet, Scram jet, PROPELLER THEORY	hogishw.	res/Ven	unti-	9
		ory, Blade element theory, combined blade element and momentum theory, propelle				50
perform	nance pa er select	ory, Blade element theory, combined blade element and momentum theory, propelle rameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted prion, propeller charts. INLETS, NOZZLES AND COMBUSTION CHAMBERS			eller i	50
UNIT Subsorin sup	nance pa er selection onic and personic azzles – T	rameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted prion, propeller charts. INLETS, NOZZLES AND COMBUSTION CHAMBERS supersonic inlets – Relation between minimum area ratio and external deceleration inlets – Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under a Thrust reversal. Classification of Combustion chambers – Combustion chamber per	ratio –St	tarting	g prob	9 lem
Subsorin supin noz	nance pa er select C – III onic and personic zzles – T ng – Flan	rameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted prion, propeller charts. INLETS, NOZZLES AND COMBUSTION CHAMBERS supersonic inlets – Relation between minimum area ratio and external deceleration inlets – Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under a Thrust reversal. Classification of Combustion chambers – Combustion chamber per ne stabilization	ratio –St	tarting	g prob	9 lem sion
UNIT Subsortin suptin noz	nance pa er selection onic and personic azzles – T	rameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted prion, propeller charts. INLETS, NOZZLES AND COMBUSTION CHAMBERS supersonic inlets – Relation between minimum area ratio and external deceleration inlets – Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under a Thrust reversal. Classification of Combustion chambers – Combustion chamber per	ratio –St	tarting	g prob	9 lem
Subsorin sup in noz coolin UNIT	nance pa er select C – III onic and personic zzles – T ng – Flan C – IV duction t ity polyg	rameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted prion, propeller charts. INLETS, NOZZLES AND COMBUSTION CHAMBERS supersonic inlets – Relation between minimum area ratio and external deceleration inlets – Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under a Thrust reversal. Classification of Combustion chambers – Combustion chamber per ne stabilization	ratio –Stand opting	tarting mum e e – Fl	g probexpans	9 lem sion tube
Subsorin sup in noz coolin UNIT	nance pa er select C – III onic and personic zzles – T ng – Flan C – IV duction t ity polyg	rameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted prion, propeller charts. INLETS, NOZZLES AND COMBUSTION CHAMBERS supersonic inlets – Relation between minimum area ratio and external deceleration inlets – Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under a Thrust reversal. Classification of Combustion chambers – Combustion chamber per me stabilization AXIAL FLOW COMPRESSORS, FANS AND TURBINES to centrifugal compressors- Axial flow compressor- geometry- twin spools- three gons- degree of reaction – radial equilibrium theory- performance maps- axial flow	ratio –Stand opting	tarting mum e e – Fl	g probexpans	9 lem sion tube 9
Subsorin sup in noz coolin UNIT Introd veloci veloci UNIT Introdu – solid, classific	er select: T – III Onic and personic zzles – Thing – Flam F – IV duction to ity polygity	INLETS, NOZZLES AND COMBUSTION CHAMBERS supersonic inlets – Relation between minimum area ratio and external deceleration inlets – Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under a Thrust reversal. Classification of Combustion chambers – Combustion chamber per me stabilization AXIAL FLOW COMPRESSORS, FANS AND TURBINES to centrifugal compressors- Axial flow compressor- geometry- twin spools- three gons- degree of reaction – radial equilibrium theory- performance maps- axial flowns- stage analysis- performance maps- thermal limit of blades and vanes.	ratio –Stand optir formanc spools- ow turb	stage stage ines-	g probexpans ame t analygeome	9 llem sion nube 9 ysis-etry- 9 s use sion plum
Subsorin sup in noz coolin UNIT Introd veloci veloci UNIT Introdu – solid, classific charact	nance parer selection and personic and personic zeles – Π I ng – Flam T – IV I luction to ity polygity polygit	INLETS, NOZZLES AND COMBUSTION CHAMBERS supersonic inlets – Relation between minimum area ratio and external deceleration inlets –Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under a Thrust reversal. Classification of Combustion chambers – Combustion chamber per me stabilization AXIAL FLOW COMPRESSORS, FANS AND TURBINES to centrifugal compressors- Axial flow compressor- geometry- twin spools- three gons- degree of reaction – radial equilibrium theory- performance maps- axial flowns- stage analysis- performance maps- thermal limit of blades and vanes. ROCKET AND ELECTRIC PROPULSION rocket propulsion – Reaction principle – Thrust equation – Classification of rockets and hybrid – Comparison of these engines with special reference to rocket performance electro thermal – electro static – electromagnetic thrusters- geometries of Ion	ratio –Si and optin formanc spools- ow turb	stage stage ines-	g probexpans ame t analygeome	9 lem sion sion sube 9 yysis-etry- 9 IOD
Subsorin sup in noz coolin UNIT Introd veloci veloci UNIT Introdu – solid, classific charact	nance parer select: T - III Onic and personic zzles - The properties of the polygity polygi	rameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted prion, propeller charts. INLETS, NOZZLES AND COMBUSTION CHAMBERS supersonic inlets – Relation between minimum area ratio and external deceleration in inlets – Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under a Thrust reversal. Classification of Combustion chambers – Combustion chamber per me stabilization AXIAL FLOW COMPRESSORS, FANS AND TURBINES to centrifugal compressors- Axial flow compressor- geometry- twin spools- three gons- degree of reaction – radial equilibrium theory- performance maps- axial flowns- stage analysis- performance maps- thermal limit of blades and vanes. ROCKET AND ELECTRIC PROPULSION rocket propulsion – Reaction principle – Thrust equation – Classification of rockets and hybrid – Comparison of these engines with special reference to rocket performance electro thermal – electro static – electromagnetic thrusters- geometries of Ion – hall thrusters. TCOMES sposure with the different types of propulsive devices used for jet and rocket	ratio —So and optir formanc spools- ow turb based on ace — elec n thrusto	stage stage ines- ctric pers- ctric pers- ctric pers-	g probexpans ame to analygeometric peam/p	9 lem sion ube 9 ysis-etry- 1 1 1 1 1 1 1 1 1 1 1 1 1
Subsorin sup in noz coolin UNIT Introduveloci veloci UNIT Introductassification charact	rance parer select: C – III Onic and personic zzles – Tong – Flant F – IV duction to ity polygity	rameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted prion, propeller charts. INLETS, NOZZLES AND COMBUSTION CHAMBERS supersonic inlets – Relation between minimum area ratio and external deceleration in inlets – Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under a Thrust reversal. Classification of Combustion chambers – Combustion chamber per me stabilization AXIAL FLOW COMPRESSORS, FANS AND TURBINES to centrifugal compressors- Axial flow compressor- geometry- twin spools- three gons- degree of reaction – radial equilibrium theory- performance maps- axial flowns- stage analysis- performance maps- thermal limit of blades and vanes. ROCKET AND ELECTRIC PROPULSION rocket propulsion – Reaction principle – Thrust equation – Classification of rockets and hybrid – Comparison of these engines with special reference to rocket performance electro thermal – electro static – electromagnetic thrusters- geometries of Ion – hall thrusters. TCOMES sposure with the different types of propulsive devices used for jet and rocket	ratio —Si and optin formanc spools- ow turb based on nce — elec n thrusto	stage ines- i propertic pers- th: 45	g probexpans ame to analygeometropulation peam/p	9 lem sion ube 9 ysis-etry- 1 IOD



CO4	Be able to of in jetengine		cess of combusti	on and the pa	rameters that affeo	et combustion	Analyzing
CO5	Be able to		vledge on the	basic concep	ots of various ty	pes of electric	Analyzing
REFI	ERENCE BO	OKS:			0	(2)(/1)	COURSE OBJECT
1 H	ill, PG. & Pet	erson, CR. "Me	chanics & Thern	nodynamics o	of Propulsion" Pea	rson education, 2nd	edition, 2014
			H., Rogers, GFO on Education Car		nicky and Andrew on, 2017.	Nix	2 To describe you
					Combustion Enginal Blishing Co., 1980	nes as applied to Re	ciprocating, Gas
4 C	Dates, GC,"Ae	rothermodynam	ics of Aircraft E	ngine Compo	onents", AIAA Edu	acation Series, 200	7 orthor man of 1 c
5 S	utton, GP, "Ro	ocket Propulsion	Elements", Joh	n Wiley & So	ons Inc., New Yor	k, 9th Edition, 2017	CUO SUM
WEE	SITE REFE	RENCE / NPT	EL/ SWAYAM/	MOOC REI	FERENCE:	er 200 Germana 1	a 1 2 - 24/9
etern tre	e subtitut ex	I han serious	nestrice to notice	our try mains	%20SISTEM%20I	DAYA%20GERAK/	Elements%20of%20F
2 h	ttps://en.wikip	oedia.org/wiki/P	ropeller_theory	1222-00-00-0		ORG. STORIES HOUSE	angenentasur.
3 h	ttps://en.wikip	edia.org/wiki/C	Combustor		1310	AND PERSONAL PROPERTY.	
DA FR	a sessol rower	allogary year	d) mseacom		a Phonody is a	Stade of meat char	Managaran managara
4 h	ttps://www.sc	iencedirect.com	/topics/engineer	ing/axial-flov	w-compressors		
CO-	PO MAPPIN	G	X Man		TC	II	n Hi-Tibil
	COs	PO1	PO2	PO3	PO4	PO5	PO6
	CO1	3	2	2	2	1 gottadi e	2 1000
	CO2	3	2	2	2	1	2
1000000							

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	1 noticel	care sense 1 - 2 loos
CO2	3	2	2	2	1	2
CO3	ni woli i 3 ne - min	2	2	2	2	enogytog 2 olov
CO4	3	2	2	2	2	2
CO5	3	2	Ones less	2 2 2	nad paraugon	action of not alternal



	R1PC02	FLIGHT VEHICLE AERODYNAMICS	L	Т	P	C
			3	1	0	4
OU	RSE OBJ	ECTIVES:	3			
1	To gain in	nsights into the basics of fluid flow, its model and tool to solve the fluid flow pro	blems		4./11	
2	To be fan	niliar with the conservation laws of fluid dynamics, and how to apply them to pra	actical	luid flo	ws	
3	To gain k	mowledge on elementary flows to combine and form realistic flows with suitable	assum	ptions		
4	To analys	se incompressible flow over three-dimensional bodies like wing and so on	hair d	I mis	mark!	
5	To gain k	mowledge on the basic concepts of viscous flows, boundary layers to practical flo	ows	1,3° 10		
UN	IT – I	INTRODUCTION TO AERODYNAMICS				12
Inifo	orm paralle	nt coefficient, Continuity and Momentum equations, Point source and sink, dou of flow, combination of basic flows, Pressure and Velocitydistributions on bodies of fluid flows, Magnus effect.				ılatio
UNIT - II INCOMPRESSIBLE FLOW THEORY						12
atio. UNI	IT – III	COMPRESSIBLE FLOW THEORY				12
Com	11.111					
Rayle Linea	eigh and I arized supe	y, Isentropic flow through nozzles, Normal shocks, Oblique and Expansion we Fanno Flow, Potential equation for compressible flow, Small perturbation the ersonic flow, Method of characteristics Classification of Combustion chambers of the cooling – Flame stabilization	eory, F	randtl-	Glauert	Rule
Rayle Linea perfo	eigh and I arized supe	Fanno Flow, Potential equation for compressible flow, Small perturbation th	eory, F bers –	randtl- Combu	Glauert stion ch	Rule
Rayle Linea Derfo UN Critic	eigh and I arized supermance – I IT – IV cal Mach r	Fanno Flow, Potential equation for compressible flow, Small perturbation the ersonic flow, Method of characteristics Classification of Combustion chambers are tube cooling – Flame stabilization	eory, F bers –	Prandtl- Combu	Glauert stion ch	Rule ambe
Rayle Linea Derfo UNI Critic (ASV	eigh and I arized supermance – I IT – IV cal Mach r	Fanno Flow, Potential equation for compressible flow, Small perturbation the ersonic flow, Method of characteristics Classification of Combustion chambers the cooling – Flame stabilization AIRFOILS, WINGS AND AIRPLANE CONFIGURATION IN HIGH SPORTS TO BE THE CONFIGURATION OF THE CONFIGURATION OF THE CONFIGURATION IN HIGH SPORTS TO BE THE CONFIGURATION OF THE CONF	eory, F bers –	Prandtl- Combu	Glauert stion ch	Rule ambe
Raylor Lineau Lineau UN Critic (ASV UN Basic and T	eigh and I arized supermance - 1 IT - IV cal Mach r W and FSW ITT - V cs of visco Turbulent t	Fanno Flow, Potential equation for compressible flow, Small perturbation the ersonic flow, Method of characteristics Classification of Combustion chambers the cooling – Flame stabilization AIRFOILS, WINGS AND AIRPLANE CONFIGURATION IN HIGH SP number, Drag divergence Mach number, Shock stall, super critical airfoils, trans V), Supersonic airfoils, Shock-Expansion Theory, Wave drag, Delta wings.	eory, F bers – EED F sonic a	Prandtl-Combu CLOWS Area rule	Glauert stion ch	Rule ambe
Linear Li	eigh and I arized supermance - 1 IT - IV cal Mach r W and FSW ITT - V cs of visco Turbulent t	Fanno Flow, Potential equation for compressible flow, Small perturbation the ersonic flow, Method of characteristics Classification of Combustion chambers the cooling – Flame stabilization AIRFOILS, WINGS AND AIRPLANE CONFIGURATION IN HIGH SP number, Drag divergence Mach number, Shock stall, super critical airfoils, trans V), Supersonic airfoils, Shock-Expansion Theory, Wave drag, Delta wings. VISCOUS FLOW THEORY us flow theory, Boundary Layer, Flow separation, Displacement, momentum and boundary layers, Boundary layer over flat plate, Blasius Solution, Estimation of	eory, F bers – EED I sonic a	Prandtl- Combu FLOWS area rule	Glauert stion ch	Rule amber 12 wing 12 amina amina
Linea Linea Linea UNI Critic (ASV UN Basic and t	eigh and I arized supormance – I IT – IV cal Mach r W and FSW ITT – V cs of visco Turbulent t	Fanno Flow, Potential equation for compressible flow, Small perturbation the ersonic flow, Method of characteristics Classification of Combustion chambers that the cooling – Flame stabilization AIRFOILS, WINGS AND AIRPLANE CONFIGURATION IN HIGH SPORT TO THE	eory, F bers – EED I sonic a	Prandtl-Combu FLOWS Trea rule Treation of the company of the co	Glauert estion ch e, Swept cness, La	Rule Rule Rule Rule Rule Rule Rule Rule
Linea Linea Linea UNI Critic (ASV UN Basic and t	eigh and I arized supormance — I IT — IV Cal Mach row and FSW ITT — V Cal Cal Mach row and FSW Carbulent throughout the suporman to the suporman of the suporm	Fanno Flow, Potential equation for compressible flow, Small perturbation the ersonic flow, Method of characteristics Classification of Combustion chambers of the cooling – Flame stabilization AIRFOILS, WINGS AND AIRPLANE CONFIGURATION IN HIGH SPORTURE. Tumber, Drag divergence Mach number, Shock stall, super critical airfoils, transity, Supersonic airfoils, Shock-Expansion Theory, Wave drag, Delta wings. VISCOUS FLOW THEORY Tusted the supersonic superso	eory, F bers – EED I sonic a	Prandtl-Combu FLOWS Trea rule Triction of the company of the com	Glauert stion ch	Rule ambee 12 wing 12 12 RIOD
UN UN Basicand t	eigh and I arized supermance – I IT – IV Cal Mach row and FSW CIT – V Cas of viscoo Turbulent burbulent flurbulent flurbu	Fanno Flow, Potential equation for compressible flow, Small perturbation the ersonic flow, Method of characteristics Classification of Combustion chambers tube cooling – Flame stabilization AIRFOILS, WINGS AND AIRPLANE CONFIGURATION IN HIGH SP number, Drag divergence Mach number, Shock stall, super critical airfoils, trans V), Supersonic airfoils, Shock-Expansion Theory, Wave drag, Delta wings. VISCOUS FLOW THEORY us flow theory, Boundary Layer, Flow separation, Displacement, momentum and boundary layers, Boundary layer over flat plate, Blasius Solution, Estimation of low, The Reference Temperature Method. TCOMES	eory, F bers – EED I sonic a	Prandtl-Combu FLOWS Trea rule Triction of the process of the pr	Glauert stion chestion chestio	Ruldamber 12 wing 12 12 RIOD



CO4		he knowledge on thue shock waves and	ermodynamic state of the expansion waves	e gas behind norm	al	Analyzing					
CO5	Be provided with a turbulent boundary		on the basic concepts o	f laminar and		Analyzing					
REFI	ERENCE BOOKS:	0			20VH2	vire°aatuba					
1	J.D. Anderson, Fund	lamentals of Aerody	namics, McGraw-Hill E	Education, 6th edition	on, 2017	n-risport T					
2	Rathakrishnan.E, G	as Dynamics, Prent	ice Hall of India, 7th ed	ition, 2020	udo anti dise acid	esti olef					
3	Shapiro, AH, "Dynamics & Thermodynamics of Compressible Fluid Flow", Ronald Press, 1982.										
4	Houghton, EL and Caruthers, NB, "Aerodynamics for Engineering Students", Butterworth-Heinemann series, 7 th edition 2017										
5	Zucrow, M.J, and	Anderson, J.D, "El	lements of gas dynami	cs" McGraw-HillE	Book Co., New	York, 1989.					
WEB	SITE REFERENC	E / NPTEL/ SWAY	AM/ MOOC REFERE	ENCE:	HOMOSTY !	1 1 1271					
1	https://eng.libretext		Aerospace_Engineering/	Aerodynamics_and	d_Aircraft_Perfo	rmance_(Marchma					
2	https://archive.npte	l.ac.in/courses/101/1	105/101105059/	a protession in		100 pag terebut 1					
3	https://en.wikipedia	.org/wiki/Aerodyna	mics	AND SERVED	N. OSLEVI SA	H 1971					
4	https://en.wikipedia	.org/wiki/Spacecraf	ft_electric_propulsion	111	and or busine	ni l'dictrona cidil i					
CO-	PO MAPPING	- CO		VIX	a y legico	in ries					
C	Os PO1	PO2	PO3	PO4	PO5	PO6					
C	01	and the second	3.9.1	1011	3	mus lastquasid					
C	02	E RESIDENCE PAR	3	FERRA 1808 BY	2	1					
C	03	er en elicinarias en us Agai arabia	3	1	2	Crifford Marking					
C	04 _			3 1		1					
C	O5 _	-	3	1	2	1					



ARIH

PPAR	21PC03	ANALYSIS OF COMPOSITE STRUCTURES	L	T	P	C			
		A SHOW TO A SHOW THE	3	0	0	3			
COUR	RSE OB.	JECTIVES:	JC7E	14.75	THE P	dat.			
1	To im	part knowledge on the macro mechanics of composite materials	(n 4)	i retu	A	1			
2		ermine stresses and strains in composites and also imparts an idea about the manufactu site materials	ringi	nethod	ls of				
3	To get	an idea on failure theories of composites		mole		į,			
4	compo	ovide the basic knowledge on the properties of fibre and matrix materials used in commosites as well as some common manufacturing techniques	ercia	l pitte					
5	To gai	To gain knowledge on the basic concepts of acoustic emission technique							
UNI	T-I	FIBERS, MATRICES, AND FABRICATION METHODS				9			
Proper	rties of In	Properties of Glass, Carbon and Aramid Fibers – Thermosetting and Thermoplastin portance to the Composite, Summary of Fabrication Processes – Scope of Compositions.				450			
UNIT - II MICROMECHANICS OF A UNIDIRECTIONAL COMPOSITE						9			
Stres Mate Stres	erial-Trai	sis of an Orthotropic Lamina-Hooke's Law-Stiffness and Compliance Matrices and Strain		ecially	Ortho	9 otrop			
UNIT	Γ-IV	ANALYSIS OF LAMINATED COMPOSITES				9			
Lam Lam	inate De inate - (ains - Variation of Stresses in a Laminate - Resultant Forces and Moments - Synthese scription System - Construction and Properties of Special Laminates - Symmetric Cross-Ply, and Angle-Ply Laminates - Quasi-isotropic Laminates - Determination of ermination of Hygrothermal Stresses - Analysis of Laminates after Initial Failure.	Lan	ninates	- Ba	lance			
UNI	T - V	ANALYSIS OF LAMINATED PLATES AND BEAMS			100	9			
	y – Ben	uations For Laminated Composite Plates Governing Equations for Laminated I ding, Buckling and Vibration of Laminated Beams and Plates repair-Analysis of sar							
	N		TOT	'AL: 4	5 PER	IOD			
COU	RSE OU	TCOMES		Bloor	ns Lev	/el			
CO1	To calculate the elastic and strength properties of unidirectional laminates using micromechanicstheory Applyin								
CO2	To an	alyse a composite laminate using the different failure theories		Ana	alyzing	ŗ			
CO3		elect the most appropriate manufacturing process for fabricating composite onents		Reme	emberi	ng			
	comp	onents							



CO4	To demonst	rate uno	derstanding of the	lifferent materials (f	ibres, resins, cores) u	ised in	Understanding					
CO5	To gain kno monitoring			e inspection (NDI) a	nd structural health		Analyzing					
REFE	RENCE BOO	OKS:			g ·	27410	alao azadon					
1	Autar K Ka	w, "Med	chanics of Compos	site Materials", CRC	Press, 2nd edition, 2	2015	menn of					
2	Agarwal, F		Broutman, LJ,	"Analysis and Perf	ormance of Fibre C	Composites", John	Wiley& Sons, 3 ^r					
3		Calcote, LR, "The Analysis of laminated Composite Structures", Von -Nostrand Reinhold Company, New York, 1998										
4	Isaac M. Da	aniel &0	OriIshai, " Mechar	nics of Composite M	aterials", OUP USA	publishers, 2ndedi	tion, 2005					
5	Lubing, "F	landboo	k on Advanced P	lastics and Fibre Gl	ass", Von Nostran I	ReinholdCo., New	York, 1989					
WEBS	 SITE REFER	ENCE	/ NPTEL/ SWAY	AM/ MOOC REFE	RENCE:		l le mou					
1.	https://www	v.compo	ositesworld.com/a	rticles/fabrication-me	ethods	ertange to the Cor	med to solventeral					
2	https://www	v.degru	yter.com/documen	t/doi/10.1515/secm-	2016-0088/html?lan	g=en						
3	http://ethes	is.nitrkl	.ac.in/5878/1/1101	ME0335-6.pdf	The standard and the standard	en samon sa	oW bin simile\					
4	http://www	ae.iitkg	gp.ac.in/ebooks/ch	apter7.html		e verstalini. Georgia – Preni	inter - garana. 2 byja saontijes?					
CO-P	O MAPPINO	}					Valuese Praedoes					
CC	Os PO	01	PO2	PO3	PO4	PO5	PO6					
CC	01	2	der Phys. Structus of Set	lineante 2	overed & Specially Common	A CHIEF BY 3	Mangrial-Transi Stress-Desermin					
CC	O2	2	2010007 586	2	n med sine wiend p a DO CETTAVIMA.	3	Mot consiligated					
CC	03	media	E - atravals bu	2 m 2 m 2 m	Liamin Francisco	2	in is went on t					
C	04	to non	mine de la compania del compania de la compania de la compania del	1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	C - esteratores alla	2	ro deplus					
C	05			2		Para priority ha ora	7-7120					

Q.

	101	RESEARCH METHODOLOGY AND IPR	L	T	P	С
			3	0	0	3
COURSE O	BJECT	IVES:				
1	To und	erstand the research design		T	2	
2	To kno	w data collection and sources	le si		7	
3	To awa	are data analysis and reporting			ų.	
4	To unc	lerstand the concepts of Intellectual Property Rights	fortP			
5	To kno	w the objectives and benefits of Patent				
UNIT -	- I	RESEARCH DESIGN				9
		n studies, Experiments and Surveys.				9
UNIT -	- 11	DATA COLLECTION AND SOURCES				y
UNIT-	- 111	DATA ANALYSIS AND REPORTING				u
Overview of	f Multiva	ariate analysis, Hypotheses testing and Measures of Association. Presenting Insight oral presentation	sanc	l find	9	9 Ising
Overview of	f Multiva orts and c	ariate analysis, Hypotheses testing and Measures of Association. Presenting Insight	sanc	l find	9	
Overview of written repo UNIT - Intellectua Trade secr	f Multiva orts and control of the co	ariate analysis, Hypotheses testing and Measures of Association. Presenting Insight oral presentation	opme ght c	ent pro	ocess,	sing 9
Overview of written repo UNIT - Intellectua Trade secr	f Multiva orts and co - IV al Proper rets, utility rules of I	INTELLECTUAL PROPERTY RIGHTS Ly – The concept of IPR, Evolution and development of concept of IPR, IPR development of IPR & Bio diversity, Role of WIPO and WTO in IPRestablishments, Right	opme ght c	ent pro	ocess,	sing 9
Overview of written report UNIT - Intellectua Trade secre Common remaintenan UNIT - Patents - coapplication,	f Multivaries and control of IV Il Properrets, utility rules of I ace - V Objectives, process	INTELLECTUAL PROPERTY RIGHTS Ly – The concept of IPR, Evolution and development of concept of IPR, IPR development of IPR, Bio diversity, Role of WIPO and WTO in IPRestablishments, Right PR practices, Types and Features of IPR Agreement, Trademark, Functions of UNE: PATENTS Is and benefits of patent, Concept, features of patent, Inventive step, Specificates E-filling, Examination of patent, Grant of patent, Revocation, Equitable As patents, patent agents, Registration of patent agents.	oppme ght c SCO	ent pro of Pro o in IP , Type	ocess, perty, PR	9 pater
UNIT - Intellectua Trade secr Common r maintenan UNIT - Patents - c application,	f Multiva orts and control of the co	INTELLECTUAL PROPERTY RIGHTS Ly – The concept of IPR, Evolution and development of concept of IPR, IPR development of IPR, Bio diversity, Role of WIPO and WTO in IPRestablishments, Right PR practices, Types and Features of IPR Agreement, Trademark, Functions of UNE: PATENTS Is and benefits of patent, Concept, features of patent, Inventive step, Specificate E-filling, Examination of patent, Grant of patent, Revocation, Equitable As patents, patent agents, Registration of patent agents.	oppme ght c SCO	ent proof Proof Proof in IP	ocess, perty, PR	9 pate eence
UNIT - Intellectua Trade secr Common r maintenan UNIT - Patents - c application, Licensing o	f Multivaries and corts and corts and corts and corts and corts are set of Properties, utilities of I ace — V objective, process of related OUTCO	INTELLECTUAL PROPERTY RIGHTS Ly – The concept of IPR, Evolution and development of concept of IPR, IPR development of IPR, Bio diversity, Role of WIPO and WTO in IPRestablishments, Right PR practices, Types and Features of IPR Agreement, Trademark, Functions of UNE: PATENTS Is and benefits of patent, Concept, features of patent, Inventive step, Specificate E-filling, Examination of patent, Grant of patent, Revocation, Equitable As patents, patent agents, Registration of patent agents.	oppme ght c SCO	ent proof Proof Proof In IP , Type ment L: 45	ocess, perty, PR	9 pate cence
Overview of written report UNIT - Intellectual Trade secret Common remaintenant UNIT - Patents - complication, Licensing of COURSE CO	orts and control of Multivaries and control of Incomplete in Incomplete	INTELLECTUAL PROPERTY RIGHTS Ly — The concept of IPR, Evolution and development of concept of IPR, IPR development of the properties, Types and Features of IPR Agreement, Trademark, Functions of UNES PATENTS Is and benefits of patent, Concept, features of patent, Inventive step, Specificates E-filling, Examination of patent, Grant of patent, Revocation, Equitable As patents, patent agents, Registration of patent agents. TOMES Ilculate the elastic and strength properties of unidirectional laminates using	oppme ght c SCO	ent pro of Pro of in IP , Type ment L: 45	ocess, perty, PR	9 9 pate cencee
Overview of written report UNIT - Intellectual Trade secrement Common remaintenant UNIT - Patents - capplication, Licensing of COURSE	f Multivaries and corts and corts and corts and corts and corts and corts are set of I are set o	INTELLECTUAL PROPERTY RIGHTS Ly — The concept of IPR, Evolution and development of concept of IPR, IPR development of the properties of IPR & Bio diversity, Role of WIPO and WTO in IPRestablishments, Right PR practices, Types and Features of IPR Agreement, Trademark, Functions of UNES and benefits of patent, Concept, features of patent, Inventive step, Specificates E-filling, Examination of patent, Grant of patent, Revocation, Equitable As patents, patent agents, Registration of patent agents. TOMES Ilculate the elastic and strength properties of unidirectional laminates using mechanicstheory	oppme ght co SCO attion	ent pro of Pro of Pro of in IP , Type ment Ap An	ocess, perty, PR es of s, Licons Leoplying	9 9 pate cencee RIOF evel g



CO5	To gain knowledge on n		spection (NDI)	and structural he	ealth	Remembering
	monitoring of composite	es			September 1	
REFEREN	ICE BOOKS:					
1	Cooper Donald R, Schin Hill Education, 11e (20		nd Sharma JK, '	Business Resear	ch Methods", T	ataMcGraw
2	Catherine J. Holland, 6 Press, 2007	'Intellectual prop	perty: Patents,	Гrademarks, Сор	yrights,Trade S	Secrets", Entrepreneu
3	David Hunt, Long Nguy	en, Matthew Ro	dgers, "Patent s	earching: tools &	techniques", W	iley,2007
4	The Institute of Compound of Professional Programme REFERENCE / NPTEL	ne Intellectual Pi	operty Rights, l	Law and practice		
WEBSITE			Language Company	NCE:	ow the objective	ni of L
1	https://emeritus.org/in/l	earn/types-of-res	earch-design/			
2	https://www.analyticsvi	dhya.com/blog/2	022/03/an-over	view-of-data-col	lection-data-sou	rces-and-data-mining
3	https://en.wikipedia.org	/wiki/Intellectua	l_property	ing the system.	on studies, Pape	new pach (Jingerraph
4	https://www.wipo.int/pa	atents/en/	3508362-0	MA WOOD SEE	(0°) / (F2/B	A THEFT
CO-PO M	IAPPING		ostajon je bang	ogramolyjan) g	Jan January	MA sensor merch
CC	PO1	PO2	PO3	PO4	PO5	PO6
CO	01 2		2		3	1
CC	2	-	2	-	3	one across 1 conse
CC		-	2		2	1
CC	04 -	_	2	NORA TAILE	2	1
, Artista	#1PR, IPB des lopiners pi	Instance to topic	hopese pre in	adovil SH to	pomo unt - g	provide chart Prope
CC)5 -	E TOTAL POET METERS	2	With the charge	1	mar sarias losar

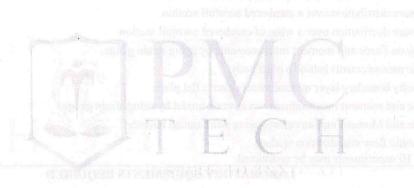


PPAR	IPL01		AERODYNAM	IICS LABORATORY		L	Т	P	C
2	信任	60%	MDS.	693	103	109		Taken Y	
						0	0	4	2
COUR	SE OBJECTI	VES:		0 ::				inche	
1	To gain know	ledge on the pri	inciples of subson	ic wind tunnel and their o	peration	£ .		503	
2	To acquire princompressib		ge on various aero	odynamic principles relate	ed to inviscid			800	
3	To calculate	various aerodyn:	amic characteristi	ics of various objects					
4	To characteri	ze laminar and t	urbulent flows						
5	To get practic	cal exposure on	flow visualization	techniques pertaining to	subsonic flows	ř.		203	
			LIST	OFEXPERIMENTS					
1.	Calibration	of subsonic win	ıd tunnel.						_
2.			smooth cylinder.						
3.			rough cylinder.						
4.			symmetric aerofo	oil section					
5.			cambered aerofo						
6.				ed aerofoil section.					
7.			palacine and the second second second	by using strain gauge.					
8.	The state of the s	surements behind		by using strain gauge.					
			THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.	a flat wlata					
9.			easurements over						
10.				model by using strain ga	uge.				
11.			ements using win	d tunnel balance.					
12.		ow visualization		LLL					
	Any 10 exp	periments may b		Y EQUIPMENTS REQU	TRED				1
1.	Subsonic w	vind tunnel							-
2.	Rough and	smooth cylinder	r						
3.	Symmetric	al and Cambered	d aerofoil						
4.	Wind tunn								
5.	Pressure Ti								
6.	Blower								
7.		dels like flat pla	ate, bluff body						
						TOT	TAL: 6	0 PER	IODS
COUL	RSE OUTCOM	IES					Bloo	ms Lev	el
CO1	Able to oper	ate and calibrate	e subsonic wind to	unnel			Ap	plying	
CO2	Able to anal	yse the pressure	distribution over	the streamlined and bluff	bodies		Aŗ	plying	
CO3	Able to carr	y out measureme	ent of force and m	noments on aircraft model	S		An	alyzing	
CO4	Capable of r	neasuring bound	dary layer thickne	ess over various models			An	alyzing	
CO5	Able to carr	y out flow visua	lization at subson	ic speeds			An	alyzing	i



CO-PO MAI	PPING					
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1 ,	3	1	2	- 0	3	rograe k aoo.
CO2	3	- Piotima lo	night by 2 banks bel	Sixozius la sala	poor adg a agis h	online sil
CO3	3	b) selection and sur	nkm zakrawang suman 2	cuoren audinav ne	3	n maspes of 1
CO4	3	1	2	o et se annustes o	mis the personal and	stational of 2
CO5	3	seoli linoshi s	n manin 2 va esemble	on and suffigure v	all no vi3 regrates	i la get paren





Estime models like the plans blust body

COLLABOR CONTROL Able to operate and callonate alphanism over the streamhord and in the str

PPAR1PL	02 AIRCRAFT PROPULSION LABORATORY	L	T	P	
		0	0	4	
OURSE O	BJECTIVES:	Q.			
1 1	To gain knowledge on wall pressure distribution on subsonic inlets and nozzles				Š
2	To perform testing on compressor blades			00-	
3	To interpret the experimental data using software				
4	To get practical exposure on flow visualization techniques pertaining to supersonic jets				
5	To gain basic knowledge on cold flow studies		- 5	0.1	Y
	LIST OF EXPERIMENTS				
l. W	all pressure measurements of a subsonic diffuser.				n,
	ascade testing of compressor blades.				
	ressure distribution on a cavity model.				
	'all pressure measurements on non-circular combustor.				
	'all pressure measurements on converging nozzle.				
	'all pressure measurements on convergent-divergent nozzle.				
7. T	otal pressure measurements along the jet axis of a circular subsonic jet.				
3. T	otal pressure measurements along the jet axis of a circular supersonic jet.				
9. T	otal pressure measurements in the radial direction of the subsonic jet.				
10. T	otal pressure measurements in the radial direction of the supersonic jet.				
11. C	old flow studies of a wake region behind flame holders.				
12. P	rediction of flow angles using angle probe.				
A	ny 10 experiments may be conducted.		134		
	LABORATORY EQUIPMENTS REQUIRED				
	ubsonic wind tunnel				
2. H	ligh speed jet facility				
	lower				
	ressure scanner				
5. N	Tozzle and cavity models	ОТА	L: 60	PERI)I
		1	Bloon	ns I ev	.1
COURSE	DUTCOMES	2		is Devi	21
CO1			Ana	lyzing	51
	DUTCOMES				
CO1	Able to perform wall pressure distribution on subsonic and supersonic nozzles Able to acquire knowledge on fundamental concepts of low speed jets and experimental techniquespertain to measurements		Ana	lyzing	21
CO1	Able to perform wall pressure distribution on subsonic and supersonic nozzles Able to acquire knowledge on fundamental concepts of low speed jets and experimental		Ana	lyzing	
CO2	Able to perform wall pressure distribution on subsonic and supersonic nozzles Able to acquire knowledge on fundamental concepts of low speed jets and experimental techniquespertain to measurements Provided with adequate knowledge on pressure distribution on cavity models Able to perform wake survey methods		Ana	lyzing	
CO1 CO2	Able to perform wall pressure distribution on subsonic and supersonic nozzles Able to acquire knowledge on fundamental concepts of low speed jets and experimental techniquespertain to measurements Provided with adequate knowledge on pressure distribution on cavity models		Ana Ana Ana	lyzing	



O-PO MAPPI	NG					
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	<u>.</u>	2	1 •
CO2	3	2	2	and otallo const	lles to 2 follows:	1
CO3	3	2	2	- 100	2	1
CO4	3	2	2		но зависи 2 чентини	eg of 1 #
CO5	3	2	2	oston <u>e</u> san hi	2	1





PPA	R2PC04	ADVANCED FLIGHT DYNAMICS	L	T	P	C
		DESTRUCTION STORES TO TOTAL TO THE METER WITH THE STRUCT OF THE STRUCT O	3	0	0	3
COU	RSE OB	JECTIVES:	2270	E BEK	HELLER	113
1	To gaini	ng depth knowledge on aircraft performance in level, climbing, gliding flight mod	des	2.00%	nistreft	ŧ.
2	To get fa	amiliarize the equations of motion in accelerated flight modes	dir.	CIL AD	maint i	K.
3	To impa	rt knowledge on the basic aspects of stability and control of an airplane about three	ee axis	Shirm	to Sulf	7
4	To provi	de adequate knowledge on various parameters that decide the stability level of an	airpla	ine	edolM -	
5	To be far	miliar with the aspects of control in longitudinal, lateral and directional modes	lagita'	· Ja .	melsvi	ā
UN	IT – I	STEADY FLIGHT PERFORMANCE			e ou la	9
Over	view of A	erodynamics and ISA – Straight and level flight: thrust and power required/availa	ible, di	ifferenc	es of pro	peller
		powered airplanes, maximum speed, effects of altitude - Climb and Descent pe				le and
rate	of climb, d	lescent angle and rate of descent - Range, endurance of propeller driven and jet	power	ed airpl	lanes.	
UN	IT – II	MANEUVER PERFORMANCE	day or	n, topic	Atapu j	9
		aximum producible load factor – fastest and tightest turn – Vertical maneuver: pu gram –Take-off and landing performance.	, hi buti	ole be no	A CONTRACTOR	
KINI	TOTAL TAX			المراقرة	inter con	0
	IT – III tic equilib	STATIC LONGITUDINAL STABILITY AND CONTROL rium and stability – Pitch stability of conventional and canard aircraft – control f	fixed n	eutral p	point and	9
Sta stat neu con	tic equilib tic margin itral point itrol force		nge mo	ment -	- control	
Sta stat neu con	tic equilib tic margin ıtral point	rium and stability – Pitch stability of conventional and canard aircraft – control f – effect of fuselage and running propellers on pitch stability – control surface hir – limit on forward CG travel –maneuver stability: Pull –up & level turn – control	nge mo	ment -	- control	
Sta stat neu con UN	tic equilib tic margin atral point atrol force IT – IV w and side	rium and stability – Pitch stability of conventional and canard aircraft – control f – effect of fuselage and running propellers on pitch stability – control surface hin – limit on forward CG travel –maneuver stability: Pull –up & level turn – control for maneuver– measurement of neutral point and maneuver point by flight tests.	ity – ri	oment - and trir	- control in tabs –	free 9
Start neuron con UN Ya free	tic equilib tic margin atral point atrol force IT – IV w and side	rium and stability – Pitch stability of conventional and canard aircraft – control f – effect of fuselage and running propellers on pitch stability – control surface hir – limit on forward CG travel –maneuver stability: Pull –up & level turn – control for maneuver– measurement of neutral point and maneuver point by flight tests. STATIC LATERAL, DIRECTIONAL STABILITY AND CONTROL e slip, effect of wing sweep, wing dihedral and vertical tail on directional stability	ity – ri	oment - and trir	- control in tabs –	free 9
State state con UN Ya free UN	tic equilib tic margin atral point atrol force IT – IV w and side e – yaw co	rium and stability – Pitch stability of conventional and canard aircraft – control from effect of fuselage and running propellers on pitch stability – control surface hir – limit on forward CG travel –maneuver stability: Pull –up & level turn – control for maneuver – measurement of neutral point and maneuver point by flight tests. STATIC LATERAL, DIRECTIONAL STABILITY AND CONTROL et slip, effect of wing sweep, wing dihedral and vertical tail on directional stabilisation – rudder sizing – pedal force - dihedral effect: contribution of various compositions.	ity – ru	oment - and trir udder fi - roll co	ixed and	free 9 rudde
Sta state neu corr UN Ya free UN Rigi equa of ec	tic equilibitic marginutral point atrol force IT – IV w and side e – yaw co	rium and stability – Pitch stability of conventional and canard aircraft – control f – effect of fuselage and running propellers on pitch stability – control surface hir – limit on forward CG travel –maneuver stability: Pull –up & level turn – control for maneuver – measurement of neutral point and maneuver point by flight tests. STATIC LATERAL, DIRECTIONAL STABILITY AND CONTROL e slip, effect of wing sweep, wing dihedral and vertical tail on directional stabilisantrol – rudder sizing – pedal force - dihedral effect: contribution of variouscompositions of the contribution of variouscompositions of va	ity – roonents	udder for roll control	ixed and ontrol. of longing — linear	free 9 rudde 9 tudina izatio
Sta star neu con UN Ya free UN Rigir equa of eco	tic equilibitic marginutral point atrol force IT – IV w and side e – yaw co	rium and stability – Pitch stability of conventional and canard aircraft – control from effect of fuselage and running propellers on pitch stability – control surface hir – limit on forward CG travel –maneuver stability: Pull –up & level turn – control for maneuver – measurement of neutral point and maneuver point by flight tests. STATIC LATERAL, DIRECTIONAL STABILITY AND CONTROL et slip, effect of wing sweep, wing dihedral and vertical tail on directional stabilisentrol – rudder sizing – pedal force - dihedral effect: contribution of various compositions of motion - Axes systems and their significance – Euler angles – rece and moment derivatives – short period and phugoid approximations – purepi	ity – roonents	udder for roll control	ixed and ontrol. of longing — linear	free 9 rudde 9 tudina ization Inerti
Sta state neu con UN Ya free UN Rigii equa of ec coup	tic equilibitic marginutral point atrol force IT – IV w and side e – yaw continued by the point atrol force atrons – for quations for force atrons for the poling.	rium and stability – Pitch stability of conventional and canard aircraft – control from effect of fuselage and running propellers on pitch stability – control surface hir – limit on forward CG travel –maneuver stability: Pull –up & level turn – control for maneuver – measurement of neutral point and maneuver point by flight tests. STATIC LATERAL, DIRECTIONAL STABILITY AND CONTROL et slip, effect of wing sweep, wing dihedral and vertical tail on directional stabilisentrol – rudder sizing – pedal force - dihedral effect: contribution of various compositions of motion - Axes systems and their significance – Euler angles – rece and moment derivatives – short period and phugoid approximations – purepi	ity – roonents	udder for a control co	ixed and ontrol. of longing - linear vawing -	free 9 rudde 9 tudina izatio Inerti
Sta state neu con UN Ya free UN Rigi equa of ec coup	tic equilibitic marginutral point atrol force IT – IV w and side e – yaw continued by the partitions – for equations fooling.	rium and stability – Pitch stability of conventional and canard aircraft – control from effect of fuselage and running propellers on pitch stability – control surface hir – limit on forward CG travel –maneuver stability: Pull –up & level turn – control for maneuver – measurement of neutral point and maneuver point by flight tests. STATIC LATERAL, DIRECTIONAL STABILITY AND CONTROL e slip, effect of wing sweep, wing dihedral and vertical tail on directional stabilization – rudder sizing – pedal force - dihedral effect: contribution of various composition of motion – Axes systems and their significance – Euler angles – rece and moment derivatives – short period and phugoid approximations – purepion lateral – directional motion – roll, spiral and dutch roll approximations- Pure received.	ity – roonents	udder for a control co	ixed and ontrol. of longing – linear vawing –	free 9 rudde 1 tudina izatio Inerti
Sta state neuron con UN Ya free UN Rigin equation of economic court.	tic equilibitic marginutral point atrol force IT – IV w and side e – yaw continue – yaw continue – to desire the side e – yaw continue – to desire e – to	rium and stability – Pitch stability of conventional and canard aircraft – control for effect of fuselage and running propellers on pitch stability – control surface hir – limit on forward CG travel –maneuver stability: Pull –up & level turn – control for maneuver – measurement of neutral point and maneuver point by flight tests. STATIC LATERAL, DIRECTIONAL STABILITY AND CONTROL e slip, effect of wing sweep, wing dihedral and vertical tail on directional stabilistic outrol – rudder sizing – pedal force - dihedral effect: contribution of various composition of motion – Axes systems and their significance – Euler angles – rece and moment derivatives – short period and phugoid approximations – purepion lateral – directional motion – roll, spiral and dutch roll approximations – Pure recorded to the contribution of th	ity – roonents	udder fire roll control of the second contro	of longing – linear vawing – : 45 PEI	free 9 rudde 1 tudina izatio Inerti



CO4	Be ab	le to describ	e the effect of	change in CG on th	e aircraft stability		Analyzing
CO5	latera		ntions, construc		nd identify longituding Is for longitudinal and		Analyzing
REFE		E BOOKS:				a -	COLEGE OBJECTS
1	Perkin	s CD &Hage	e, RE, "Airplan	e performance, sta	bility and control", Wi	lley India Pvt Ltd, 2	2011 garage CU
2	Ander	son, JD, "Ai	rcraft Performa	nce & Design", Fi	irst edition, Mc Graw	Hill India,2010	2 t Troise faculturi
3					Flight Mechanics", 2		ilev& Sons, 1995
4					cond edition, Elsevier		com shirters of the
					المحروب فللبار أبانا فللأراق		D WOLLD TO SHOW
5	Nelson	ı, RC, "Fligl	nt Stability & A	Automatic Control	', Second edition, Mc	Graw-Hill,2017	A MILLIANDE NO TALL
WEB	SITE I	REFERENC	CE / NPTEL/ S	SWAYAM/ MOOC	C REFERENCE:		
1		and this own	a.org/wiki/Stea	n in indicators that	Steady%20flight%2C	%20unaccelerated%	%20flight%2C%20or,a
2	https:/	/www.globa	lspec.com/refer	rence/43619/20327	9/chapter-10-maneuv	er-performance	cate of chimb, descent
3	https:/	Janns dtic m	il/sti/tr/pdf/AD	A319976 ndf			
,	пирэл	apps.acro.m	in strumpum no	1131770.put			
4	https:/	/en.wikiped	ia.org/wiki/Airo	craft_flight_dynam	ics	pulled but to the	il cannot be design
CO-F	PO MA	PPING		V S Soon Look		e Agroviça on	AND THE THE
C	Os	PO1	PO2	PO3	PO4	PO5	PO6
C	01	orn ing so	2	2	2	of the Colorador and an	nestra point - haire
C	02	1	1000	100 SM 2 7 11 M	ATE JAM 2	2	A Z YE TEN
C	03	ed sebbas – jos lidi – no	gilidela larin e grandasiari e	2	2	and a substitution of the	is jills abor him wa'Y ne inunci may esti
C	04	2	2	2	2	1	1
C	05	2	1	2	3	ALL ATTEMA	1





PPAI	R2PC05	AEROSPACE STRUCTURES	L	T	P	C
	20 A SEE A	ntiburédica af chand, cuanariell ablau sad aise un id na httl att agas Gabhaalitet.	3	1	0	4
OUR	SE OBJECT	IVES:	ate mgles	th balls sx	Tank	750
1	To gain impo	ortant technical aspects on the theory of bending of structures.		de de la co		
2	To learn the	key aspects of shear flow in open and closed sections.				
3	To study the	stability problems in structures with various modes of loading.	r este Estima		HEROTE !	
4	To analyse a	ircraft structural components under various forms of loading.	nozbi.	K. Pon	soured !	
5	To have basi	c idea about the importance of flight envelope	miA ^ν .	in. PMG	and I	
τ	JNIT – I	BENDING OF BEAMS		ALLA ELL		12
τ	INIT – II	SHEAR FLOW IN THIN-WALLED SECTION n and displacement relationships for open section thin-walled beams—	rendom Sedielo	ng yeneye. rubandili	La pan	12
flow	in thin walled	open sections - Determinations of the shear centre - Symmetrical and	unsymn	netrical c	ross-secti	ons –
Desig	r flow due to b gn of thin-wall NIT – III	ending in open sections - Torsion of thin-walled open section member				12
Design U	gn of thin-wall NIT – III r flow in thin- flange and mu ulti-cell tubes	ending in open sections – Torsion of thin-walled open section member ed members SHEAR FLOW IN CLOSED SECTIONS walled closed sections – Symmetrical and unsymmetrical sections – Flutti-flange box beams – Determinations of the shear centre – Bredt-Bat – Shear flow due to combined bending and torsion – Stress analysis o	lexural s	shear flo	w in two	flange,
Shear three in m wing	gn of thin-wall NIT – III r flow in thin- flange and mu ulti-cell tubes	ending in open sections – Torsion of thin-walled open section member ed members SHEAR FLOW IN CLOSED SECTIONS walled closed sections – Symmetrical and unsymmetrical sections – Flulti-flange box beams – Determinations of the shear centre – Bredt-Bat	lexural s	shear flo	w in two	flange,
Sheathree in m wing U	gn of thin-wall INIT – III r flow in thin- flange and mu ulti-cell tubes g spar – Introdu INIT – IV ility problems ling coefficier ened panels – cal load for a fl	ending in open sections – Torsion of thin-walled open section member ed members SHEAR FLOW IN CLOSED SECTIONS walled closed sections – Symmetrical and unsymmetrical sections – Flutti-flange box beams – Determinations of the shear centre – Bredt-Bat – Shear flow due to combined bending and torsion – Stress analysis of a strength of thin walled structures – Buckling of sheets under compression, stat – Inelastic buckling of plates – Sheet-stiffener panels – Effective was Crippling stress estimation – Local Buckling – Wagner beam theory at plate – Principles of stiffener/web construction.	lexural sho theo f aircra	shear flo ry – Tors ft compo	w in two sional she onents – T	flange, ar flow Capered 12 s – Plate plates an nation of
Shea three in m wing U	gn of thin-wall INIT – III r flow in thin- flange and mu ulti-cell tubes g spar – Introdu INIT – IV ility problems ling coefficient ened panels – cal load for a flu UNIT – V	shear flow In CLOSED SECTIONS walled closed sections – Symmetrical and unsymmetrical sections – Flutti-flange box beams – Determinations of the shear centre – Bredt-Bat – Shear flow due to combined bending and torsion – Stress analysis of the shear lag. STABILITY PROBLEMS of thin walled structures – Buckling of sheets under compression, set – Inelastic buckling of plates – Sheet-stiffener panels – Effective we Crippling stress estimation – Local Buckling – Wagner beam theory at plate – Principles of stiffener/web construction. ANALYSIS OF AIRCRAFT STRUCTURAL COMPONENTS	lexural sho theo f aircra	shear flo ry – Tors ft compo nd comb Failure s erimenta	w in two sional she onents – T	flange, ar flow Capered 12 s – Platolates annation of
Sheathree in m wing U Stab buck stiffe critic U Aircra curve	gn of thin-wall INIT – III r flow in thin- flange and mu ulti-cell tubes g spar – Introdu INIT – IV illity problems ling coefficier ened panels – cal load for a fl UNIT – V aft Loads – Sy – The flight en ural parts of w	ending in open sections – Torsion of thin-walled open section member ed members SHEAR FLOW IN CLOSED SECTIONS walled closed sections – Symmetrical and unsymmetrical sections – Flutti-flange box beams – Determinations of the shear centre – Bredt-Bat – Shear flow due to combined bending and torsion – Stress analysis of a strength of thin walled structures – Buckling of sheets under compression, stat – Inelastic buckling of plates – Sheet-stiffener panels – Effective was Crippling stress estimation – Local Buckling – Wagner beam theory at plate – Principles of stiffener/web construction.	skear, avidth - Exp	shear flo ry – Tors ft compo nd comb Failure s erimenta dynamic of the w uction to	w in two sional she onents – To loads & Sing and f Aeroelas	flange, ar flow Capered 12 s - Plan plates an nation of 12 Schrenk cuselage ticity an
Shea three in m wing U Stab buck stiffe critic U Aircra curve Struct shells	gn of thin-wall INIT – III r flow in thin- flange and mu ulti-cell tubes s spar – Introdu INIT – IV ility problems cling coefficier ened panels – cal load for a fl UNIT – V aft Loads – Sy – The flight en cural parts of w	shear flow due to combined bending and torsion – Stress analysis of thin walled structures – Buckling of sheets under compression, so to Inleastic buckling of plates – Sheet-stiffener panels – Effective w Crippling stress estimation – Local Buckling – Wagner beam theory at plate – Principles of stiffener/web construction. ANALYSIS OF AIRCRAFT STRUCTURAL COMPONENTS of the manoeuvre loads – Load factor determination – Inertia loads invelope – Shear force, bending moment and torque distribution along thing and fuselage and their functions – Analysis of rings and frames — strength of things and frames — strength of the members of the member of the members of the member of the member of the members of the	skear, avidth - Exp	shear flo ry – Tors ft compo nd comb Failure s erimenta dynamic of the w uction to	w in two sional she onents – To loads & Sional and factors and fac	flange, ar flow Capered 12 s - Plate plates an nation of the control of the con
Design U Sheat three in m wing U Stab bucks stiffed critical U Aircrase curve COU COU	gn of thin-wall INIT – III r flow in thin- flange and mu ulti-cell tubes g spar – Introdu INIT – IV ility problems ling coefficier ened panels – cal load for a fl UNIT – V aft Loads – Syn – The flight en ural parts of w RSE OUTCO	ending in open sections – Torsion of thin-walled open section member ed members SHEAR FLOW IN CLOSED SECTIONS walled closed sections – Symmetrical and unsymmetrical sections – Flalti-flange box beams – Determinations of the shear centre – Bredt-Bat – Shear flow due to combined bending and torsion – Stress analysis of action to shear lag. STABILITY PROBLEMS of thin walled structures – Buckling of sheets under compression, set – Inelastic buckling of plates – Sheet-stiffener panels – Effective we Crippling stress estimation – Local Buckling – Wagner beam theory at plate – Principles of stiffener/web construction. ANALYSIS OF AIRCRAFT STRUCTURAL COMPONENTS memetric manoeuvre loads – Load factor determination – Inertia loads a tyelope – Shear force, bending moment and torque distribution along thing and fuselage and their functions – Analysis of rings and frames — MES	skear, avidth - Exp	shear flo ry – Tors ft compo nd comb Failure s erimenta dynamic of the w uction to	w in two sional she onents – To sined load tress in place loads & Sving and f Aeroelas AL: 60 P	flange, ar flow Capered 12 s - Plaulates annation of Caperel
Shea three in m wing U Stab buck stiffe critic U Aircra curve Struct shells	gn of thin-wall INIT – III r flow in thin- flange and mu ulti-cell tubes g spar – Introdu INIT – IV ility problems ling coefficier ened panels – cal load for a fl UNIT – V aft Loads – Syn – The flight en ural parts of w RSE OUTCO	ending in open sections – Torsion of thin-walled open section membered members SHEAR FLOW IN CLOSED SECTIONS walled closed sections – Symmetrical and unsymmetrical sections – Flulti-flange box beams – Determinations of the shear centre – Bredt-Bat – Shear flow due to combined bending and torsion – Stress analysis of action to shear lag. STABILITY PROBLEMS of thin walled structures – Buckling of sheets under compression, set – Inelastic buckling of plates – Sheet-stiffener panels – Effective we Crippling stress estimation – Local Buckling – Wagner beam theory at plate – Principles of stiffener/web construction. ANALYSIS OF AIRCRAFT STRUCTURAL COMPONENTS memetric manoeuvre loads – Load factor determination – Inertia loads a velope – Shear force, bending moment and torque distribution along thing and fuselage and their functions – Analysis of rings and frames — MES oncept of normal stress variation in unsymmetrical sections subject to	skear, avidth - Exp	shear flo ry – Tors ft compo nd comb Failure s erimenta dynamic of the w uction to	w in two sional she onents – To loads & Sional and factors and fac	flange, ar flow Capered 12 s - Plan plates an nation of 12 Schrenk cuselage ticity an ERIOD



			_	tle cell and multi	-cell tubes	Eval	luating
	subjected	l to shear and to	rqueloads.			3	
CO4		the behaviour of			lates and also to know	Ana	lyzing
CO5	Analyse	and design struc	tural members	subject to compre	ession	Ana	lyzing °
REFE	RENCE I	BOOKS:	enulas.	ne to unit and to	resit altur abetes hoi	in had study color air	ne off i
1	Bruhn. E	EF, "Analysis and	d Design of Flig	tht Vehicle Struct	tures", Tristate Offset Co.	, 2010.	de of t
2	Bruce. K		Analysis of Airci	raft Structures: A	n Introduction", Cambrid	lgeUniversity Press	s, 2 nd
3	Megson.		ft Structures f	for Engineering	Students",	Elsevier, Aerospa	ce Engineering
4	Peery, D	J. And Azar, JJ,	"Aircraft Struct	ures", 2nd Edition	n, McGraw-Hill, New Yor	k,1993	
5	Rivello,	R.M, "Theory a	nd Analysis of F	Flight structures"	, McGraw-Hill, N.Y., 199	93	ment some
WEBS	SITE REF	ERENCE / NP	TEL/ SWAYA	M/ MOOC REF	ERENCE:	THE SHEET LOT	lkso-tilum m
1	100			bikes/design/desi	i_63.htm#:~:text=Bendin b)%20opposite.	g%20of%20Beams	s&text=The%20p
2		n.wikipedia.org/ e%20US.	wiki/Shear_flo	w#:~:text=An%2	20equivalent%20definitio	n%20for%20shear	per%20foot%20;
3	https://v	www.slideshare.i	net/SaikatMond	al37/stability-pro	titles in the second	more to the second	and the American Laboratory
	100			Profession of	oolem		
4		opscience.iop.or	g/article/10.108	a contract	9/1/012127/pdf#:~:text=T	The%20basic%20m	nethods%20invol
off her		opscience.iop.or n,to%20specifie	g/article/10.108	88/1757899X/149		The%20basic%20m	nethods%20invol
СО-Р	ed%20i	opscience.iop.or n,to%20specifie	g/article/10.108	88/1757899X/149		The%20basic%20m	nethods%20involv
CO-P	ed%20i	opscience.iop.or n,to%20specifie ING	g/article/10.108 d%20loads%20	88/1757899X/149 and%20actions.	9/1/012127/pdf#:~:text=T	al Analt Album ben office of cale of northifestal calculation 181	Seguil Sould
CO-P	ed%20ir	opscience.iop.or n,to%20specifie ING	g/article/10.108 d%20loads%20	88/1757899X/149 and%20actions.	9/1/012127/pdf#:~:text=T	PO5	PO6
CO-P	ed%20ii PO MAPP	opscience.iop.or n,to%20specifie ING	g/article/10.108 d%20loads%20	88/1757899X/149 and%20actions.	PO4 2	PO5	PO6
CO-P	ed%20ii PO MAPPI COs	opscience.iop.or n,to%20specifie ING	g/article/10.108 d%20loads%20	PO3 3 3	PO4 2 2	PO5	PO6



ARRS

PPAR2PC06		CFD FOR AEROSPACE APPLICATIONS	L	T	P	C
Buttele	ali .	organ the explicit time dependent methods and their factorization schemes	3	0	0	3
OURSE	OBJEC	CTIVES: and important of the implicit methods and important constitution of the implicit methods.	il rah	or l	701	
1	To ge	t familiarize with the procedure to obtain numerical solution to fluid dynamic proble	ems.	7	19/4%	37
2	To ga	in knowledge on the important aspects of grid generation for practical problems.	gro.	HET.	T	
3	To ge	et exposure on time dependant and panel methods.	1 59	518	2	
4	To lea	arn the techniques pertaining to transonic small perturbation force.				
5	To ma	ake use of commercial CFD software for aerospace applications.	er e	lei -		
UNIT -	- I	NUMERICAL SOLUTIONS OF SOME FLUID DYNAMICAL PROBLEM	S	wild I		9
	ations- l	nnique. Numerical solution for CD nozzle isentropic flows and local similar solution and local similar solution for CD nozzle isentropic flows and local similar solution. GRID GENERATION	ions	of bou	ndary	9
generation	n using	id control functions - boundary point control - orthogonality of grid lines at bou Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured gr	rids,	ies. El		
generation hybrid gr UNIT -	n using ids, gride III	Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured granul around typical 2D and 3D geometries—Overlapping grids—Grids around multi both TIME DEPENDENT METHODS ion, Explicit methods, Time split methods, Approximate factorization scheme, Un	rids, dies.	ies. E Cartes	sian gr	grid rids, 9
generation hybrid gr UNIT – Stability around a	on using rids, grids, grid rill of solution in the solution of solution in the	Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured granument typical 2D and 3D geometries—Overlapping grids—Grids around multi botal TIME DEPENDENT METHODS	rids, dies.	ies. E Cartes	sian gr	grid rids, 9
generation hybrid gr UNIT – Stability around a	on using rids, grids, grids rill of solution in problems on proble	Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured go around typical 2D and 3D geometries—Overlapping grids—Grids around multi book TIME DEPENDENT METHODS ion, Explicit methods, Time split methods, Approximate factorization scheme, Un Some time dependent solutions of gas dynamic problems. Numerical solution of	rids, dies.	ies. E Cartes	sian gr	grid rids, 9
generation hybrid gr UNIT - Stability around a conduction UNIT - Introduct Staggered	on using ids, grid-III of solution foils. on proble IV tion to d grid a	Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured granul around typical 2D and 3D geometries—Overlapping grids—Grids around multi book TIME DEPENDENT METHODS ion, Explicit methods, Time split methods, Approximate factorization scheme, Un Some time dependent solutions of gas dynamic problems. Numerical solution cems using SLOR methods.	nstead of un	dytran dytran asteady	sonic f	grid grids, 9 flow heat
generation hybrid gr UNIT - Stability around a conduction UNIT - Introduct Staggered	on using rids, grid- III of solution foils. on probletion to d grid a compresse	Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured granound typical 2D and 3D geometries—Overlapping grids—Grids around multi book TIME DEPENDENT METHODS ion, Explicit methods, Time split methods, Approximate factorization scheme, Unsome time dependent solutions of gas dynamic problems. Numerical solution cems using SLOR methods. FINITE VOLUME METHOD Finite volume Method—Different Flux evaluation schemes, central, upwind approach—Pressure-Velocity coupling—SIMPLE, SIMPLER algorithms—pressure-	nstead of un	dytran dytran asteady	sonic f	grid grids, 9 flow heat
generation hybrid gr UNIT - Stability around a conduction UNIT - Introduct Staggered (both incomplete the conduction of	of solution to discompressible, applith heat sticity—tweeton.	Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured get around typical 2D and 3D geometries –Overlapping grids – Grids around multi both around typical 2D and 3D geometries –Overlapping grids – Grids around multi both TIME DEPENDENT METHODS ion, Explicit methods, Time split methods, Approximate factorization scheme, Unsome time dependent solutions of gas dynamic problems. Numerical solution dems using SLOR methods. FINITE VOLUME METHOD Finite volume Method - Different Flux evaluation schemes, central, upwind a approach - Pressure-Velocity coupling - SIMPLE, SIMPLER algorithms- pressursible and compressible forms) - Application of Finite Volume Method -artificial different flux evaluations of Finite Volume Method -artificial different flux evaluations. Application of Finite Volume Method -artificial different flux evaluations. The following for Viscous flows, verifical cation of CFD tools to 2D and 3D configurations. CFD for kinetic heating analysic conduction code, Unsteady flows – Grid movement method, Oscillating geometry, Introduced are applications, High performance computing for CFD applications – Paragraphical conductions. The properties of the following for CFD applications – Paragraphical conductions are applications, High performance computing for CFD applications – Paragraphical conductions.	rids, dies. asteadof un and h re co custion is – (etries duction	dytranasteady and va Coupli	sonic for 2-D schemen equal	grid dids, 9 flow heat 9 on of CFD onal recial
generation hybrid gr UNIT - Stability around a conduction UNIT - Introduct Staggered (both incomplete the conduction of	of solution to discompressible, applith heat sticity—tweetoon.	Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured granound typical 2D and 3D geometries –Overlapping grids – Grids around multi both around typical 2D and 3D geometries –Overlapping grids – Grids around multi both TIME DEPENDENT METHODS ion, Explicit methods, Time split methods, Approximate factorization scheme, Unstructured grands are grown to the dependent solutions of gas dynamic problems. Numerical solution of the emission of gas dynamic problems. Numerical solution of the emission of the	rids, dies. sstead of un and h re co custom is – (etries ductio alleli	dytran asteady and variation to contact the coupling of the co	sonic for 2-D schemen equal	grid dids, 9 flow heat 9 nes - ation 7 on of CFD onal les -
generation hybrid gr UNIT - Stability around a conduction UNIT - Introduct Staggered (both incompleted by the conduction of the conduction	of solution to describe a sompresson to the solution to describe a sompresson the solution to	Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured granul typical 2D and 3D geometries —Overlapping grids — Grids around multi book around typical 2D and 3D geometries —Overlapping grids — Grids around multi book around typical 2D and 3D geometries —Overlapping grids — Grids around multi book around typical 2D and 3D geometries —Overlapping grids — Grids around multi book around typical 2D and 3D configurations. Shemes, central, upwind a proposach — Pressure-Velocity coupling — SIMPLE, SIMPLER algorithms—pressurable and compressible forms) — Application of Finite Volume Method—artificial different Flow around typical 2D and 3D configurations. CFD for kinetic heating analysic conduction code, Unsteady flows — Grid movement method, Oscillating geometry are aerospace applications, High performance computing for CFD applications — Parasition.	rids, dies. sstead of un and h re co custom is – (etries ductio alleli	dytran asteady and varieties. Electrical and varieties and varieties, Company to contact and varieties, Company to contact and varieties.	sonic for 2-D schemen equal sc	grid dids, 9 flow heat 9 nes ation 9 on of CFD onal les —
generation hybrid gr UNIT - Stability around a conduction UNIT - Introduct Staggered (both incomplete the conduction of	of solution to describe a compression of solution of solut	Laplace's equations for geometries like aerofoil and CD nozzle. Unstructured granul typical 2D and 3D geometries —Overlapping grids — Grids around multi book around typical 2D and 3D geometries —Overlapping grids — Grids around multi book around typical 2D and 3D geometries —Overlapping grids — Grids around multi book around typical 2D and 3D geometries —Overlapping grids — Grids around multi book around typical 2D and 3D configurations. Shemes, central, upwind a proposach — Pressure-Velocity coupling — SIMPLE, SIMPLER algorithms—pressurable and compressible forms) — Application of Finite Volume Method—artificial different Flow around typical 2D and 3D configurations. CFD for kinetic heating analysic conduction code, Unsteady flows — Grid movement method, Oscillating geometry are aerospace applications, High performance computing for CFD applications — Parasition.	rids, dies. sstead of un and h re co custom is – (etries ductio alleli	dytran asteady and vaccouplings, Compon to contact and the con	sonic for 2-D schemen equal sc	grid dids, 9 flow heat 9 nes ation 7 on of CFD onal recial les —



	technic	ques ineffective	inbending.						
CO3	To familiarise himself/herself with high performance computing for CFD applications. To implement the explicit time dependent methods and their factorization schemes						Remembering		
CO4	To imp	olement the exp	olicit time depen	dent methods ar	nd their factorization	schemes	Analyzing		
CO5	To do	the stability and	alysis and linear	ization of the in	plicit methods	25/4/23	Analyzing		
REFEREN	NCE BO	OKS:	n bialt of postaje	na ramaterical sa	the procedure to our	idw-sanatanat	lag of		
1	Chung	g. TJ, "Computa	ntional Fluid Dyn	namics", Cambi	ridge University Pres	s, 201 0	nag of F		
2	Bose.	ose. TK, "Numerical Fluid Dynamics", Narosa Publishing House, 2001.							
3	Hirsch	Hirsch, AA, "Introduction to Computational Fluid Dynamics", McGraw-Hill, 1989							
4	John I	John D. Anderson, "Computational Fluid Dynamics", McGraw Hill Education, 2017							
5		SedatBiringen&Chuen-Yen Chow, "Introduction to Computational Fluid Dynamics by Example Wiley publishers, 2 nd edition, 2011							
WEBSITI	E REFEI	RENCE / NPT	EL/ SWAYAM	MOOC REFI	ERENCE:	S. Amelikato es	imenyti kini Escapii.		
1	https:/	//digital.library.	adelaide.edu.au/	dspace/bitstream	m/2440/21002/2/02w	hole.pdf	demis a le notures		
2	https:/	//www.scienced	lirect.com/topics	s/engineering/gr	rid-generation	abontoru but	all about purpor taxed		
СО-РО М	IAPPINO	G					and the second		
COs	ore or	PO1	PO2	PO3	PO4	PO5	PO6		
CO1		2	2	2		1	Ni - Hay		
CO2	detryh is	2	2	3		2	nei vios la validade		
CO3		2	1	3	1 aboution	90.12 plate	condiction and		
CO4		2	2	3	поналучии	2	ve-Tres		
COS	5 market 1	icii billiagii ii	2	2	Investible Lodi	M samur sii. 1	il ce matanhount		



PPAR2PC	C 07	FEA FOR AEROSPACE APPLICATIONS	L	T	P	C
			3	0	0	3
OURSE	OBJEC	TIVES:	0			
1	To lea	rn the concepts of finite element methods and the various solution schemes availab	le.			
2	To im	part knowledge to solve plane stress and plane strain problems.				
3	To sol	ve heat transfer and fluid mechanics problems using Finite element methods.				
4	To for	mulate mass and stiffness element matrices for vibration problems.	18.1	ii.		
5	To be	familiar in obtaining solutions to fluid flow problems.		59 1.		
UNIT -	- I	INTRODUCTION	O A		Fie	9
 Problem Flexibility 	n Formu y Matric tion, Noo	approximate methods – Rayleigh-Ritz, Galerkin and Finite Difference Methods lation – Application to Structural Elements & Practical Problems – Derivation es – Spring Systems – Role of Energy Principles – Basic Concepts of Finite Elements, Degrees of Freedom – Solution Schemes				9
UNII -	- 11	DISCRETE ELEMENTS				9
Determina UNIT -	ation of	ns – Boundary Conditions–Determination of Displacements & Reactions – Con Nodal Loads & Stresses CONTINUUM ELEMENTS	nstitu	inve R		
UNIT – Plane Stre Solution U – Use of I	ess & Pla Using Fi	Nodal Loads & Stresses CONTINUUM ELEMENTS ane strain Loading – CST Element – LST Element – Element Characteristics – Prol nite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and rea and Volume Co-ordinates – Isoparametric Formulation – Shape Functions – Ro	blem Lum	Formu	lation oad Ve	9
UNIT – Plane Stre Solution U – Use of I	ess & Pla Using Fi Local, A	Nodal Loads & Stresses CONTINUUM ELEMENTS ane strain Loading – CST Element – LST Element – Element Characteristics – Prol nite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and	blem Lum	Formu	lation oad Ve	9 & ector
Plane Stre Solution I – Use of I Integratio UNIT – Formulati of the G Response Determin	ess & Pla Using Fi Local, A on – Loa - IV ion of the coverning c Calcul action of	Nodal Loads & Stresses CONTINUUM ELEMENTS ane strain Loading – CST Element – LST Element – Element Characteristics – Prol nite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and rea and Volume Co-ordinates – Isoparametric Formulation – Shape Functions – Red d Consideration – Complete FE Solution	blem Lum ole o	Formuped Lof Num	Deriva	9 & ector 9 ntior
Plane Stre Solution I – Use of I Integratio UNIT – Formulati of the G Response	ess & Pla Using Fi Local, A on – Loa - IV ion of the coverning c Calcul action of	Nodal Loads & Stresses CONTINUUM ELEMENTS ane strain Loading – CST Element – LST Element – Element Characteristics – Prolonite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and rea and Volume Co-ordinates – Isoparametric Formulation – Shape Functions – Red Consideration – Complete FE Solution VIBRATION & BUCKLING The Mass and Stiffness Element Matrices for Vibration Problems – Bar and Beam Eng Equation – Natural Frequencies and Modes – Damping Considerations – Hation Using Numerical Integration – Buckling of Columns – Problem Form	blem Lum ole o	Formuped Lof Num	Deriva	9 & ector 9 ation
Plane Stressolution I - Use of I Integratio UNIT - Formulati of the G Response Determin UNIT -	ess & Pla Using Fi Local, A on – Loa I V ion of the Coverning Calcul lation of V nensiona nt Load	Nodal Loads & Stresses CONTINUUM ELEMENTS ane strain Loading – CST Element – LST Element – Element Characteristics – Prolonite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and rea and Volume Co-ordinates – Isoparametric Formulation – Shape Functions – Red Consideration – Complete FE Solution VIBRATION & BUCKLING The Mass and Stiffness Element Matrices for Vibration Problems – Bar and Beam Fig Equation – Natural Frequencies and Modes – Damping Considerations – Hation Using Numerical Integration – Buckling of Columns – Problem Form Buckling Loads and Modes.	blem Lum ole o	Formuped Lof Num ents — onic Ron —	Deriva Lespon Solution	9 & ector 9 attior 9 m
Plane Stressolution U-Use of I Integratio UNIT - Formulatio of the G Response Determin UNIT - One Dim Equivaler	ess & Pla Using Fi Local, A on – Loa I V ion of the Coverning Calcul lation of V nensiona nt Load	Nodal Loads & Stresses CONTINUUM ELEMENTS ane strain Loading – CST Element – LST Element – Element Characteristics – Prolonite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and rea and Volume Co-ordinates – Isoparametric Formulation – Shape Functions – Red Consideration – Complete FE Solution VIBRATION & BUCKLING The Mass and Stiffness Element Matrices for Vibration Problems – Bar and Beam Eng Equation – Natural Frequencies and Modes – Damping Considerations – Hation Using Numerical Integration – Buckling of Columns – Problem Form Buckling Loads and Modes. HEAT TRANSFER & FLUID MECHANICS PROBLEMS Il Heat Transfer Analysis – Formulation of the Governing Equations in Fin Vector – Solution & Temperature Distribution – Finite Element Formulation & Ing Fluid Mechanics .	blem Lum ole o Elem darmo ulatio	Formuped Lof Num ents — onic Ron — Elemention f	Deriva Lespon Solution	9 & ector 9 attior 9 mm mple
Plane Stressolution U-Use of I Integratio UNIT - Formulatio of the G Response Determin UNIT - One Dim Equivaler	ess & Pla Using Fi Local, A on – Load of Calcul action of the coverning cove	CONTINUUM ELEMENTS ane strain Loading – CST Element – LST Element – Element Characteristics – Prolinite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and rea and Volume Co-ordinates – Isoparametric Formulation – Shape Functions – Red Consideration – Complete FE Solution VIBRATION & BUCKLING The Mass and Stiffness Element Matrices for Vibration Problems – Bar and Beam English Equation – Natural Frequencies and Modes – Damping Considerations – Hation Using Numerical Integration – Buckling of Columns – Problem Form Buckling Loads and Modes. HEAT TRANSFER & FLUID MECHANICS PROBLEMS If Heat Transfer Analysis – Formulation of the Governing Equations in Fin Vector – Solution & Temperature Distribution – Finite Element Formulation & Ing Fluid Mechanics.	blem Lum ole o Elem darmo ulatio	Formuped Lof Num ents — onic Ron — Elemention f	Deriva Lespon Solution	9 & ector 9 attior 9 m mple
Plane Stre Solution I - Use of I Integratio UNIT - Formulati of the G Response Determin UNIT - One Dim Equivaler	ess & Pla Using Fi Local, A on – Loa - IV ion of the foverning e Calcul nation of - V nensiona nt Load s Involvi	CONTINUUM ELEMENTS ane strain Loading – CST Element – LST Element – Element Characteristics – Prolinite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and rea and Volume Co-ordinates – Isoparametric Formulation – Shape Functions – Red Consideration – Complete FE Solution VIBRATION & BUCKLING The Mass and Stiffness Element Matrices for Vibration Problems – Bar and Beam English Equation – Natural Frequencies and Modes – Damping Considerations – Hation Using Numerical Integration – Buckling of Columns – Problem Form Buckling Loads and Modes. HEAT TRANSFER & FLUID MECHANICS PROBLEMS If Heat Transfer Analysis – Formulation of the Governing Equations in Fin Vector – Solution & Temperature Distribution – Finite Element Formulation & Ing Fluid Mechanics.	blem Lum ole o Elem darmo ulatio	Formuped Lof Num ents — onic Ron — Elemention f AL: 4:	Deriva Lespon Solution	9 Mation See
UNIT – Plane Stre Solution I – Use of I Integratio UNIT – Formulati of the G Response Determin UNIT – One Dim Equivaler Problems	ess & Pla Using Fi Local, A on – Loa - IV ion of the coverning c Calcul nation of - V nensiona nt Load s Involvi OUTCo	Nodal Loads & Stresses CONTINUUM ELEMENTS ane strain Loading – CST Element – LST Element – Element Characteristics – Prolinite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and rea and Volume Co-ordinates – Isoparametric Formulation – Shape Functions – Red Consideration – Complete FE Solution VIBRATION & BUCKLING Be Mass and Stiffness Element Matrices for Vibration Problems – Bar and Beam Eg Equation – Natural Frequencies and Modes – Damping Considerations – Hation Using Numerical Integration – Buckling of Columns – Problem Form Buckling Loads and Modes. HEAT TRANSFER & FLUID MECHANICS PROBLEMS All Heat Transfer Analysis – Formulation of the Governing Equations in Fin Vector – Solution & Temperature Distribution – Finite Element Formulation & Ing Fluid Mechanics . OMES Solitity to frame governing equations involving different type of finite elements whedge on the general finite element methodology for a variety of practical	blem Lum ole o Elem darmo ulatio	Formulated Land Formulation for Formulation fo	Deriva Lespon Solution 5 PER	9 & ecctor 9 m mple IOI vel



CO4	Knowledge on hor elements solutions		erical integration te	chniques effectively	y in finite	Analyzing				
CO5			nsfer and fluid med	chanics problems u	sing the	Analyzing				
REFERE	NCE BOOKS:									
1	Dhanaraj, R &K.I	PrabhakaranNair	, K, Finite Element	Method, Oxford u	niversity press, Ind	ia,2015				
2	Bathe, KJ &Wilso 1983.	Bathe, KJ &Wilson,EL, Numerical Methods in Finite Elements Analysis, Prentice Hall ofIndia Ltd., 1983.								
3		Krishnamurthy, CS, Finite Elements Analysis, Tata McGraw – Hill, 1987								
4	Rao, SS Finite Ele Edition, 1998	Rao, SS Finite Element Method in Engineering, Butterworth, Heinemann Publishing, 3 rd Edition, 1998								
5			s, Michael E. Ples Sons, 4 th Edition, 2 th		Vitt, Concepts and	Applications of Finite				
WEBSIT	E REFERENCE / N	NPTEL/ SWAYA	AM/ MOOC REFI	ERENCE:						
1	https://archive.np	tel.ac.in/courses	/112/104/11210430)2/	organizacija Nasilizacija	arrier to writing				
2	https://courses.an	sys.com/index.p	hp/courses/structur	es-in-aerospace/	Hays write - to	Siziela Villingoli				
3	https://nptel.ac.in	/courses/112103	298	217/31/1	in visitinge	0 = reval				
CO-PO N	MAPPING		and the same	Harden Albert	programme and a	in and a second				
CO	PO1	PO2	PO3	PO4	PO5	PO6				
СО	1 1	2	3	Y Party Z	2	1				
CO	2 1	2	2		2	A hope to service				
CO	3 2	2	3	PACT THE	3	1,,,,				
СО	4 1	2	3	uniek szejelk w	3	to to man I was a				



PSRA

PPAR2F	PL03	AIRCRAFT STRUCTURES LABORATORY	L	Т	P	C
erosanykow.		Karakalawah kan parabagi ajanga vila masa di	0	0	4	2
COURSE	OBJECTIVE	S:		4.4.3	100 E	
al _{og}	To get practi	ical knowledge on calibration of photoelastic materials.		i on		
2	To gain prac	tical exposures on calculating shear centre locations for closed and open sections	3.			
3	To provide w	with the basic knowledge of fabricating a composite laminate.				
4	To have basi	c knowledge on unsymmetrical bending of beams.		26	9	
5	To design an	d conduct different types of practical tests involving various aircraft structuralco	mpor	ents	9	
		LIST OF EXPERIMENTS		46		
1.	Calibration of p	photo elastic materials				
2.	Experimental n					
3.	Forced vibratio					
4.		I static testing of composite laminates				
5.		e evaluation of defects in composite laminates using acoustic emission				
6.	Non-destructiv	e evaluation of defects in composite laminates using ultrasonic.				
7.	Whirling of cor	mposite shafts				
8.		l bending of beams				
9.	Determination	of influence coefficients and flexibility matrix				
10.	Shear centre lo	cation for open & closed thin-walled sections				
11.	Buckling of col	lumns with different end conditions				
12. Any 10ex		verification of the Wagner beam theory be conducted out of 12.				
		LABORATORY EQUIPMENTS REQUIRED				
1.	Electrical resis	tance strain gauges installation kit.	-	1		Ħ
2.		with resistors, wires, clips, and strain gauges.				
3.	Column testing	g set-up (with provision for different end conditions)				
4.	Unsymmetrica	I beam bending set-up.				
5.		travelling microscope.				
6.		setup for location of shear centre (open & closed sections)				
7.	Whirling of sha	afts demonstration unit.				
8.	Photo-elastic n	nodels.				
9.	Equipment for	the fabrication of composite laminates.				
10.	Testing instrum	nents and equipment for ultrasonic testing.				
11.	Diffuser transn	nission type polariscope with accessories				
12.	Experimental s	setup for vibration of beams& vibration measuring instruments.				
13.	Universal Test	ing Machine.				
14.	Wagner beam		TAT	. 60	PERI	
-125						
COURS	E OUTCOMES			Bloo	ms Le	ve
CO1	To conduct	tests and interpret data involving strain gauges		An	alyzin	g
CO2	To get expo	sure on experimental methods in photoelasticity	T	An	alyzin	g



gestin

CO3	To design an exper	,	Analyzing			
CO4	To comprehend no		Analyzing			
CO5	To fabricate of con		Analyzing			
СО-РО М	APPING			g	EFVITE	1180 129 87)
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	remunias no cesus Transplacinas na	2	or l
CO2	3	2	nest to 2 2 bood to	i semuzenti do 281	ol-would great gives	1
CO3	3	2	2	o supplies ship	2	1
CO4	3	2	2	-	2	1
CO5	3	2	2	ouix -	2	1 0



PPAR2PL04		COMPUTATIONAL	L LABORATORY			T	P	(
adeden			painth stances	hostod No. opcubelle Ar	0	0	4	2
COURSE C	DBJECTI	ES:				o		
1	This cour	e is intended to make students familiar	with different types of s	tructural analysis	usi	ngfini	te elen	nent
2		helps students to correctly interpret the	he results of simulation.	sh hare anorthurs		18		
3	To equip	rith the knowledge base essential for a	pplication of computation	nal fluid dynamic	es to	engin	eering	flov
4		the essential numerical background for	or solving the partial diff	erential equations	sgov	ernin	g the fl	uid
5	To develo	students' skills of using a commercial	software package	109			:00	
1		LIST OF EX	PERIMENTS	3	1		100	
		nulation of 1-D diffusion and conducti			1		terai	
		nulation of 1-D convection-diffusion p						
		nulation of 2-D unsteady state heat co						
		nulation of 2-D diffusion and 1-D con						
		id generation over airfoil section3-D n			ozz	les		
		l simulation of flow development of a		e jets				
		nulation of boundary layer developme						
8. N	Numerical s	nulation of subsonic combustion in a r	ramjet combustor					
9. N	Numerical s	nulation of transonic flow over airfoils						
Minimum o	of 6 Experi	ents to be performed by using CFD So				102	MAN	
		LIST OF EXPER	IMENTS IN FEM					
1.	Grid genera	on methods and geometry clean up tec	hniques.					
2. S	Static analy	s of a uniform bar subject to different	loads -1-D element					
3. T	Thermal str	sses in a uniform and tapered member	- 1-D element					
4. S	Static analy	s of trusses / frames under different lo	ads					
		is & deformation of a beam using 1-D nd user-defined loads	element & 2-D – incorp	ooration ofdiscret	е,			
6. S	Static analy	s of a beam with additional spring sup	port					
7. S	Stress conc	tration in an infinite plate with a smal	l hole					
8. E	Bending of	plate with different support conditions	5					
9.	Stability an	ysis of a plate under in-plane loads						
10. I	Buckling of	olid and thin-walled columns under di	fferent end conditions					
11. F	Free vibrati	n analysis of a bar / beam						
12. I	Forced resp	nse of a bar / beam under harmonic ex	citation					
13. I	Heat transf	analysis using 1-D & 2-D elements -	conduction and convect	ion				
14. N	Modelling	nd analysis of a laminated plate						
15. I	Impact ana	sis of a laminated plate.						
		ments to be performed by using FEM	Software tools					
		IPMENTS REQUIREMENTS						
1. I	Desktop co	puters	A 21 2					
2.	MS visual	LL						





CFD software

_	TO	OTAL: 60 PERIOD
COURSE	OUTCOMES	Blooms Level
CO1	To get solution of aerodynamic flows	Analyzing
CO2	To perform stability analysis of structural components	Analyzing
CO3	To define and setup flow problem properly within CFD context, performing solid modelling usingCAD package and producing grids via meshing tool	Analyzing
CO4	To comprehend both flow physics and mathematical properties of governing Navier- Stokesequations and define proper boundary conditions for solution	Analyzing
CO5	To use CFD software to model relevant engineering flow problems	Analyzing

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	121.1	1	1
CO2	3	2	2	o thu gradith T	ik Lio nedelum U-liio nedelum	a latarianemis 1
CO3	3	2	3	l sitte e samma I han nataritik	1-13p opinion 1-13p opinion	r kanonanid 1
CO4	3	2	3	oritiza la litra no	m neißer ach bit	s banusus 1
CO5	3	2	2	1	radion intern	selencement 1

PPAR2PR01	MINI PROJECT WITH SEMINAR	L	T	P	C
	A Compression of the last of t				
		0	0	4	2

COURSE OBJECTIVES:

Seminar is to be given by the student after the completion of a mini project chosen by the student. Topics for the mini projects can be from the aeronautical engineering and allied fields. The mini project can be based on either numerical or analytical solution or design or fully experimental; or a combination of these tasks.



PPAR1PE01 THEORY OF VIBRATIONS L T				T	P	C
	william was	and completions to the extremely an experimental control of the co	3	0	0	3
COURSE	OBJEC	TIVES:	17,000	D61 3	rrieg	170
1	To ge	t insight into the basic aspects of vibration theory.	est parties	and		
2	This	course presents the principles of dynamics and energy methods pertaining tostro	uctures.			
3	This	course provides a platform for better understanding of the approximate methods	s for aero	space	structu	res.
4	To ge	t insight into the dynamic responses of the large systems.				
5	To ge	t insight into the basic aspects of aero-elasticity.	UF I	1	Jan.	
UNIT	-I	SINGLE DEGREE OF FREEDOM SYSTEMS				9
		ibrations with and without damping, base excitation, and vibration measuringing	istrumen	ts.	ios.	•
	UNIT – II MULTI-DEGREES OF FREEDOM SYSTEMS					9
	vectors,	reedom systems, Static and dynamic couplings, Eigen values, Eigen vectors an Vibration absorber, Principal coordinates, Principal modes. Hamilton's Principal				
UNIT -	III	VIBRATION OF ELASTIC BODIES				9
Transvers		ions of strings, Longitudinal, Lateral and Torsional vibrations. Approximate mo	ethods fo	rcalcu	lating	
UNIT -		EIGEN VALUE PROBLEMS & DYNAMIC RESPONSE OF LARGE	SYSTEN	1S		9
		raction methods – Subspace hydration method, Lanczos method – Eigen raction e of large systems – Implicit and explicit methods	value rec	luction	n metho	od –
UNIT	- V	ELEMENTS OF AEROELASTICITY				9
Aeroelas	tic probl	ems – Collar's triangle of forces – Wing divergence – Aileron control reversal	– Flutter.			
			ТОТ	AL: 4:	5 PER	IODS
COURSE	OUTC	OMES		Bloor	ns Lev	el
CO1	Able	to solve SDOF problems using energy methods		Under	rstandi	ng
CO2	Capa	ble of applying Lagrange's equation in real time vibration problems		Ap	plying	
CO3	Able	to calculate natural frequency of a system		Ap	plying	Ť
CO4	Capa	ble of analysing dynamic response of large systems		Ana	alyzing	ŗ
CO5	Able	to analyse flutter problems		Ana	alyzing	5
REFERE	NCE B	OOKS:				91
1	Thor 2014	nson W.T, Marie Dillon Dahleh, "Theory of Vibrations with Applications", Harl	ow, Esse	«Pears	on	
2		oshenko, S. "Vibration Problems in Engineering", John Wiley & Sons, Inc., 201	8	- Tracket		



3	Meirovitch, L. "E	irovitch, L. "Elements of Vibration Analysis", New Delhi, McGraw-Hill Education, 2014							
4	F.S. Tse., I.F. Mor	se and R.T. Hinl	kle, "Mechanical Vib	rations", Prentice-H	all of India, 1985	103512453			
5	Rao.J.S. and Gu	pta.K. "Theory	and Practice of Med	chanical Vibrations"	, New Delhi, New	Age Internationa			
WEBSITE	E REFERENCE / N	NPTEL/ SWAY	AM/ MOOC REFE	RENCE:	23 47 14	LEO SERVICO			
1	https://nptel.ac.in	n/courses/11210	7212	basic aspects of vibra	adı ozu bilgizmi teşi	ol l			
2	https://nptel.ac.ir	n/courses/101104	4005	men engine of	m company partners of				
СО-РО М	IAPPING		of the large systems.	dynamic estantes:	ner insiete one the	62 4.			
COs	PO1	PO2	PO3	PO4	PO5	PO6			
C01	3	(r) a tenderal/	2	and the same and the same	3	one and playing			
CO2	3	PRINCE STREET, ST	2	3	3				
CO3	3		2	E, 1074 30 2.3139	PRILIT 3 III	D - FINE			
CO4	3	ata danta a	2 and 2	amanga sa suas iles oo lunomid ,	decite and add a	o scorgoo ever			
CO5	3		2	3	3	_			



ARES

TTAKITI	E02	ROCKETRY AND SPACE MECHANICS	L	T	P	(
			3	0	0	3
COURSE	OBJEC	TIVES:		a		
1	This c	ourse presents the fundamental aspects of rocket motion along with detailed estimatories.	tion	ofrock	cet	
2		ourse also imparts knowledge on optimization of multistage rockets.		Tays is	E HA	
3	This c	ourse provides the basics of space mechanics required for an aeronautical student				
4	This c	ourse helps students to provide with the basics of orbit transfer of satellites.				
5	This c	ourse will help students to gain knowledge on various control methods of rockets.		1000	¥ (17.	(19)
UNIT -	- I	ORBITAL MECHANICS				9
UNIT -		ody problems – Jacobi's Integral, Libration points – Estimation oforbital and escap SATELLITE DYNAMICS			teo	9
transfer a	nd exam	and geostationary satellites- factors determining life time of satellites – satellitepertuples –Hohmann orbits – calculation of orbit parameters– Determination of satellite orbital elements- satellite epiphermis.				
UNIT -	- III	ROCKET MOTION				9
		eneous gravitational fields - Description of vertical, inclined and gravityturn traject	.01100	dotte		
UNIT -		ride – simple approximations to burnout velocity. ROCKET AERODYNAMICS				9
UNIT - Description diffiction di	on of va	ROCKET AERODYNAMICS rious loads experienced by a rocket passing through atmosphere – drag estimation at the drag and base pressure drag – Boat-tailing in missiles – performance at various				skir
UNIT - Description diffiction di	on of valrag, for	ROCKET AERODYNAMICS rious loads experienced by a rocket passing through atmosphere – drag estimati				skir
UNIT - Description of stability - UNIT -	on of values, for rocket	ROCKET AERODYNAMICS rious loads experienced by a rocket passing through atmosphere – drag estimation drag and base pressure drag – Boat-tailing in missiles – performance at varied dispersion – launching problems.	ous a	ltitude	es – ro	skir cke
UNIT - Description of stability - UNIT -	on of values, for rocket	ROCKET AERODYNAMICS rious loads experienced by a rocket passing through atmosphere – drag estimation drag and base pressure drag – Boat-tailing in missiles – performance at varied dispersion – launching problems. STAGING AND CONTROL OF ROCKET VEHICLES aging of rocket vehicles – multistage vehicle optimization – stage separation dylynamic and jet control methods of rocket vehicles – SITVC.	ous a	ltitude	es – ro	skir cke 9
UNIT - Description of stability - UNIT - Need for technique	on of va drag, for rocket V multi st	ROCKET AERODYNAMICS rious loads experienced by a rocket passing through atmosphere – drag estimation drag and base pressure drag – Boat-tailing in missiles – performance at varied dispersion – launching problems. STAGING AND CONTROL OF ROCKET VEHICLES raging of rocket vehicles – multistage vehicle optimization – stage separation dylynamic and jet control methods of rocket vehicles – SITVC.	namio	csand	separa	skir ocker 9 ition
UNIT - Description of stability - UNIT - Need for technique	on of values, for rocket – V multi stees aerod	ROCKET AERODYNAMICS Trious loads experienced by a rocket passing through atmosphere – drag estimation drag and base pressure drag – Boat-tailing in missiles – performance at varied dispersion – launching problems. STAGING AND CONTROL OF ROCKET VEHICLES Taging of rocket vehicles – multistage vehicle optimization – stage separation dylaynamic and jet control methods of rocket vehicles – SITVC. OMES Towledge on the fundamental laws of orbital mechanics with particular emphasis erplanetary trajectories	namio	csand	separa 5 PER	skir ocker 9 ition
UNIT - Description of stability - UNIT - Need for technique	on of values, for rocket V multi stees- aerod OUTCO To kr onint To c	ROCKET AERODYNAMICS Trious loads experienced by a rocket passing through atmosphere – drag estimation drag and base pressure drag – Boat-tailing in missiles – performance at varied dispersion – launching problems. STAGING AND CONTROL OF ROCKET VEHICLES Taging of rocket vehicles – multistage vehicle optimization – stage separation dylaynamic and jet control methods of rocket vehicles – SITVC. OMES Towledge on the fundamental laws of orbital mechanics with particular emphasis	namio	csand AL: 4	separa 5 PER ms Levering	skin cket 9 ition
UNIT - Description of stability - UNIT - Need for technique COURSE	on of values, for rocket V multi stess aerod OUTCO To kr onint To co geoce	ROCKET AERODYNAMICS Trious loads experienced by a rocket passing through atmosphere – drag estimation drag and base pressure drag – Boat-tailing in missiles – performance at varied dispersion – launching problems. STAGING AND CONTROL OF ROCKET VEHICLES Taging of rocket vehicles – multistage vehicle optimization – stage separation dylaynamic and jet control methods of rocket vehicles – SITVC. TOMES Townsel on the fundamental laws of orbital mechanics with particular emphasis erplanetary trajectories alculate orbital parameters and perform conceptual trajectory designs for entric orinterplanetary missions miliarize themselves with trajectory calculations for planar motion of	namio Ren Ana	csand AL: 4: Bloor	separa 5 PER ns Levering	skin cket 9 ition
UNIT - Description of stability - UNIT - Need for technique COURSE CO1	on of values, for rocket V multi stes- aerod OUTCO To kr onint To c geoce To fa	ROCKET AERODYNAMICS Trious loads experienced by a rocket passing through atmosphere – drag estimation drag and base pressure drag – Boat-tailing in missiles – performance at varied dispersion – launching problems. STAGING AND CONTROL OF ROCKET VEHICLES Taging of rocket vehicles – multistage vehicle optimization – stage separation dylaynamic and jet control methods of rocket vehicles – SITVC. TOMES Townsel on the fundamental laws of orbital mechanics with particular emphasis erplanetary trajectories alculate orbital parameters and perform conceptual trajectory designs for entric orinterplanetary missions miliarize themselves with trajectory calculations for planar motion of	Ren Ana	csand AL: 43 Bloor nember	separa 5 PER ms Levering	skin cket 9 ition



1 Co	Cornelisse, JW, "Rocket Propulsion and Space Dynamics", J.W. Freeman & Co., Ltd., London, 2012.								
2 Pa	rker, ER, "Mate	rials for Missiles	s and Spacecraft",	McGraw-Hill Book	Co., Inc., 1982	SOMETHING			
3 Su	ıresh. B N & Siv	van. K, "Integrate	ed Design for Space	ce Transportation Sys	tem", Springer Ind	ia,2016			
4 St	ıtton, GP, Biblar	z, O, "Rocket Pr	opulsion Elements	s", John Wiley & Son	s Inc., New York, 9	thEdition, 2017			
5 Va	Van de Kamp, "Elements of Astromechanics", Pitman Publishing Co., Ltd., London, 1980								
EBSITE RE	FERENCE / N	PTEL/ SWAYA	M/ MOOC REFI	ERENCE:	Literatura				
1 ht	tps://archive.npt	tel.ac.in/courses/	101/105/10110502	29/		STANS TO THE PROPERTY OF THE P			
2 14	https://onlinecourses.nptel.ac.in/noc19_ae08/preview								
2 ht	ips://onlinecour	ses.npter.ac.in/no	oc19_ae08/preview	Y					
		ses.npter.ac.in/no	oc19_ae08/previev	word day or at min	n glad hav sæuere	agzi			
		PO2	PO3	PO4	PO5	PO6			
P-PO MAPI	PING	a days are traken	pelitoriey no egre	iwona aligi ta aligia. Manang ta aligia	PO5	PO6			
-PO MAPI	PING PO1	a days are traken	PO3	iwona aligi ta aligia. Manang ta aligia	PO5 - 3	to rompress.			
COs	PING PO1 3	a days are traken	PO3	iwona aligi ta aligia. Manang ta aligia	gar — (marge va ii — maridone visa —	acid Flore office 1			
COs CO1 CO2	PING PO1 3 3	a days are traken	PO3 2 2	PO4 -	- 3	Send Photo wheel			



PPAR1PE03		COMPUTATIONAL HEAT TRANSFER		Т	P	C
		3, Numpyterinous Florid Dynamus", Cambridge Mainstage Press. 2002	3	0	0	3
O'URSE (OBJECT	TIVES: paralla 3 Hills war out and could have the property as the Tives.	medal	illo	3	-
1	To get	insights into the basic aspects of various discretization methods.	V.C.n	dek	þ	
2	To pro	vide basic ideas on the types of PDE's and its boundary conditions to arrive at its	soluti	ion.		
3	To imp	part knowledge on solving conductive, transient conductive and convective problems.	ems us	singco	mputat	iona
4	To solv	ve radiative heat transfer problems using computational methods.				
5	To provide a platform for students in developing numerical codes for solving heat transferproblems.					
UNIT -	- I	INTRODUCTION	2101		ary C	9
dimension	- II D-heat conal steady	CONDUCTIVE HEAT TRANSFER onduction equation in Cartesian, cylindrical and spherical coordinates. Computa y state heat conduction – with Heat generation- without Heat generation- 2D-hea andary conditions- Numerical treatment for extended surfaces- Numerical tre	it cond	duction	probl	em
conductio	n- Nume	rical treatment to 1D-steady heat conduction using FEM	diffici	101		out
	ion to Im	TRANSIENT HEAT CONDUCTION plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One tion – with heat Generation-without Heat generation – 2D-transient heat conduct				9
Introducti steady hea different	ion to Im at conduct boundary heat Con	plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One	tion pr	oblem	with	
Introduction steady here different transient UNIT – Convection problems approach	ion to Im at conduct boundary heat Con- IV on- Numeral Compu	plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of Onetion —with heat Generation-without Heat generation — 2D-transient heat conduct conditions using Implicit, explicit Schemes-Importance of Courant number- Anaduction problems CONVECTIVE HEAT TRANSFER erical treatment (FDM) of steady and unsteady 1-D and 2-d heat convection- direction of thermal and Velocity boundary layer flows. Upwind scheme- Street grades in the convection of the co	tion pralysis	for I-I	y-unste	9 eady icity
Introduction steady head different transient UNIT -	ion to Im at conduct boundary heat Con- IV on- Numeral Compu	plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One ction —with heat Generation-without Heat generation — 2D-transient heat conduct conditions using Implicit, explicit Schemes-Importance of Courant number- Anaduction problems CONVECTIVE HEAT TRANSFER erical treatment (FDM) of steady and unsteady 1-D and 2-d heat convection- direction of thermal and Velocity boundary layer flows. Upwind scheme- Str	tion pralysis	for I-I	with D,2-D y-unste	9 eady
Introduction steady here different transient UNIT - Convection problems approach UNIT - Radiation Introduct	ion to Imat conduction to Imat conduction to Imate at Conduction Image and Image at Conduction Image at Conduction to Image at Conduction to Image at Conduction Image	plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of Onetion —with heat Generation-without Heat generation — 2D-transient heat conduct conditions using Implicit, explicit Schemes-Importance of Courant number- Anaduction problems CONVECTIVE HEAT TRANSFER erical treatment (FDM) of steady and unsteady 1-D and 2-d heat convection- direction of thermal and Velocity boundary layer flows. Upwind scheme- Street grades in the convection of the co	ffusion programment of the state of the stat	nstead function tacalro	y-unsternor-vort	9 eady icity 9 hod-
Introduction steady head different transient UNIT - Convection problems approach UNIT - Radiation Introduct Developing	ion to Imat conductory at conductory heat Con- IV on- Nume- Compu- Creeping V n fundantion to Fing a num	plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One tion —with heat Generation-without Heat generation — 2D-transient heat conduct conditions using Implicit, explicit Schemes-Importance of Courant number- Anaduction problems CONVECTIVE HEAT TRANSFER erical treatment (FDM) of steady and unsteady 1-D and 2-d heat convection- direction of thermal and Velocity boundary layer flows. Upwind scheme- String flow RADIATIVE HEAT TRANSFER mentals-Shape factor calculation-Radiosity method- Absorption Method — inite Volume Method- Numerical treatment of radiation enclosures using florical code for 1D, 2D heat transfer problems.	ffusion programment of the state of the stat	nstead function	y-unsternation metals are metals are metals.	9 eadyyicity 9 hod-hod.
Introduction steady head different transient UNIT - Convection problems approach UNIT - Radiation Introduct Developing	ion to Imat conduct boundary heat Con- IV on- Numer Computer Creeping on fundantion to Fing a numer COUTCO	plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One tion —with heat Generation-without Heat generation — 2D-transient heat conduct conditions using Implicit, explicit Schemes-Importance of Courant number- Anaduction problems CONVECTIVE HEAT TRANSFER erical treatment (FDM) of steady and unsteady 1-D and 2-d heat convection- direction of thermal and Velocity boundary layer flows. Upwind scheme- String flow RADIATIVE HEAT TRANSFER mentals-Shape factor calculation-Radiosity method- Absorption Method — inite Volume Method- Numerical treatment of radiation enclosures using florical code for 1D, 2D heat transfer problems.	ffusion programment of the state of the stat	nstead function AL: 4	y-unsternation metals by m	9 eady icity 9 hod- hod. IOI
Introduction steady head different transient UNIT - Convection problems approach UNIT - Radiation Introduct Developing	on- Numeron fundamental Computer Comput	plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One to condition with heat Generation-without Heat generation – 2D-transient heat conduct conditions using Implicit, explicit Schemes-Importance of Courant number- Anaduction problems CONVECTIVE HEAT TRANSFER Perical treatment (FDM) of steady and unsteady 1-D and 2-d heat convection- direction of thermal and Velocity boundary layer flows. Upwind scheme- String flow RADIATIVE HEAT TRANSFER Penentals-Shape factor calculation-Radiosity method- Absorption Method – inite Volume Method- Numerical treatment of radiation enclosures using factorical code for 1D, 2D heat transfer problems.	ffusion programment of the state of the stat	nstead function AL: 4 Bloom	y-unstern method	9 eadyicity 9 hod-hod.
Introduction steady here different transient UNIT - Convection problems approach UNIT - Radiation Introduct Developin	on- Numeror Computer Creeping - V	plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One ction —with heat Generation-without Heat generation — 2D-transient heat conduct conditions using Implicit, explicit Schemes-Importance of Courant number- Anaduction problems CONVECTIVE HEAT TRANSFER erical treatment (FDM) of steady and unsteady 1-D and 2-d heat convection- diatation of thermal and Velocity boundary layer flows. Upwind scheme- Strong flow RADIATIVE HEAT TRANSFER mentals-Shape factor calculation-Radiosity method- Absorption Method — inite Volume Method- Numerical treatment of radiation enclosures using factorical code for 1D, 2D heat transfer problems. DMES an Idea about discretization methodologies for solving heat transfer problems et to solve 2-D conduction and convection problems an ability to develop solutions for transient heat conduction in simple	ffusion programment of the state of the stat	nstead function AL: 4 Bloom Ap	y-unstead method	9 eady icity 9 hod- hod.
Introduction steady here different transient UNIT - Convection problems approach UNIT - Radiation Introduct Developin COURSE CO1 CO2	on- Numeror Computer Creeping - V on fundamion to Fing a numeror Be able Have a geometric Be caped and to the computer	plicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One ction —with heat Generation-without Heat generation — 2D-transient heat conduct conditions using Implicit, explicit Schemes-Importance of Courant number- Anaduction problems CONVECTIVE HEAT TRANSFER erical treatment (FDM) of steady and unsteady 1-D and 2-d heat convection- diatation of thermal and Velocity boundary layer flows. Upwind scheme- Strong flow RADIATIVE HEAT TRANSFER mentals-Shape factor calculation-Radiosity method- Absorption Method — inite Volume Method- Numerical treatment of radiation enclosures using factorical code for 1D, 2D heat transfer problems. DMES an Idea about discretization methodologies for solving heat transfer problems et to solve 2-D conduction and convection problems an ability to develop solutions for transient heat conduction in simple	ffusion programment of the state of the stat	nstead function AL: 4 Bloor Ap Eva	y-unsteened by method m	9 eady icity 9 nod-hod. IOI



1				ngineering Heat &	Mass Transfer", N	ew age publisher, 4th	nedition		
2	Internation)i" Cl-	idea I Iniconsity Dua	2002	T. C.		
2	بالتشاهب				ridge University Pre				
3	Holman,J	Holman, JP, "Heat Transfer", McGraw-Hill Book Co, Inc., McGraw-Hill College; 10th edition, 2017							
4	John D. A	John D. Anderson, "Computational Fluid Dynamics", McGraw Hill Education, 2017							
5	John H. L	John H. Lienhard, "A Heat Transfer", Text Book, Dover Publications, 5th edition, 2020.							
VEBSIT	E REFEREN	NCE / N	PTEL/ SWAYA	M/ MOOC REFI	ERENCE:	in aghalwayal mayari	of t		
					T	niordi	100		
1	https://on	linecours	ses.nptel.ac.in/no	c22_me101/previ	ew months appearing				
2	https://arc	hive not	https://archive.nptel.ac.in/courses/112/105/112105271/						
_		TILL TO.LIP	el.ac.iii/courses/	112/103/1121032/	1/				
		an ve.mp.	.ei.ac.iii/courses/	112/103/1121032/	17	2004022			
	MAPPING		er.ac.m/courses/	112/103/1121032/	Manual Colestino	nabaral biglioté sa	inde Differen		
	MAPPING	01	PO2	PO3	PO4	PO5	PO6		
	MAPPING	ianes el	olization, Madigo	expansion-Disco	rone Farlor's some	PO5	PO6		
CO-PO M	MAPPING P	ianes el	olization, Madigo	expansion-Disco	rone Farlor's some	PO5	PO6		
CO-PO M	MAPPING P	01	olization, Madigo	PO3	PO4	nengia tu numios-	PO6		
CO-PO M COs	MAPPING P S 1	3	olization, Madigo	PO3	PO4	nengia tu numios-	PO6		
CO-PO M COs CO1	MAPPING P S L 2	3 3	olization, Madigo	PO3 2 2	PO4 3 3	3	PO6		



PERE

PPAR1PI	E04	THEORY OF ELASTICITY	L	T	P	C	
		erra W. "Stresses in Shells". Springer – Verlag, 1990	3	0	0	3	
COURSE	OBJEC	TIVES: and Green L.M. Theory of Educate Stability, Miscolar Hillier Stability of the A.Z. of the Company of the	mison	iii a	ŧ	1	
1000	To lear	n the basic concepts and equations of elasticity.	mbe	av j	+		
2	To pro	vide with the concepts of plain stress and strain related problems.		38.3	TER	TW.	
3	To gai	n knowledge on equilibrium and stress-strain equations of polar coordinates.	p#\\.20	and [
4	To exp	ose to axisymmetric problems.					
5	To get	insight into the basic concepts of plates and shells.					
UNIT -	JNIT – I BASIC EQUATIONS OF ELASTICITY						
stress - S	ess and plottion o	APPLIED CONCEPTS ane strain problems – Airy stress function – Biharmonic equation – Compatibilit f bar and beam problems using the elasticity approach – Torsion ofbars – Determments – Warping of cross-sections – Prandtl's stress function approach – St. Ven	inatio	n of st	resses,	9 s of	
UNIT -		POLAR COORDINATES		neuro		9	
	and sphe	ck curved bar – Stresses in straight and curved beams due to thermal loading – Theres – Stress concentration in bending AXISYMMETRIC PROBLEMS				9	
internal a to gravita UNIT -	ind externation – Article V	tress-strain equations in cylindrical coordinates – Lame's problem – Thick- walle hal pressure – Application of failure theories – Stresses in compositetubes – Shrin halysis of a rotating disc of uniform thickness – Discs of variable thickness – Rota PLATES AND SHELLS eory – Assumptions, governing equations and boundary conditions – Navier's	k fitti	ng – S hafts a nod of	tresses nd cyli	due inde 9 on -	
		Solution – Rectangular and circular plates – Solution techniques – Analysis of stion and stresses due to applied loads.		366			
COURSE	OUTCO	DMES .	101	Maradan ay	5 PER		
COI		knowledge of basic elasticity relationships and equations.		Reme	mberir	ng	
CO2	Know	how to carry out stress analysis in 2-D and 3-D		Reme	mberir	ng	
CO3		exposure on the formulation of constitutive and governing equations for problems in Cartesian and cylindrical coordinates		Ana	llyzing		
CO4	Be ab	le to analyse and solve practical problems in cartesian and cylindrical inates		Analyzing			
CO5		le to determine the stress, strain and displacement field for common nmetrical members.		Ana	lyzing	;	



9,199

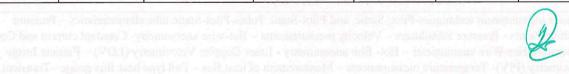
	Timoshenko, S.P. Winowsky. S., and Kreger, "Theory of Plates and Shells", McGraw Hill BookCo., 2nd edition, 2015							
2	Flugge, W, "Stresses	in Shells", Springer	r – Verlag, 1990		2 3			
3	Timoshenko, S.P. and	Gere, J.M, "Theory	y of Elastic Stabili	ty", McGraw Hil	lBook Co.2010.	40 353G0		
4	Varadan, TK and Bhaskar, K, "Analysis of plates-Theory and problems", NaroshaPublishing Co., 2001							
EBSITE I	REFERENCE / NPT	EL/ SWAYAM/ MO	OOC REFEREN	CE: have some	unti ritiri shirrong o			
1	https://archive.nptel.a	ac.in/courses/105/10	5/105105177/	e dail silwps in	systheed ways	T T		
2	https://archive.nptel.a	ac in/content/storage	e2/courses/105108	070/module1/lect	ture1 pdf	T		
			itani, lano satglia ta		n can mishani 150 r			
O-PO MA	PPING							
COs	PO1	PO2	PO3	PO4	PO5	PO6		
CO1	1	1-	2	1	1	amaild pa		
CO2	solution 3 man	noite of Lamon de	18 - non 2 m acr	de vis 1 smale	2 11/2 2	azonia a In		
CO3	hand remained Trick and		2	1	-d l emante	15 box m1 s		
CO4	3	1	2	1	3	1		
				CONTRACTOR OF THE SAME		A STATE OF THE PARTY OF THE PAR		



PPAR1PI	E05	EXPERIMENTAL AERODYNAMICS	L	T	P	C
Nes .	of Shariff I	HILD or called Cylin and tome substitute when the color of the first tells and the color of the first of the color of the	3 .	0	0	3
COURSE	OBJEC	rives:	Jent	les (
1	To lear	rn basics of wind tunnel operation and its associated measurements.	40516			
2	To pre	sent the concepts of different flow visualization methods.	Hebri			
3	To imp	part knowledge on flow measurement variables				
4	To be	familiar with data acquisition methods pertaining to experiments in aerodynamics.	AP IN Y	200	I I Later	435
5	To do	uncertainty analysis for their experiments		****		
UNIT -	- I	LOW SPEED TUNNEL	Non			9
Turbulen	ce – Win	sonic wind tunnels – Speed Setting – Flow Direction – Three-Hole and Five-Hole d tunnel balance – Water tunnel.	Yaw	Probe	es –	
UNIT -	- II	HIGH SPEED TUNNEL				9
Infinite p Deflectio	splaceme late with n of a thi	FLOW VISUALIZATION TECHNIQUES ent relations in polar coordinates – Equilibrium and stress-strain equations in polar a small central hole – Stress concentration – Bending of a curved beam(Winkler-ick curved bar – Stresses in straight and curved beams due to thermal loading – Theres – Stress concentration in bending	Bach	theory	/) –	9
UNIT -		MEASUREMENTS OF PROPERTIES			10.7	9
Sensitive temperate Velocime analysis of UNIT	Paints - ure Hot-V of foil ga - V uisition a	ment techniques-Pitot, Static, and Pitot-Static Tubes-Pitot-Static tube characteristic Pressure transducers – Velocity measurements – Hot-wire anemometry- Constant Wire anemometer – Hot- film anemometry - Laser Doppler Velocimetry (LDV) – 1). Temperature measurements – Measurement of heat flux – Foil type heat flux gauge– Thin film sensors– Slug type heat flux sensor. DATA ACQUISITION SYSTEMS AND UNCERTAINTY ANALYSIS and processing – Signal conditioning – Statistical analysis of experimental data –	curre Partic uge -	ent and cle Im Trans	d Constage sient	9
Estimation	on of mea	asurement errors – Uncertainty calculation – Uses of uncertaintyanalysis.	гот	AL: 4	5 PER	IOI
COURSE	OUTC	OMES		Bloor	ns Lev	el
CO1	CO1 Have knowledge on measurement of flow properties in wind tunnels and their Remember associated instrumentation					ng
CO2	Be ab	ole to demonstrate and conduct experiments related to subsonic and supersonic		Ana	alyzing	•
CO3 Gain idea on flow visualization of subsonic and supersonic flows		idea on flow visualization of subsonic and supersonic flows	Understanding			
CO4		miliar with calibration of transducers and other devices used for flow urement		Ana	alyzing	5
			1			



CO5	Be able to estimate endata.	Be able to estimate errors and to perform uncertainty analysis of the experimentata.						
on repe	NCE BOOKS:	T KITLATO	CHARLE IN THE STATE	4144-53		2/11/9/14/19/		
KEFEKE	NCE BOOKS:							
1	Timoshenko, S.P. Winedition, 2015	nowsky. S., and Kre	eger, "Theory of Plan	tes and Shells", N	AcGraw Hill Bo	okCo., 2nd		
2	Flugge, W, "Stresses in Shells", Springer – Verlag, 1990							
3	Timoshenko, S.P. and	Gere, J.M, "Theory	y of Elastic Stability	", McGraw Hill	Book Co.2010.			
4	Varadan, TK and Bha	skar, K, "Analysis o	of plates-Theory an	d problems",Na	roshaPublishing	; Co., 2001		
WEBSIT	E REFERENCE / NPT	EL/ SWAYAM/ MO	OOC REFERENC	E:	he topolites with	07		
1	https://archive.nptel.a	c.in/courses/101/10	05/101105088/	nalysis for their	cVitterateur ob	al s		
2	https://archive.nptel.a	c.in/courses/112/10	05/112105287/	- Literatura	HUP GALL	LA-MAL.		
CO-PO N	MAPPING	non – Playe-Halo	eming Play Direct	Z trodč – slave	e baiw chroetke	to existence		
COs	PO1	PO2	PO3	PO4	PO5	PO6		
CO	L - plor ou l'airo papir	i sasa I 2 danour	2 00	in Electronic	ent Ima	nozanie zon		
CO	2 3	3	2	my de propie	3	to necessifie damma door		
CO	3 2	2	2	/ / - 1 - 1	2			
CO	4 3	3	2	and slotter	3	consignation To management		
CO	5 3	2	2	U de passent	3	Street to the law		



PPAR1PE	R1PE06 CONTROL ENGINEERING				P	C
200	Mer.	nor the me ton the	3	0	0	3
COURSE (BJEC	TIVES:		a		
1		roduce the mathematical modelling of systems, open loop and closed loop system n and frequency domain.	s anda	nalyse	s in tir	ne
2		part the knowledge on the concept of stability and various methods to analyse stab ency domain	oility ii	n both	time a	nd
3		roduce sampled data control system			T)	
UNIT -	I	INTRODUCTION				9
		Simple pneumatic, hydraulic and thermal systems, Series and parallel system, Andents, Development of flight control systems	alogies	s, mec	hanica	l and
UNIT -	II	OPEN AND CLOSED LOOP SYSTEMS	-1			9
		systems – Control system components - Block diagram representation of controls, Signal flow graphs, Output to input ratios	ystem	s, Red	uction	
UNIT –	III	488			9	
		nation, Response of systems to different inputs viz., Step impulse, pulse, parabolionse of first and second order systems, steady state errors and error constants of un				t
UNIT -		CONCEPT OF STABILITY				9
		fficient conditions, Routh-Hurwitz criteria of stability, Root locus and Bode techn uency response	iques,(Conce	pt and	
UNIT -	V	SAMPLED DATA SYSTEMS				9
Z-Transfo	rms Int	roduction to digital control system, Digital Controllers and Digital PID controllers				
			TOTA	AL: 45	5 PER	IODS
COURSE	OUTC	OMES		Bloon	ns Lev	el
CO1		ty to apply mathematical knowledge to model the systems and analyse the ency domain		Ap	plying	
CO2	Abili	ty to check the stability of the both time and frequency domain		Ap	plying	
CO3		ty to solve simple pneumatic, hydraulic and thermal systems, Mechanical lectricalcomponent analogies based problems.		Reme	mberi	ng
CO4		ty to solve the Block diagram representation of control systems, Reduction ockdiagrams, Signal flow graph and problems based on it		Ana	ılyzing	,
CO5		ty to understand the digital control system, Digital Controllers and Digital PID rollers		Ana	lyzing	,
REFEREN	ICE BO	OOKS:				
1	OGA	TO, Modern Control Engineering, Pearson, New Delhi, 2016				
2		, J.J.D. and C.H. Houpis, "Feedback control system analysis and synthesis", McConternational 3rs Edition, 1998	Graw-			
WEBSITE		CRENCE / NPTEL/ SWAYAM/ MOOC REFERENCE:	100			
1	https	://archive.nptel.ac.in/courses/108/106/108106098/				



2	https://archive.nptel.a	c.in/courses/107/	106/107106081/							
СО-РО М	CO-PO MAPPING									
COs	PO1	PO2	PO3	PO4	PO5	PO6				
CO1	dougle was les esci.	peola boil 1001	2	desir ja lasmedi.	naile solloware s	1				
CO2	ied di palimoje l'ectendo	stock - cons	2 1009	200 00 le 2000	1	1				
CO3	1	- 1	2	1 10 10 10	name of I beauty of	1				
CO4	on a going lateral	Januarun Saul	2	Libosti I s. angu	1	1				
CO5	1	-	2	1	1	1				





PPAR2PE0	7	STRUCTURAL DYNAMICS	L	T	P	C
ne den d	ement.	Salestander of the state of the salestand vertices the state of the salestand vertical vertic	3	0	0	3
COURSE O	BJECT	TIVES: BOURGOOK GOOGLEGERE GOOGLEGERE	101	701 A	ries.	3U/
1	This co	ourse imparts knowledge on the force deflection properties of structures and natural	ıl mo	desof	vibrati	on.
2	This co	ourse also presents the principles of dynamics and energy methods pertaining to str	uctu	res.		
3	This co	ourse will make students to realise the importance of natural modes of vibration.				
		ourse will provide in-depth knowledge on natural vibrations of beams and plates.	-	-	-	V. 3
April 19 Carlot	This co	ourse also provides a platform for better understanding of the approximate method	s fora	erosp	ace	
UNIT - I		FORCE DEFLECTION PROPERTIES OF SYSTEMS				9
		eneralized coordinates – Virtual work and generalized forces – Force – Deflectioni bility methods.	nflue	ence fu	inction	ıs –
UNIT – I	I	PRINCIPLES OF DYNAMICS	- 4			9
		brations of systems with finite degrees of freedom – Response to periodic excitation. Integral	on –I	mpuls	e Resp	onse
UNIT – I	II	NATURAL MODES OF VIBRATION	T		ECV4	9
		on for Multi degree of freedom Systems – Solution of Eigen value problems – No Conditions- Modal Analysis.	rmal	coordi	inates	
UNIT – I		ENERGY METHODS				9
		ole – Rayleigh – Ritz method – Coupled natural modes – Effect of rotary inertia and is – Natural vibrations of beams and plates	dshea	ır on la	ateral	
UNIT – '	V	APPROXIMATE METHODS				9
		hods of evaluating the Eigen frequencies and eigen vectors by reduced, subspon and QR methods.	ace,	Lancz	os, Po	wer,
			TOT	AL: 4	5 PER	IODS
COURSE O	UTCO	DMES		Bloor	ns Lev	el
CO1		le to solve the equation of motion of a linear system and use this solution to e thevibration behaviour of the system		Ap	plying	
CO2	Be cap	pable to relate the results of a modal analysis relate to the vibration of a structure		Ap	plying	
CO3		re knowledge on equation of motion of a lumped MDOF mass-spring- er system		Reme	mberi	ng
CO4		knowledge on vibration characteristics of continuous system such as s, bar, shafts andbeams		Ana	alyzing	7
CO5	Be ab	le to assess the fundamental frequency of MDOF systems using approximate ds		Ana	alyzing	7
REFEREN	CE BC	OOKS:		7		
1	Hurty	, WC and Rubinstein, MF, "Dynamics of Structures", Prenticed. New Delhi 2017	e Ha	llof In	dia	



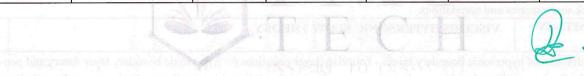
2	Ramamurthi, V, "N Ltd, 2008	Mechanical Vibration	Practice and No	oise Control", Na	rosaPublishingHou	ise Pvt.
3		nd Young,DH,"Vibra	tion Problems i	n Engineering",	JohnWilley & Son	sInc., 1984.
4	Tse.FS, Morse, II Pvt. Ltd, New De	E and Hinkle, HT, "M lhi, 2004	fechanical Vibra	ations: Theory ar	dApplications",Pr	entice Hall of India
WEBSITE	E REFERENCE / N	PTEL/ SWAYAM/ N	100C REFER	ENCE:	4844140	
Trace 1	https://nptel.ac.in/	/courses/101105022	орижжае эся	et am ne bilipative	nak enjayan ozugo	SHET
2	https://archive.np	tel.ac.in/courses/101/1	04/101104062/			
CO-PO M	IAPPING	n anastromente on anastromoberda	tomes no agin	senser or steerom niveral digitant	bridge flow strates	
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	an an a I — sara I — mandi bes	2	2	2	burani bang
CO2	_		2	2	Abother gride	1
CO3	duem) non-visue o	Magnetic popular	3,0,000	2	2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	secret bull-size
CO4	_	_	3	2		1
COS			2	2	E EXTENS	HI-THU 1



PPAR2P	E08	HYPERSONIC AERODYNAMICS	L	Т	P	С
1994	edinië në	12. Meiser und Devid T. Pearl, Eignesalens Air Meuhhnig propulsion. A LA Al-Stand	3	0	0	3
COURSE	OBJEC'	TIVES: FUEL RESIDENCE TO BE SEEN ALE RESIDENCE DE LE PROPERTIE DE L'ANTINE DE	Jul	al F	Į.	
1	To rea	lise the importance of studying the peculiar hypersonic speed flow characteristics pes	pertai	ningto	flight	4
2		vide knowledge on various surface inclination methods for hypersonic inviscid flo	ws.	Mary.		7
3	To arr	ive at the approximate solution methods for hypersonic flows.	Von		-	-4
4	To im	part knowledge on hypersonic viscous interactions.	-		n from a	
5	To imp	part knowledge on the effect on aerodynamic heating on hypersonic vehicles	3.79-23	1323		
UNIT	-I	INTRODUCTION TO HYPERSONIC AERODYNAMICS				9
flight sim map for h	nilarity pa nypersoni	personic flows - Thin shock layers – entropy layers – low density and high densit rameters – shock wave and expansion wave relations of inviscidhypersonic flows c vehicles.				ude
UNIT -	-11	SURFACE INCLINATION METHODS FOR HYPERSONIC INVISCID FLOWS			.03	9
shock exp	pansion r	ination methods – modified Newtonian Law – Newtonian theory – tangent wedge nethods – Calculation of surface flow properties – practical application of surface indence principle.				ls –
UNIT -	- III	APPROXIMATE METHODS FOR INVISCID HYPERSONIC FLOWS				9
wave the	ory – hyp	pproximate methods hypersonic small disturbance equation and theory – Maslen''s personic equivalence principle- entropy effects - rotational method of characteristics and correlations.				
UNIT -		VISCOUS HYPERSONIC FLOW THEORY				9
similar h	ypersonic	personic boundary layers - boundary layer equations r – hypersonic boundary layer boundary layers – hypersonic aerodynamic heating and entropy layerseffects on a friction estimation.				
UNIT	- V	VISCOUS INTERACTIONS AND TRANSITION				9
- Parame	eters affe	viscous interactions – hypersonic shockwaves and boundary layer interactions cting hypersonic boundary layer transition - Estimation of hypersonic boundary later for laminar viscous interactions in hypersonic viscous flow.				
			ГОТА	AL: 4	5 PER	IODS
COURSE	OUTC	OMES		Bloor	ns Lev	el
CO1		ble to arrive at the solution for problems involving inviscid and viscous sonic flows	Ren	nembe	ering	
CO2		thorough knowledge on high temperature effects in hypersonic aerodynamics	Ren	nembe	ering	
CO3		le to arrive at various solution methods to overcome aerodynamic heating em onhypersonic vehicles	App	olying		
CO4	To ga	in ideas on the design issues associated with hypersonic vehicles	Ana	alyzin	g	
CO5	Able	to realize the importance and use of the relevant equations for viscous hypersonic	Ana	alyzin	g	
REFERE	NCE BO	OOKS:		7 10		



	Anderson, JD, "Hyperson 2016	nic and High Temp	perature Gas Dyna	amics", AIAA Ed	ucation Series, 2n	idedition,
2	Anderson, JD, "Modern of edition, 2017	compressible flow	: with Historical	Perspective", Mc	Graw HillEducati	ion, 3 rd
3	William H. Heiser and Da	ıvid T. Pratt, Hype	ersonic Air Breath	ing propulsion, A	IAAEducation Se	eries, 1994.
4	John T. Bertin, Hyperson	ic Aerothermodyn	amics, AIAAEdu	cation Series, 199	3	NO SERVE
WEBSITE	E REFERENCE / NPTEL	SWAYAM/ MO	OC REFERENC	E: que lo sociatio	anii adlazina k	
1	https://archive.nptel.ac.ir	/courses/101/103	/101103003/	odge on sacious ac	Iwami abawang a	
2	https://archive.nptel.ac.ir	/content/syllabus	_pdf/101103003. _I	odf		
СО-РО М	IAPPING		PERSONAL PROPERTY OF THE PARTY	AND THE PERSON NAMED IN		
COs	PO1	PO2	PO3	PO4	PO5	PO6
COs	County A reports dead how o	PO2 2	PO3	PO4	PO5	PO6
o gnaled in	Vitable v = zwoll 3 becarge	in the water	PO3 1 1	PO4	PO5	PO6
CO1	A The last last last last last last last last	2	PO3 1 1	PO4	PO5	PO6
CO2	3	2	PO3 1 1 1	PO4	PO5 1 1 1	PO6



AR50

	E09	ADVANCED PROPULSION SYSTEMS	L	T	P	C
- 34	.organia	n, iff. "Maller compressing from with literalized Persportive", Medium Millifed	3	0	0	3
COURSE	OBJEC	TIVES:	miori)	W.		
1	This	course will cover the basic aspects of thermodynamic cycle analysis of air-breathin	gprop	ulsion	systen	ns.
2	This o	course is intended to impart knowledge on advanced air breathing propulsion system	ms lil	ke airai	ugmen	ted
3		course will give the knowledge on the basic aspects of scramjet propulsion system.	EVERO	167		
4	This	course will provide in-depth knowledge about the nozzle performance.	v Veg	and	-	
5	This	course also presents vast knowledge on the operating principles of nuclear, electric	and i	onprop	oulsion	
UNIT	- I	THERMODYNAMIC CYCLE ANALYSIS OF AIR-BREATHING PROPUSYSTEMS	LSIC	ON	100	9
Thermod	ynamic	pulsion systems like Turbojet, turboprop, ducted fan, Ramjet and Air augmented F cycles – Pulse propulsion – Combustion process in pulse jet engines – inletchargin propertical charging			Subcri	itica
UNIT -		RAMJETS AND AIR AUGMENTED ROCKETS			ion	9
UNIT -		Ram rocket. SCRAMJET PROPULSION SYSTEM			00	9
integrated				1 .	10000	
fundame	ntal requ on of sup	culation of propulsion flow path – flow path integration – Various types of superson uirements of supersonic combustors – Mixing of fuel jets in supersonic cross flow – ersonic combustors NUCLEAR PROPULSION	nic co - perf	ombust	tors –	9
fundame estimatio UNIT - Nuclear I - Nuclear	ntal requon of sup IV rocket en rocket rce devel	ersonic combustors — Mixing of fuel jets in supersonic cross flow— ersonic combustors NUCLEAR PROPULSION Ingine design and performance — nuclear rocket reactors — nuclear rocket nozzles engine control — radioisotope propulsion — basic thruster configurations — thrustert lopment — nozzle development — nozzle performance of radioisotope propulsion systems.	- perf	ology-	ce	
Nuclear no Nuclear heat soun UNIT	ntal requence of super IV rocket errocket rocket roc devel V oncepts	rirements of supersonic combustors – Mixing of fuel jets in supersonic cross flow – ersonic combustors NUCLEAR PROPULSION Ingine design and performance – nuclear rocket reactors – nuclear rocket nozzles engine control – radioisotope propulsion – basic thruster configurations – thruster lopment – nozzle development – nozzle performance of radioisotope propulsion system ELECTRIC AND ION PROPULSION in electric propulsion – power requirements and rocket efficiency – classificators – plasma thruster– Fundamentals of ion propulsion – performanceanalysis – i	techn stems	ology- s.	ce 	9 rs -
Nuclear no Nuclear heat soun UNIT	ntal requent of sup IV rocket en rocket rocket roc devel V oncepts atic thru	nirements of supersonic combustors – Mixing of fuel jets in supersonic cross flowersonic combustors NUCLEAR PROPULSION Ingine design and performance – nuclear rocket reactors – nuclear rocket nozzles engine control – radioisotope propulsion – basic thruster configurations – thruster topment – nozzle development – nozzle performance of radioisotope propulsion system ELECTRIC AND ION PROPULSION in electric propulsion – power requirements and rocket efficiency – classif sters – plasma thruster– Fundamentals of ion propulsion – performance analysis – in the control of t	techn stems	ology- on of the	ce	9 rs -
fundame estimation UNIT - Nuclear - Nuclea heat sour UNIT Basic coelectrosta	rocket er rocket	rirements of supersonic combustors – Mixing of fuel jets in supersonic cross flowersonic combustors NUCLEAR PROPULSION Ingine design and performance – nuclear rocket reactors – nuclear rocket nozzles engine control – radioisotope propulsion – basic thruster configurations – thruster lopment – nozzle development – nozzle performance of radioisotope propulsion system of the propulsion – power requirements and rocket efficiency – classificators – plasma thruster – Fundamentals of ion propulsion – performanceanalysis – in to Analyse in detail the thermodynamics cycles of air breathing propulsion	techn stems	ology- on of tocket en AL: 45	chrusterngine.	9 rs -
Nuclear - Nuclea heat sour UNIT Basic coelectrosts	rocket er rocket roc devel - V COUTC Able syste Able	rirements of supersonic combustors – Mixing of fuel jets in supersonic cross flowersonic combustors NUCLEAR PROPULSION Ingine design and performance – nuclear rocket reactors – nuclear rocket nozzles engine control – radioisotope propulsion – basic thruster configurations – thruster lopment – nozzle development – nozzle performance of radioisotope propulsion system of the propulsion – power requirements and rocket efficiency – classificators – plasma thruster – Fundamentals of ion propulsion – performanceanalysis – in to Analyse in detail the thermodynamics cycles of air breathing propulsion	techn stems	ology-s. on of tocket en	chrusterngine. 5 PER ms Lev	9 rs -
Nuclear non-Nuclear heat sour UNIT Basic coelectrosts COURSE	rocket en rocket rocket en	rirements of supersonic combustors – Mixing of fuel jets in supersonic cross flow- ersonic combustors NUCLEAR PROPULSION Ingine design and performance – nuclear rocket reactors – nuclear rocket nozzles engine control – radioisotope propulsion – basic thruster configurations – thrustert lopment – nozzle development – nozzle performance of radioisotope propulsion system ELECTRIC AND ION PROPULSION in electric propulsion – power requirements and rocket efficiency – classif sters – plasma thruster– Fundamentals of ion propulsion – performanceanalysis – i EOMES to Analyse in detail the thermodynamics cycles of air breathing propulsion ems to gain idea on the concepts of supersonic combustion for hypersonic vehicles	techn stems	ology- on of tocket en AL: 45 Bloom Ana	chrusterngine. 5 PER ms Lev	rel
fundame estimation UNIT - Nuclear in Nuclea	rocket er rocket roc developments atic thru Able system Able and in Able	nirements of supersonic combustors — Mixing of fuel jets in supersonic cross flow— ersonic combustors NUCLEAR PROPULSION Ingine design and performance — nuclear rocket reactors — nuclear rocket nozzles engine control — radioisotope propulsion — basic thruster configurations — thrustert lopment — nozzle development — nozzle performance of radioisotope propulsion system ELECTRIC AND ION PROPULSION in electric propulsion — power requirements and rocket efficiency — classif sters — plasma thruster— Fundamentals of ion propulsion — performanceanalysis — in the control of	techn stems	ology- on of tocket en Ana Reme	chruster ngine. 5 PER ns Lev nlyzing	9 rs IOI rel



						And the same of the same
1	Anderson, JD, "Hyper 2016					
2	Anderson, JD, "Mode edition, 2017	rn compressible	flow: with Histor	ical Perspective", N	AcGraw HillEduca	tion, 3 rd
- 3	William H. Heiser and	David T. Pratt, I	Hypersonic Air Br	eathing propulsion	, AIAAEducation S	eries, 1994.
4	John T. Bertin, Hypers	sonic Aerothermo	odynamics, AIAA	Education Series, 1	993	
EBSITI	E REFERENCE / NPT	EL/ SWAYAM/	MOOC REFER	ENCE:	dicinita es E, anos su	
1	https://archive.nptel.a	c.in/courses/101	/106/101106082/	i no egicelwood odt	arig fliw veitoo u	n i
2	https://www.youtube.	com/watch?v=L	v6OuuJbyFo	Noted days on sto	von line ozmoo su	T .
3	https://nptel.ac.in/cou	rses/112103243	e on the appealant	abeliated less the	PERSONAL SERVICES SE	71 2
O-PO M	IAPPING				SECURISAS	
COs	PO1	PO2	PO3	PO4	PO5	PO6
COI	3	67	2	2	3	1 1
CO2	3	-	2		2	godot – argi
CO3	3		3	roulings	2	AF-181
CO4	ladican - sumero que lo se	des my - n	3	Vec Albana	3 oltalish	- milm1
COS	5 2	40	2		2	do norteral



AR52

PPAR2PE1	0	AEROSPACE MATERIALS	L	T	P	C
		A CONTRACTOR OF THE STATE OF TH	3	0	0	3
COURSE OF	ВЈЕСТ	TIVES:			3	
1	To get	insights into the basic aspects of material science.				
2	To prov	vide basic idea on the mechanical behaviour of materials.				
		art knowledge on the macro mechanics of composite materials,				
4	To gair	a knowledge on the analysis and manufacturing methods of composite materials.				
5	To lear	n about the sandwich construction				
UNIT – I		MATERIAL SCIENCE				9
plasticity -	Strengt	metals & metallic alloys – Imperfections – Dislocations in Different Crystal Systhening Mechanisms Due to Interaction of Dislocations with Interfaces – Other Station Mechanisms				
UNIT – I	I	MECHANICAL BEHAVIOUR				9
materials – octahedral s N curve	use of fattress fa	and mechanical behaviour of materials – linear elasticity and plasticity – failure ailure theories – maximum normal stress and maximum shear stressfailure theorilure theory – failure theories based on strain energy – cyclic loading and fatigu	ries – i	import	ance o	f the S-
UNIT – II		METALLIC ALLOYS used for different aerospace applications – Properties of conventional and advance				9
Technologie Protection M	bon Coes & Co	HIGH TEMPERATURE MATERIALS Imposites and Ceramic Materials For High Temperature Aerospace Application ontrolling Parameters – Mechanical and Thermal Properties of These Material S 1 System for a Re-Entry Vehicle – Use of Super alloys –Metal Matrix Composite olications – Mechanical and Thermal Fatigue	system	s-Th	ermal	
UNIT - V		SMART MATERIALS				9
		art materials-shape memory effects-shape memory alloys-shape memory polynesting materials-self healing polymers.		ectro-i		
COURSE O	UTCC	OMES			ns Lev	
CO1		e to investigate the physical and mechanical behaviour of different materials		Ap	plying	
CO2		exposure on dislocation theories and their importance			plying	
CO3		general knowledge of the properties of different aerospace materials		Ap	plying	
CO4	Be abl	e to apply failure theories appropriately		Ana	alyzing	5
CO5	Be abl	e to select good materials for a specific aerospace application		Ana	alyzing	5
REFERENC	CE BO	OKS:				
1	Adria	n Mouritz, "Introduction to Aerospace Materials", Woodhead Publishing, 1st edi	tion, 2	012		
2		R M, "Mechanics of Composite Materials", 2nd Edition, CRC Press, Taylor is Group, 1998	&			
			NEW Y	/	1	4 4-5

12.30



3	Sam Zhang &Dongliang Zhao, "Aerospace Materials Handbook", CRC Press, Taylor & FrancisGroup, 2012.
4	Brain culshaw, smart structures and materials, Artech house, 2000
WEBSIT	E REFERENCE / NPTEL/ SWAYAM/ MOOC REFERENCE:
WEBSIT	https://archive.nptel.ac.in/courses/101/106/101106038/

CO-PO MAPPING

COs	PO1	PO2	РО3	PO4	PO5	PO6
CO1	3	2	1 min	dens danibase	1	1
CO2	3	2	1	42/4/22/46	1	j - T <u></u>
CO3	3	2	obiotilo percentio	of outlymouses	ne sampiliseer	ž – vinturalė Lientrosilei ()
CO4	3	2	1	VALUE DACK	1	
CO5	3	2	n lances in least	mantinum vain	con and all less residential ex	



	E11	AIRWORTHINESS AND AIR REGULATIONS	L	T	P	C
		The section was confident and the section of the se	3	0	0	3
OURSE (OBJEC	TIVES:	ist.ex			
1	To get	t insight into the basic aspects of aircraft rules.	V/III	K BALL	r televi	33
2	To gai	in knowledge on the basic concepts of airworthiness.				
3	To lea	arn the basic aspects on certification and publication procedures.	I			
4	To im	part knowledge on licensing and material selections.	T		100	
5	To pro	ovide with the concepts of case studies and civil aviation requirements			100	
UNIT -	-I	INTRODUCTION TO AIRCRAFT RULES	us a			9
		uirements for civil and military aircraft – CAA, FAA, JAR and ICAO regulations – s and specifications	-Defe	ence st	andard	s –
UNIT -	П	BASIC CONCEPTS OF AIRWORTHINESS				9
document	s like ce	ponsibilities of various categories of AME license and approved persons — Knowled retificate of Registration — Certificate of Airworthiness — Conditions of issue and varional retificate of Log Book, Journey Log Book, Technical Log Book etc.				
UNIT -	Ш	CERTIFICATION AND PUBLICATION PROCEDURES	133			9
		cates - Technical Publications - Aircraft Manual - Flight Manual - Aircraft Sched	uics	regi		1
Procedure UNIT -	e, Certifi IV	ication, Identification and Marking of Aircraft. LICENSING AND MATERIAL SELECTIONS Concessions – Airworthiness directives – Service bulletins – Crew training and their				9
Procedure UNIT - Modificat licenses -	e, Certifi IV	ication, Identification and Marking of Aircraft. LICENSING AND MATERIAL SELECTIONS				- 352
Procedure UNIT -	tions – C	ication, Identification and Marking of Aircraft. LICENSING AND MATERIAL SELECTIONS Concessions – Airworthiness directives – Service bulletins – Crew training and their				- 257
Procedure UNIT - Modificat licenses - stores. UNIT -	tions – Capprove	LICENSING AND MATERIAL SELECTIONS Concessions – Airworthiness directives – Service bulletins – Crew training and their ed inspection – Approved materials – Identification of approved materials – Bonder CASE STUDIES AND CIVILAVIATION REQUIREMENTS Les aeronautical products like rubber goods and various fluids – Accident invest der which C of A is suspended – ICAO and IATA regulations – Chicago and Wifereent issues of Advisory Circulars – Civil Aviation Requirements Section 2 – Air	r d and tigat Varsa	ion prow con	ntine	9 9 es -
Procedure UNIT - Modificat licenses - stores. UNIT - Storage of Circumsta Familiaria	e, Certific IV tions – Co-approve V of various ances ur zation of	Concessions – Airworthiness directives – Service bulletins – Crew training and their ed inspection – Approved materials – Identification of approved materials – Bonder CASE STUDIES AND CIVILAVIATION REQUIREMENTS us aeronautical products like rubber goods and various fluids – Accident investment which C of A is suspended – ICAO and IATA regulations – Chicago and W frecent issues of Advisory Circulars – Civil Aviation Requirements Section 2 – Air	tigat Varsa	ion prow con hiness	ntine	9 9 es ns
Procedure UNIT - Modificat licenses - stores. UNIT - Storage of Circumsta Familiaria	e, Certific IV tions – Co-approve V of various ances ur zation of	Concessions – Airworthiness directives – Service bulletins – Crew training and their ed inspection – Approved materials – Identification of approved materials – Bonder CASE STUDIES AND CIVILAVIATION REQUIREMENTS us aeronautical products like rubber goods and various fluids – Accident investment which C of A is suspended – ICAO and IATA regulations – Chicago and W frecent issues of Advisory Circulars – Civil Aviation Requirements Section 2 – Air	tigat Varsa	ion provided control of the control	ntine oceduration	9 9 es ns
Procedure UNIT - Modificat licenses - stores. UNIT - Storage of Circumsta Familiaria	tions – Coapprove Vof various ances ur zation of	Concessions – Airworthiness directives – Service bulletins – Crew training and their ed inspection – Approved materials – Identification of approved materials – Bonder CASE STUDIES AND CIVILAVIATION REQUIREMENTS us aeronautical products like rubber goods and various fluids – Accident invested which C of A is suspended – ICAO and IATA regulations – Chicago and W frecent issues of Advisory Circulars – Civil Aviation Requirements Section 2 – Air COMES	tigat Varsa	ion provided control of the control	ntine oceduration to be provided in the second seco	9 9 es ns IOI el
Modificat licenses – stores. UNIT – Storage of Circumstate Familiarization COURSE	e, Certific IV tions – Co-approve V of various ances un zation of To record To get	LICENSING AND MATERIAL SELECTIONS Concessions – Airworthiness directives – Service bulletins – Crew training and their ed inspection – Approved materials – Identification of approved materials – Bonder CASE STUDIES AND CIVILAVIATION REQUIREMENTS Les aeronautical products like rubber goods and various fluids – Accident investment which C of A is suspended – ICAO and IATA regulations – Chicago and W frecent issues of Advisory Circulars – Civil Aviation Requirements Section 2 – Air COMES alise the importance of aircraft rules	tigat Varsa	dquara ion provided control of the c	ntine ocedurivention 5 PER ns Lev plying	9 9 1000 1000 1000
Procedure UNIT - Modificat licenses - stores. UNIT - Storage of Circumsta Familiariz COURSE CO1 CO2	e, Certific IV tions – Co-approve V of various ances ur zation of To real To get To de	LICENSING AND MATERIAL SELECTIONS Concessions – Airworthiness directives – Service bulletins – Crew training and their ed inspection – Approved materials – Identification of approved materials – Bonder CASE STUDIES AND CIVILAVIATION REQUIREMENTS Les aeronautical products like rubber goods and various fluids – Accident investment which C of A is suspended – ICAO and IATA regulations – Chicago and W frecent issues of Advisory Circulars – Civil Aviation Requirements Section 2 – Air COMES alise the importance of aircraft rules et exposure on the basic concepts of airworthiness	tigat Varsa	dquara ion provided control of the c	ntine occeduration structure from the structure fro	9 9 1000
Procedure UNIT - Modificat licenses - stores. UNIT - Storage of Circumsta Familiaria COURSE CO1 CO2 CO3	e, Certific IV tions – Corapprove - V of various ances ur zation of To real To get To de To ca	LICENSING AND MATERIAL SELECTIONS Concessions – Airworthiness directives – Service bulletins – Crew training and their ed inspection – Approved materials – Identification of approved materials – Bonder CASE STUDIES AND CIVILAVIATION REQUIREMENTS Les aeronautical products like rubber goods and various fluids – Accident investment which C of A is suspended – ICAO and IATA regulations – Chicago and Wife recent issues of Advisory Circulars – Civil Aviation Requirements Section 2 – Air COMES alise the importance of aircraft rules et exposure on the basic concepts of airworthiness evelop test flight and Certification	tigat Varsa	dquara ion provided control of the c	ntine occeduration For PER or Lev plying emberia	9 9 es - ns - IOD el ng ng
Procedure UNIT - Modificat licenses - stores. UNIT - Storage of Circumsta Familiaria COURSE CO1 CO2 CO3 CO4 CO5	e, Certific IV tions – Co-approve V of various ances ur zation of To record To get To de To ar	Case Studies and Civil Aviation Requirements Section 2 — Air of Airsuser Greent issues of Advisory Circulars — Civil Aviation Requirements Section 2 — Air of Exposure on the basic concepts of airworthiness exposure on the section and can identify the approved materials and requirements and requirements and requirements and can identify the approved materials analyse the case studies and realise the importance of civil aviation requirements.	tigat Varsa	dquara ion provided control of the c	ntine occeduration	9 9 es - ns - IOD el ng ng
Procedure UNIT - Modificat licenses - stores. UNIT - Storage of Circumsta Familiariz COURSE CO1 CO2 CO3 CO4 CO5	tions – Coapprover Vof various ances ur zation of To reserve To get To ar NCE BO	Case Studies and Civil Aviation Requirements Section 2 — Air of Airsuser Greent issues of Advisory Circulars — Civil Aviation Requirements Section 2 — Air of Exposure on the basic concepts of airworthiness exposure on the section and can identify the approved materials and requirements and requirements and requirements and can identify the approved materials analyse the case studies and realise the importance of civil aviation requirements.	tigat Varsa	dquara ion provided control of the c	ntine occeduration	9 9 es - ns - IOD el ng ng
Procedure UNIT - Modificat licenses - stores. UNIT - Storage of Circumsta Familiaria COURSE CO1 CO2 CO3 CO4 CO5 REFEREN	tions – Capprove approve V of various ances ur zation of To re To ge To de To ar NCE BO Civil	Concessions – Airworthiness directives – Service bulletins – Crew training and their ed inspection – Approved materials – Identification of approved materials – Bonder CASE STUDIES AND CIVILAVIATION REQUIREMENTS Les aeronautical products like rubber goods and various fluids – Accident invest ander which C of A is suspended – ICAO and IATA regulations – Chicago and W frecent issues of Advisory Circulars – Civil Aviation Requirements Section 2 – Air COMES Company of the basic concepts of airworthiness extension and can identify the approved materials malyse the case studies and realise the importance of civil aviation requirements DOKS:	tigat Varsa	dquara ion provided control of the c	ntine occeduration	9 9 es - ns - IOD el ng ng



4	Gran E L and Rich	nard Levenworth,	Statistical Quality	Control, 7 th Edition	n McGrawHill,1997	7
VEBSITE	REFERENCE / N	PTEL/ SWAYAM	/ MOOC REFER	ENCE:	4	LINGELIN
1	https://archive.npt	el.ac.in/courses/10	01/104/101104071/			
2	https://archive.npt	el.ac.in/courses/10	01/105/101105084/		ectivis: *	Ego againo
СО-РО М	APPING		refer (terr)	basic aspects of ai	ger instabilitie the	er 1
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	ancipal 2 hoses	boa g 3 e sat n	ingent k & setator	a 1
CO2		stabuminger ex	2	3 219001	3	ı İ
CO3	e sant eth-a-citatu	AR met ICAO se	AATAA2 III	ni yazi 3n ban li	to mil at 3 manuscr	ionimo luA
CO4	-		2	3	3	1
CO5	tism leggistre oit i	wisking barright	2 14/41	3	To tem 3 known	backaget 1 at



ARS6

	E12	EXPERIMENTAL METHODS OF STRESS ANALYSIS	L	T	P	С
gingsoft, in	TEMES T	. Dayin & Junes W. Philips. "Misual on Experimental Stress Analysis". N	3	0	0	3
COURSE	OBJEC'	TIVES:	i inches	18		
1	This co	ourse introduces the basic principles and methods of experimental stress analysis.			aria i	
2	This co	ourse helps to learn the principles and techniques of photoelastic measurements.				
3	This co	ourse presents the principles and techniques of moire analysis.				
4	This c	ourse helps to gain knowledge of the principles and a technique of strain gage mea	asure	mentsi	s prese	nted
5		ourse also enables the students to learn basic principles of operation of electrical recometric techniques, and non-destructive methods	esista	ncestr	ain gau	ges,
UNIT		BASIC CONCEPTS		HT-A.I	# 9	9
	irements nent	ain Measurement Using Mechanical Extensometers – Principles of Measurements of a Measuring System – Sources of error – Statistical Analysis of Experimental ELECTRICAL-RESISTANCE STRAIN GAGES				
Character	ristics of ons for Tr	in Metallic Alloys –Gage Construction –Gage Sensitivities and Gage Factor –Per Foil Strain Gages – Environmental Effects –The Three-Element Rectangular ransverse Strain Effects – Other Types of Strain Gages –Semiconductor Strain Gag Methods of Strain Analysis.	Rose	tte –	eeb	
					$\overline{}$	
Circuit C	ntiometer Output – T	STRAIN-GAGE CIRCUITS & INSTRUMENTATION Circuit and Its Application to Strain Measurement – Variants From The Basic Pot The Wheatstone Bridge Constant Current and Constant VoltageCircuits – Circuit S	ensit	ivity –	Calibra	
The Poter	ntiometer Output – Tage Circund age Circund Shafts	STRAIN-GAGE CIRCUITS & INSTRUMENTATION Circuit and Its Application to Strain Measurement – Variants From The Basic Pot The Wheatstone Bridge Constant Current and Constant VoltageCircuits – Circuit S Hits –Effects of Lead Wires and Switches –Electrical Noise Reduction – Strain Mea	ensit	ivity –	Calibra	-
The Potent Circuit Constrain-Grams and UNIT - Introduct Stressed Multiplic Photoela digital photoela digita	ntiometer Output – T age Circu and Shafts – IV tion – Str Model in cation and stic Mate noto elast – V t types of	STRAIN-GAGE CIRCUITS & INSTRUMENTATION Circuit and Its Application to Strain Measurement – Variants From The Basic Pot The Wheatstone Bridge Constant Current and Constant VoltageCircuits – Circuit Suits – Effects of Lead Wires and Switches – Electrical Noise Reduction – Strain Measurement – Variants – Strain Measurement – Effects of a Stressed Model in a Plane Polariscope – Effects of a a Circular Polariscope – Tardy Compensation – Two-Dimensional Photoelastic Strain – Material Calibration – Introduction to Three-Dimensional Photoelasticity a cicity. NON-DESTRUCTIVE TESTING FINDT Techniques – Acoustic Emission Technique – Ultrasonic – Pulse-Echo – The String – X-Ray Radiography – Challenges in Non- Destructive Evaluation – Non-Destructive Finage Processing Theory.	asure asure aress Aund aroug estruc	ment in	Calibra n Bars, s – Frii	9 9 nge 9 non in
The Poter Circuit C Strain-Ga Beams an UNIT - Introduct Stressed Multiplic Photoela digital ph UNIT Different Eddy Cu Composi	ntiometer Output – T age Circu and Shafts – IV tion – Str Model in cation and stic Mate noto elast – V t types of rrent Tes ites – Con	STRAIN-GAGE CIRCUITS & INSTRUMENTATION Circuit and Its Application to Strain Measurement — Variants From The Basic Pot The Wheatstone Bridge Constant Current and Constant VoltageCircuits — Circuit Suits —Effects of Lead Wires and Switches —Electrical Noise Reduction — Strain Measurement — Photoelastic Methods of Stressed Model in a Plane Polariscope— Effects of a a Circular Polariscope— Tardy Compensation — Two-Dimensional Photoelastic Strain — Material Calibration — Introduction to Three-Dimensional Photoelasticity a cicity. NON-DESTRUCTIVE TESTING FNDT Techniques — Acoustic Emission Technique — Ultrasonic — Pulse-Echo — The string — X-Ray Radiography — Challenges in Non-Destructive Evaluation — Non-Destructive of Image Processing Theory.	asure asure aress Aund aroug estruc	hTransctive E	Calibra n Bars, s – Frii emission valuation 5 PER	9 nge 9 non in
The Poter Circuit C Strain-Ga Beams an UNIT - Introduct Stressed Multiplic Photoela digital ph UNIT Different Eddy Cu Composi	ntiometer Output – T age Circu and Shafts – IV tion – Str Model in cation and stic Mate noto elast – V t types of rrent Tes ites – Con	STRAIN-GAGE CIRCUITS & INSTRUMENTATION Circuit and Its Application to Strain Measurement — Variants From The Basic Pot The Wheatstone Bridge Constant Current and Constant VoltageCircuits — Circuit Suits —Effects of Lead Wires and Switches —Electrical Noise Reduction — Strain Measurement — Photoelastic Methods of Stressed Model in a Plane Polariscope— Effects of a a Circular Polariscope— Tardy Compensation — Two-Dimensional Photoelastic Strain — Material Calibration — Introduction to Three-Dimensional Photoelasticity a cicity. NON-DESTRUCTIVE TESTING FNDT Techniques — Acoustic Emission Technique — Ultrasonic — Pulse-Echo — The string — X-Ray Radiography — Challenges in Non-Destructive Evaluation — Non-Destructive of Image Processing Theory.	asure asure aress Aund aroug estruc	hTransctive E	Calibra n Bars, s – Frii	9 nge 9 non in
The Poter Circuit C Strain-Ga Beams an UNIT - Introduct Stressed Multiplic Photoela digital ph UNIT Different Eddy Cu Composi	ntiometer Output – T age Circu and Shafts – IV tion – Str Model in cation and stic Mate noto elast – V t types of rrent Tes ites – Con	STRAIN-GAGE CIRCUITS & INSTRUMENTATION Circuit and Its Application to Strain Measurement — Variants From The Basic Pot The Wheatstone Bridge Constant Current and Constant VoltageCircuits — Circuit Suits —Effects of Lead Wires and Switches —Electrical Noise Reduction — Strain Measurement — Photoelastic Methods of Stressed Model in a Plane Polariscope— Effects of a a Circular Polariscope— Tardy Compensation — Two-Dimensional Photoelastic Strain — Material Calibration — Introduction to Three-Dimensional Photoelasticity a cicity. NON-DESTRUCTIVE TESTING FNDT Techniques — Acoustic Emission Technique — Ultrasonic — Pulse-Echo — The string — X-Ray Radiography — Challenges in Non-Destructive Evaluation — Non-Destructive of Image Processing Theory.	asure asure aress Aund aroug estruc	hTransctive E	Calibra n Bars, s – Frii emission valuation 5 PER	9 9 1 - on in
The Poter Circuit C Strain-Ga Beams an UNIT - Introduct Stressed Multiplic Photoela digital ph UNIT Different Eddy Cu Composi	ntiometer Output – T age Circu and Shafts – IV tion – Str Model in cation and stic Mate noto elast – V t types of rrent Tes ites – Cor	STRAIN-GAGE CIRCUITS & INSTRUMENTATION Circuit and Its Application to Strain Measurement – Variants From The Basic Pot The Wheatstone Bridge Constant Current and Constant VoltageCircuits – Circuit Suits –Effects of Lead Wires and Switches –Electrical Noise Reduction – Strain Measurement – Strain Measurement – Whotoelastic Methods of Stress Analysis PHOTOELASTIC METHODS OF STRESS ANALYSIS Tess-Optic Law – Effects of a Stressed Model in a Plane Polariscope – Effects of a a Circular Polariscope – Tardy Compensation – Two-Dimensional Photoelastic Stressed Fringe Sharpening – Properties of Commonly Employed erials – Material Calibration – Introduction to Three-Dimensional Photoelasticity a cicity. NON-DESTRUCTIVE TESTING TNDT Techniques – Acoustic Emission Technique – Ultrasonic – Pulse-Echo – The ting – X-Ray Radiography – Challenges in Non- Destructive Evaluation – Non-Destructive of Image Processing Theory.	asure asure aress Aund aroug estruc	hTransctive E Al: 4 Bloom	Calibra n Bars, s – Frii emission valuati 5 PER ms Lev	9 nge 9 non in
The Poter Circuit C Strain-Ga Beams an UNIT - Introduct Stressed Multiplic Photoela digital ph UNIT Different Eddy Cu Composit	types of rrent Tes	STRAIN-GAGE CIRCUITS & INSTRUMENTATION Circuit and Its Application to Strain Measurement – Variants From The Basic Pot The Wheatstone Bridge Constant Current and Constant VoltageCircuits – Circuit Suits – Effects of Lead Wires and Switches – Electrical Noise Reduction – Strain Measurement – Variants – Strain Measurement – The Variants – Effects of a Stressed Model in a Plane Polariscope – Effects of a a Circular Polariscope – Tardy Compensation – Two-Dimensional Photoelastic Strains – Material Calibration – Introduction to Three-Dimensional Photoelasticity a cicity. NON-DESTRUCTIVE TESTING ENDT Techniques – Acoustic Emission Technique – Ultrasonic – Pulse-Echo – The String – X-Ray Radiography – Challenges in Non-Destructive Evaluation – Non-Destructive of Image Processing Theory. OMES Vieldge of different methods of strain measurement	asure asure aress Aund aroug estruc	hTransctive E Al: 4 Blood Reme	Calibra n Bars, s – Frin emission valuati 5 PER ms Lev	9 nge 9 non in
The Poter Circuit C Strain-Ga Beams an UNIT - Introduct Stressed Multiplic Photoela digital ph UNIT Different Eddy Cu Composit	t types of rrent Tes tes - Cource Know An ab	STRAIN-GAGE CIRCUITS & INSTRUMENTATION Circuit and Its Application to Strain Measurement – Variants From The Basic Pot The Wheatstone Bridge Constant Current and Constant VoltageCircuits – Circuit Suits – Effects of Lead Wires and Switches – Electrical Noise Reduction – Strain Measurement – Variants Properties of Lead Wires and Switches – Electrical Noise Reduction – Strain Measurement – Variants Properties of Lead Wires and Switches – Electrical Noise Reduction – Strain Measurement – Variants – Effects of a Stressed Model in a Plane Polariscope – Effects of a La Circular Polariscope – Tardy Compensation – Two-Dimensional Photoelastic Strains – Material Calibration – Introduction to Three-Dimensional Photoelasticity a licity. NON-DESTRUCTIVE TESTING FINDT Techniques – Acoustic Emission Technique – Ultrasonic – Pulse-Echo – The ting – X-Ray Radiography – Challenges in Non- Destructive Evaluation – Non-Destructive of Image Processing Theory. OMES Viedge of different methods of strain measurement viedge on electrical resistance strain gauge	asure asure aress Aund aroug estructure are sure	hTransetive E AL: 4 Bloom Reme	Calibra n Bars, s – Frii smission valuation 5 PER ms Lev emberii	9 nge 9 nOI el



1	James W. Dally & William F. Riley, "Experimental Stress Analysis", McGraw-Hill College, 2011								
2	Albert S. Kobayashi,"I	Handbook on Exp	perimental Mech	anics", Prentice	Hall Publishers, 19	987			
3	James F. Doyle & Ja Experimental Mechanic		s, "Manual on I	Experimental Str	ess Analysis", 5 th	Edition, Society fo			
4	Sharpe Jr& William N,	Springer, "Hand	dbook of Experi	nental Solid Med	chanics",Springer,	2008			
VEBSITE	E REFERENCE / NPTE	L/ SWAYAM/ M	100C REFERE	ENCE:	SACKINGIN STREET	ATTENDED			
1	https://nptel.ac.in/cours	ses/112106068	D SOURHER SOT INTE	r Karri tallalisatione		Jane X			
2	https://archive.nptel.ac	.in/courses/108/1	05/108105064/	To obtain word in	ate of entral senset	zidi"			
3	https://archive.nptel.ac	.in/courses/112/1	.06/112106068/	of Stevillate of a	tidam pela vindes	Flux			
со-ро м	IAPPING		abadina matana	8199	BASIC CON	1-1190			
COs	PO1	PO2	PO3	PO4	PO5	PO6			
CO1	Some Managaretta orașe	240	2	2	Digrae ty	n 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2			
CO2	es Factor - Pendon Jance	o D han endivers	2	2	a Mondije Alfe	virinitamod planti			
CO3	2		3	Trulic and All	enus de seu escell Seul rough	Controvantori			
CO4	The Race Pounti Imelan	TYN-1	3	2	ASSEMBLE TO SEE	The Proposition			
CO5	- select stained to the J- date		2	3	Moranada ad	- Lunta Catana			



AR58

PPAR2PE13		AERO ELASTICITY	L	T	P	C		
		and St. Managary Pressy of Accordances. But Mill Publications Ltd., 1985	3	0	0	3		
COURSE	OBJECT	TIVES: 2 2 15 1 clot. Vilolizaboro A to upositi odi ni subsubmisi nA 20 7	35	w ²	7			
1	This co	ourse provides the basic knowledge on aero elastic phenomena and its impact on air	craf	tdesig	n.	16		
2		ourse will make students to illustrate the Aeroelastic phenomena using simplified ae	erod	ynami	c and			
3		ourse provides insight into both static and dynamic Aeroelastic phenomena and poss	sible	epreve	ntion			
4	This co	This course imparts knowledge on the flutter phenomena in detail.						
5	This co	ourse provides the basic knowledge on prevention and control of Aeroelastic instabil	litie	S				
UNIT	-I	AEROELASTIC PHENOMENA				9		
phenome bridges –	na – Gall Fluid str	sponse problems – introduction to Aeroelasticity and aeroelastic phenomena – Example 2 (Spring of transmission lines – Flow induced vibrations of tallslender structures – Instructure interaction – The aero-elastic triangle of forces – Prevention of aeroelastic in	stabi	lity of	susper	isio		
UNIT -		MODELLING OF AEROELASTIC PHENOMENA These co-efficients – illustration of aeroelastic phenomena using simplified aerodyna				9		
14	in module	s in state-space format Flexure – torsional oscillations of beams- Governing differen	-4:-1	equat	ion of			
motion a	nd its solu	ution.	ntiai	cquar	8610	9		
UNIT - Simple to and appre	nd its solution of the solutio		Semi	i-rigid c equa	tions –	ptic		
UNIT - Simple to and appro	wo diment oximate sace of 2-D wings.	ution. STATIC AEROELASTIC PHENOMENA sional idealisation – Strip theory – Exact solutions for simple rectangular wings – Solutions – Successive approximation method – Numerical approximations using material structures.	Semi	i-rigid c equa	tions –	ptic		
motion and UNIT - Simple two and appropriate of swept UNIT - Flutter and Galerkin Methods	wo dimen oximate sace of 2-D wings. - IV malysis - method to of determine the solution of determine the solution of determine the solution of determine the solution of the	static Aeroelastic Phenomena sional idealisation – Strip theory – Exact solutions for simple rectangular wings – 'S solutions – Successive approximation method – Numerical approximations using may airfoil and Straight Wing – Aileron efficiency& reversal – Control Effectiveness – Flutter Calculations Two dimensional thin airfoils in steady incompressible flow –Quasi-steady aerodyna for critical flutter speed – Stability of disturbed motion – Solution of the flutter mining the critical flutter speeds – FlutterCalculation – U-g Method – P-k Method –	Sem atrix Wi	i-rigid c equal ng def	tions – Formation atives - ant –	ons 9		
motion and UNIT - Simple two and appropriate of swept UNIT - Flutter and Galerkin Methods	wo dimensory of determined its solution of the solution of the solution of determined in the sol	static Aeroelastic Phenomena sistem of simple rectangular wings—'S solutions — Successive approximation method — Numerical approximations using material and Straight Wing — Aileron efficiency& reversal — Control Effectiveness— Flutter Calculations Two dimensional thin airfoils in steady incompressible flow—Quasi-steady aerodynatical flutter speed — Stability of disturbed motion— Solution of the flutter	Sem atrix Wi	i-rigid c equal ng def	tions – Formation atives - ant –	ons 9		
motion and UNIT - Simple to and appropriate of swept UNIT - Flutter and Galerkin Methods Bending UNIT Stiffness stability	wo dimen oximate suce of 2-D wings. - IV malysis - Torsion - V criteria - introdu	static Aeroelastic Phenomena sional idealisation – Strip theory – Exact solutions for simple rectangular wings – 'S solutions – Successive approximation method – Numerical approximations using may airfoil and Straight Wing – Aileron efficiency& reversal – Control Effectiveness – FLUTTER CALCULATIONS Two dimensional thin airfoils in steady incompressible flow –Quasi-steady aerodyna for critical flutter speed – Stability of disturbed motion – Solution of the flutter mining the critical flutter speeds – FlutterCalculation – U-g Method – P-k Method – a Flutter of a Uniform Wing – Flutter Analysis by Assumed Mode Method PREVENTION AND CONTROL dynamic mass balancing – dimensional similarity – effect of elastic deformation of action to aeroelastic control – aeroelastic aspects in the design of aircraft – Panel flu buffeting – Aeroelastic instabilities in helicopterand engine blades and prevention in	Sematrix Wi ami r det Exa	i-rigid c equal ng def cderiv cermin act Tre atic lo and its	atives - ant – eatment	ons 9		
motion and UNIT - Simple to and appropriate of swept UNIT - Flutter and Galerkin Methods Bending UNIT Stiffness stability Prevention	wo dimen oximate sace of 2-D wings. - IV malysis - method to of determ - Torsion - V criteria - introduon of tail	static Aeroelastic Phenomena sional idealisation – Strip theory – Exact solutions for simple rectangular wings – 'S solutions – Successive approximation method – Numerical approximations using may airfoil and Straight Wing – Aileron efficiency& reversal – Control Effectiveness – FLUTTER CALCULATIONS Two dimensional thin airfoils in steady incompressible flow –Quasi-steady aerodyna for critical flutter speed – Stability of disturbed motion – Solution of the flutter mining the critical flutter speeds – FlutterCalculation – U-g Method – P-k Method – a Flutter of a Uniform Wing – Flutter Analysis by Assumed Mode Method PREVENTION AND CONTROL - dynamic mass balancing – dimensional similarity – effect of elastic deformation of action to aeroelastic control – aeroelastic aspects in the design of aircraft – Panel flu buffeting – Aeroelastic instabilities in helicopterand engine blades and prevention in	Sematrix Wi ami r det Exa	i-rigid c equal ng def cderiv cermin act Tre attic lo and its nods AL: 4:	atives - ant - catment	ons 9 t of 9 inal inal IOI		
motion and UNIT - Simple to and appropriate of swept UNIT - Flutter and Galerkin Methods Bending UNIT Stiffness stability Prevention	wo dimen oximate sace of 2-D wings. - IV malysis - method to of determ - Torsion - V criteria - introduon of tail	static Aeroelastic Phenomena sional idealisation – Strip theory – Exact solutions for simple rectangular wings – 'S solutions – Successive approximation method – Numerical approximations using may airfoil and Straight Wing – Aileron efficiency& reversal – Control Effectiveness – FLUTTER CALCULATIONS Two dimensional thin airfoils in steady incompressible flow –Quasi-steady aerodyna for critical flutter speed – Stability of disturbed motion – Solution of the flutter mining the critical flutter speeds – FlutterCalculation – U-g Method – P-k Method – a Flutter of a Uniform Wing – Flutter Analysis by Assumed Mode Method PREVENTION AND CONTROL - dynamic mass balancing – dimensional similarity – effect of elastic deformation of action to aeroelastic control – aeroelastic aspects in the design of aircraft – Panel flu buffeting – Aeroelastic instabilities in helicopterand engine blades and prevention in	Sematrix Wi ami r det Exa	i-rigid c equal ng def cderiv cermin act Tre and its nods AL: 4	atives - ant - catment ngitudi	ons 9 t of 9 inal inal inal inal inal inal inal ina		
motion and UNIT - Simple two and appropriate of swept UNIT - Flutter and Galerkin Methods Bending UNIT Stiffness stability Prevention	wo dimen oximate sace of 2-D wings. - IV malysis - method to of determ - Torsion - V criteria - introdu on of tail	sional idealisation – Strip theory – Exact solutions for simple rectangular wings – Solutions – Successive approximation method – Numerical approximations using made airfoil and Straight Wing – Aileron efficiency& reversal – Control Effectiveness – FLUTTER CALCULATIONS Two dimensional thin airfoils in steady incompressible flow – Quasi-steady aerodynth for critical flutter speed – Stability of disturbed motion – Solution of the flutter mining the critical flutter speeds – FlutterCalculation – U-g Method – P-k Method – In Flutter of a Uniform Wing – Flutter Analysis by Assumed Mode Method PREVENTION AND CONTROL — dynamic mass balancing – dimensional similarity – effect of elastic deformation of action to aeroelastic control – aeroelastic aspects in the design of aircraft – Panel flut buffeting – Aeroelastic instabilities in helicopterand engine blades and prevention in Tomes knowledge of the role of Aeroelasticity in aircraft design oret the use of semi-rigid body assumptions and numerical methods in airplane	Sematrix Wi ami r det Exa	i-rigid c equal ng def cderiv cermin act Tre and its nods AL: 4	atives - ant - catment ngitudi s contro	ons 9		
motion and UNIT - Simple two and appropriate of swept UNIT - Flutter and Galerkin Methods Bending UNIT Stiffness stability Prevention	wo dimen oximate sace of 2-D wings. I V I I I I I I I I I I I I I I I I I	sional idealisation – Strip theory – Exact solutions for simple rectangular wings – Solutions – Successive approximation method – Numerical approximations using made airfoil and Straight Wing – Aileron efficiency& reversal – Control Effectiveness – FLUTTER CALCULATIONS Two dimensional thin airfoils in steady incompressible flow – Quasi-steady aerodynth for critical flutter speed – Stability of disturbed motion – Solution of the flutter mining the critical flutter speeds – FlutterCalculation – U-g Method – P-k Method – In Flutter of a Uniform Wing – Flutter Analysis by Assumed Mode Method PREVENTION AND CONTROL — dynamic mass balancing – dimensional similarity – effect of elastic deformation of action to aeroelastic control – aeroelastic aspects in the design of aircraft – Panel flut buffeting – Aeroelastic instabilities in helicopterand engine blades and prevention in Tomes knowledge of the role of Aeroelasticity in aircraft design oret the use of semi-rigid body assumptions and numerical methods in airplane	Sematrix Wi ami r det Exa	i-rigid c equal ng def cderiv cermin act Tre atic lo and its nods AL: 4 Bloor Reme	atives - ant - catment ngitudi s contro	ons 9 t of 9 IOI IOI III		
motion and UNIT - Simple to and appropriate of swept UNIT - Flutter and Galerkin Methods Bending UNIT Stiffness stability Prevention COURSE CO1 CO2	wo dimen oximate sace of 2-D wings. - IV malysis - Torsion - V criteria - introdu on of tail COUTCO Have Interpreted a design Arrive	STATIC AEROELASTIC PHENOMENA Issional idealisation – Strip theory – Exact solutions for simple rectangular wings – Strip theory – Exact solutions for simple rectangular wings – Strip theory – Exact solutions for simple rectangular wings – Strip theory – Exact solutions for simple rectangular wings – Strip theory – Exact solutions for simple rectangular wings – Strip theory – Aileron efficiency & reversal – Control Effectiveness – FLUTTER CALCULATIONS Two dimensional thin airfoils in steady incompressible flow – Quasi-steady aerodyna for critical flutter speed – Stability of disturbed motion – Solution of the flutter mining the critical flutter speeds – Flutter Calculation – U-g Method – P-k Method – In Flutter of a Uniform Wing – Flutter Analysis by Assumed Mode Method PREVENTION AND CONTROL - dynamic mass balancing – dimensional similarity – effect of elastic deformation of action to aeroelastic control – aeroelastic aspects in the design of aircraft – Panel fluth buffeting – Aeroelastic instabilities in helicopterand engine blades and prevention in Toomes knowledge of the role of Aeroelasticity in aircraft design oret the use of semi-rigid body assumptions and numerical methods in airplane in	Sematrix Wi ami r det Exa	i-rigid c equal ng def cderiv cermin act Tre atic lo and its nods AL: 4 Bloor Reme	atives - ant - catment s contro	ons 9 it of 9 inal bl el ing		



1	Bisplinghoff.RL, Ash Inc., 2016	Bisplinghoff.RL, Ashley, H and Halfmann, RL, "Aeroelasticity", 2nd Edition, Addison WesleyPublishing Co., Inc., 2016								
2	Blevins, RD,"Flow In	nduced Vibrations	", Krieger Pub	Co., 2001	1	to be madely to				
3	Broadbent, EG,"Elen	nentary Theory of	Aeroelasticity",	Bun Hill Publ	ications Ltd., 1986					
4	Fung, YC, "An Intro	duction to the Th	eory of Aeroelas	sticity", John W	iley & SonsInc., Ne	w York,2008				
VEBSITE	E REFERENCE / NPT	EL/ SWAYAM/	MOOC REFER	ENCE:	att robive to school	aidit I				
1	https://nptel.ac.in/cou	rses/101104005	in the Ambelgati	ribulli of Physica	are white bliss straigs	ent I				
2	https://archive.nptel.a	c.in/content/stora	ge2/courses/101	105022/m1l1.pc	lf skapita in tal	TIGHT .				
3	https://www.iitk.ac.in	/aero/courses			ebo	desta				
4	https://www.youtube.	com/watch?v=O8	BZGbmLKv8I	ell off no behon	eres etasate series	2017				
СО-РО М	IAPPING		A	LIMONITH	NEROLETON LA	1-100				
COs	PO1	PO2	PO3	PO4	PO5	PO6				
CO1	THE DEV. MERCHANISH	-834.3 -834.3	2	THOREWAY	MORTHUMAN	11 - 11 Par				
CO2	whose improvious osilla	neva using seat d readla-ric maly o	2	3	2	hatherice and at models – differ				
CO3	3		2	M	2	e sii kan 1 kan				
CO4	high-i tek!- egitev tede	de de la companya della companya della companya de la companya della companya del	2	y Variation	pijesolijalie lanoran	mili owi alamie				
CO5	pone con a main a reque Vación ses - W est des	resolution beautic	2	3	I I I - Corn O	1				



PPAR2PI	E14	THEORY OF BOUNDARY LAYERS	L	T	P	C	
		THE PERSON NAMED IN THE PE	3	0	0	3	
OURSE	OBJEC	TIVES:			0		
1		course imparts knowledge to students on growth of boundary layer and its effect on a of airframe of flight vehicles.	thea	erodyn	amic		
2		course will introduce them the solution methods for boundary layer problems.					
3	This c	course enables the students to understand the importance of viscosity and boundary	layer	rinflui	d flow		
4	This c	course also introduces the theory behind laminar and turbulent boundary layers.					
5	This c	course will make students to learn the concepts of boundary layer transition and sep	arati	on			
UNIT -	IT – I THEORY OF VISCOUS FLOW						
Stokes eq Non-dime flow.	quations, ensional	ations of viscous flow, Conservation of mass, Conservation of Momentum-Navier, Energy equation, Mathematical character of basic equations, Dimensional paralising the basic equations and boundary conditions, vorticity considerations, creeping	mete			lay	
UNIT -	-II	INCOMPRESSIBLE VISCOUS FLOWS AND BOUNDARY LAYER				9	
Combined	d Couet	ous flow equations, Couette flows, Hagen-Poisuelle flow, Flow between rotatin te-Poiseuille Flow between parallel plates, Creeping motion, Stokes solution for boundary layer, Displacement thickness, momentum and energy thickness					
		outidary rayor, Displacement and one gy the most		1, 7 - 1 4			
Laminar	- III boundar boundar	LAMINAR BOUNDARY LAYER THEORY ry layer equations, Flat plate Integral analysis of Karman – Integral analysis of corry layer equations – boundary layer over a curved body-Flow separation- sim	nilari	ty sol	utions,		
Laminar Laminar Blasius si plate tem	boundar boundar boundar solution perature layer ca	LAMINAR BOUNDARY LAYER THEORY y layer equations, Flat plate Integral analysis of Karman – Integral analysis of 6	nilari ofiles	ty solution	utions, onstant		
Laminar Laminar Blasius si plate tem boundary UNIT –	boundar boundar solution apperature layer ca	LAMINAR BOUNDARY LAYER THEORY y layer equations, Flat plate Integral analysis of Karman – Integral analysis of cry layer equations – boundary layer over a curved body-Flow separation- sim for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature pro e –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen mediculations. THEORY OF TURBULENT BOUNDARY LAYER	nilari ofiles ethod	ty solu for co l – Tl	utions, onstant nermal	9	
Laminar Laminar Blasius signate temboundary UNIT -	boundar boundar colution nperature layer ca - IV	LAMINAR BOUNDARY LAYER THEORY y layer equations, Flat plate Integral analysis of Karman – Integral analysis of cry layer equations – boundary layer over a curved body-Flow separation- simple for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature profe –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen malculations. THEORY OF TURBULENT BOUNDARY LAYER ical and mathematical description, Two-dimensional turbulent boundary layer	nilari ofiles ethod	ty solution ty solutions	utions, onstant nermal	9 eloci	
Laminar Laminar Blasius s plate tem boundary UNIT -	boundar boundar colution nperature layer ca - IV	LAMINAR BOUNDARY LAYER THEORY y layer equations, Flat plate Integral analysis of Karman – Integral analysis of cry layer equations – boundary layer over a curved body-Flow separation- simple for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature propere – Reynold's analogy, Integral equation of Boundary layer – Pohlhausen malculations. THEORY OF TURBULENT BOUNDARY LAYER ical and mathematical description, Two-dimensional turbulent boundary layer wof the wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent	ofiles ethod equa	ty solo for co I - Ti	utions, onstant nermal	9 eloci	
Laminar Laminar Blasius s plate tem boundary UNIT -	boundar boundar solution nperature layer ca - IV ace-physi - The lay - Bound	LAMINAR BOUNDARY LAYER THEORY y layer equations, Flat plate Integral analysis of Karman – Integral analysis of cry layer equations – boundary layer over a curved body-Flow separation- simple for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature profe –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen malculations. THEORY OF TURBULENT BOUNDARY LAYER ical and mathematical description, Two-dimensional turbulent boundary layer	ofiles ethod equa	ty solo for co I - Ti	utions, onstant nermal	9 eloci	
Laminar Laminar Blasius signate temboundary UNIT - Turbulent profiles - flat plate UNIT -	boundar boundar boundar colution nperature layer ca IV ce-physi The lay Bound V y layer c	LAMINAR BOUNDARY LAYER THEORY ry layer equations, Flat plate Integral analysis of Karman – Integral analysis of cry layer equations – boundary layer over a curved body-Flow separation- sim for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature proce –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen mealculations. THEORY OF TURBULENT BOUNDARY LAYER ical and mathematical description, Two-dimensional turbulent boundary layer wof the wall – The law of the wake – Turbulent flow in pipes and channels –Turbulary layers with pressure gradient, Eddy Viscosity, mixinglength, Turbulence model BOUNDARY LAYER TRANSITION AND SEPARATION control in laminar flow-Methods of Boundary layer control: Motion of the solid wall-boundary layers.	equa equa lent t elling	ty soli for co d – Ti ations boundary	utions, onstant nermal — Veary layer tion of suction	9 Ploci	
Laminar Laminar Blasius signate temboundary UNIT - Turbulent profiles - flat plate UNIT -	boundar boundar boundar boundar colution nperature layer ca IV ce-physi The law Bound V y layer c layer c	LAMINAR BOUNDARY LAYER THEORY by layer equations, Flat plate Integral analysis of Karman — Integral analysis of the replace of the plate flow, Falkner—Skan wedge flows, Boundary layer temperature progetical engagement of Boundary layer — Pohlhausen mealculations. THEORY OF TURBULENT BOUNDARY LAYER THEORY OF TURBULENT BOUNDARY LAYER The law of the wake — Turbulent flow in pipes and channels — Turbulent larger layers with pressure gradient, Eddy Viscosity, mixinglength, Turbulence model and BOUNDARY LAYER TRANSITION AND SEPARATION The laminar flow-Methods of Boundary layer control: Motion of the solid walk function—Injection of different gas—Prevention of transition—Cooling of the wall—Boundary gas.	equa equa lent t elling	ty soli for co d – Ti ations boundary ccelerary layer	onstant nermal Vectory layer	9 F the	
Laminar Laminar Blasius signate temboundary UNIT - Turbulent profiles - flat plate UNIT - Boundary boundary Injection	boundar boundar solution aperature layer carly layer carly layer carly layer carly layer carly layer carl layer Solution and layer carly layer carly layer carly layer Solution and layer Solution layer	LAMINAR BOUNDARY LAYER THEORY ry layer equations, Flat plate Integral analysis of Karman – Integral analysis of the ry layer equations – boundary layer over a curved body-Flow separation-sime for flat-plate flow, Falkner—Skan wedge flows, Boundary layer temperature proble—Reynold's analogy, Integral equation of Boundary layer — Pohlhausen mealculations. THEORY OF TURBULENT BOUNDARY LAYER ical and mathematical description, Two-dimensional turbulent boundary layer wof the wall — The law of the wake — Turbulent flow in pipes and channels—Turbulent lary layers with pressure gradient, Eddy Viscosity, mixinglength, Turbulence model BOUNDARY LAYER TRANSITION AND SEPARATION control in laminar flow-Methods of Boundary layer control: Motion of the solid walk function- Injection of different gas-Prevention of transition- Cooling of the wall-Boundary layer governing equations for various types of viscous flows in engineering opply proper governing equations for various types of viscous flows in engineering	equalent belling	ty soli for co d – Ti ations boundary ccelerary layer	tions, onstant nermal Veary layer suction of suctions Lev	9 f the n-	
Laminar Laminar Blasius s plate tem boundary UNIT - Turbulen profiles - flat plate UNIT - Boundary boundary Injection	boundar boundar solution apperature layer carlivate Boundar Layer Carlivate Boundar V layer Carlivate A for a different layer S of a diff	LAMINAR BOUNDARY LAYER THEORY ry layer equations, Flat plate Integral analysis of Karman – Integral analysis of cry layer equations – boundary layer over a curved body-Flow separation- sim for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature pro e –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen metalculations. THEORY OF TURBULENT BOUNDARY LAYER ical and mathematical description, Two-dimensional turbulent boundary layer w of the wall – The law of the wake – Turbulent flow in pipes and channels –Turbul dary layers with pressure gradient, Eddy Viscosity, mixinglength, Turbulence model BOUNDARY LAYER TRANSITION AND SEPARATION control in laminar flow-Methods of Boundary layer control: Motion of the solid wall suction- Injection of different gas-Prevention of transition- Cooling of the wall-Boundary gas.	equalent telling	ty soli for co d – Tl utions coundary layer AL: 4:	titions, onstant hermal — Veary layer tition of suction of suctions.	9 f the n-	
Laminar Laminar Blasius siplate temboundary UNIT - Turbulene profiles - flat plate UNIT - Boundary Injection	boundar boundar solution apperature layer carly layer Sof a different layer Sof a	y layer equations, Flat plate Integral analysis of Karman – Integral analysis of ry layer equations – boundary layer over a curved body-Flow separation- sim for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature pro e –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen mealculations. THEORY OF TURBULENT BOUNDARY LAYER ical and mathematical description, Two-dimensional turbulent boundary layer w of the wall – The law of the wake – Turbulent flow in pipes and channels –Turbulenty layers with pressure gradient, Eddy Viscosity, mixinglength, Turbulence mode BOUNDARY LAYER TRANSITION AND SEPARATION control in laminar flow-Methods of Boundary layer control: Motion of the solid wall suction- Injection of different gas-Prevention of transition- Cooling of the wall-Boundary layer gas. OMES OMES oply proper governing equations for various types of viscous flows in engineering cations otain solutions for various viscous flow problems in engineering stimate skin friction over solid surfaces, over which laminar boundary	equalent leelling FOT Ap	ty soli for co d – Ti ations boundary layer AL: 4: Bloor	titions, onstant hermal — Veary layer tition of suctions 5 PER ms Lev	9 f the n-	
Laminar Laminar Blasius siplate temboundary UNIT - Turbulener profiles - flat plate UNIT - Boundary boundary Injection COURSE CO1	boundar boundar boundar louid boundar louid boundar louid lo	LAMINAR BOUNDARY LAYER THEORY ry layer equations, Flat plate Integral analysis of Karman – Integral analysis of the ry layer equations – boundary layer over a curved body-Flow separation- simple for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature proble—Reynold's analogy, Integral equation of Boundary layer – Pohlhausen mealculations. THEORY OF TURBULENT BOUNDARY LAYER ical and mathematical description, Two-dimensional turbulent boundary layer wofthe wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent larry layers with pressure gradient, Eddy Viscosity, mixinglength, Turbulence mode BOUNDARY LAYER TRANSITION AND SEPARATION control in laminar flow-Methods of Boundary layer control: Motion of the solid wall suction- Injection of different gas-Prevention of transition- Cooling of the wall-Boundary layer gas. OMES opply proper governing equations for various types of viscous flows in engineering cations obtain solutions for various viscous flow problems in engineering	equalent telling	ty soli for colling for colling trions coundary layer AL: 4: Bloom plying	Tations, onstant nermal — Veary layer tion of suction of suctions.	9 f the n-	



1	White, F. M., Visc	ous Fluid Flow, N	McGraw-Hill & Co	o., Inc., New York, 2	2018	
2	Schlicting, H., Bo	oundary Layer Th	eory, McGraw-Hi	II, New York, 1979		ALTERNAT
3	Reynolds, A, J., T	urbulent Flows I	Engineering, John	Wiley and Sons, 19	980.	
VEBSIT	E REFERENCE / N	PTEL/ SWAYA	M/ MOOC REFE	ERENCE:		THE RESERVE
1	https://www.youtu	ube.com/watch?v	=Myk9gX8-CeI		and an analysis of the same	and 1
2	https://archive.npt	tel.ac.in/courses/	112/103/11210330	02/	plantament of	and .
3	https://archive.npt	tel.ac.in/noc/cour	rses/noc21/SEM1/	noc21-me45/		
CO-PO M	MAPPING	l colocolyt tester	kun laar renigmi ka	uidad y taski, nin er	ulti-tuni sulti tamitsu	art - V
COs	PO1	PO2	PO3	PO4	PO5	PO6
COI			2	2	3	po latera 1 de
CO2	2 No. No. of State	ulmericae y un	2	3	3	1,00
CO3	3	ALL THE GALL	2	3	3	1

CO₄

CO5





	E15	COMBUSTION IN JET AND ROCKET ENGINES		T	P	C
			3	0	0	3
COURSE	OBJECT	TIVES:				
1		ourse provides the basic principles of combustion, types of flames and also familiar in gas turbine, ramjet, scram jet and rocket engines.	liariz	es the	combu	stic
2	This co	ourse explains the concept of thermo chemistry, enthalpy, adiabatic flame temperature rapplication to combustion related problems.	re, cor	nbusti	ion pro	duc
.3	This c	ourse presents the concept of chemical rates of reaction, collision theory and ing the different types of reactions.	Arrhe	enius e	equation	n f
4	This co	ourse gives an idea to compare the properties and characteristics of different type of combustion phenomenon in rocket motors and its exhaust.				
5	rockets	ourse also imparts knowledge to interpret the various combustion processes that s.	take	place	in che	mic
UNIT -	- I	THERMODYNAMICS OF COMBUSTION		20	7	9
Thermo c	chemistry-	osolute enthalpy- enthalpy of formation- enthalpy of combustion- laws of - pressure and temperature effect on enthalpy of formation, adiabatic flame temperatures of combustion	ıre,ch	emica	l and	
UNIT -		PHYSICS AND CHEMISTRY OF COMBUSTION		- 60		9
		of transport phenomena, Conservations Equations, Transport in Turbulent Flow. Basions, Chain reactions, Multistep reactions, simplification of reaction mechanism, Glob			Kinetic	cs,
UNIT -	- III	PREMIXED AND DIFFUSED FLAMES				9
Effects of	f chemica	combustion wave, Laminar premixed flame, Burning velocity measurement methods, if and physical variables on Burning velocity, Flame extinction, Ignition, Flamestability and differences between promised flames and			rbulent	t
Premixed UNIT - Combust superson	f chemica d flame. C - IV ion in gas ic combustic	al and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilicaseous and diffusion flame – Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET sturbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlledby diffusion mixing	diffus nbust	ion.	9 ramjet	,
Premixed UNIT - Combust superson	f chemica d flame. C - IV ion in gas ic combu- ties of sup	al and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilicaseous and diffusion flame – Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET sturbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlledby diffusion mixing personic combustion	diffus nbust	ion.	9 ramjet	,
Premixed UNIT - Combust superson peculiarit UNIT	f chemical flame. C IV ion in gas ic combusties of sup V	al and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilicaseous and diffusion flame – Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET sturbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlledby diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET	diffus mbust	ion.	9 ramjet	, ion 9
Premixed UNIT - Combust superson peculiarit UNIT	f chemical flame. C IV ion in gas ic combusties of supplication in liquid	al and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilitians and diffusion flame – Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET sturbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlledby diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instabilityin rockets	mbust and	ion in heat c	ramjet onvecti	, 9
Premixed UNIT - Combust superson peculiarit UNIT - Combust of homog	f chemical flame. C IV ion in gas ic combusties of sup V ion in liq	Il and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilitiaseous and diffusion flame – Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET Is turbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlledby diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instabilityin rockets	mbust and the theo	ion in heat c	ramjet onvecti	on 9 ning
Premixed UNIT - Combust superson peculiarit UNIT - Combust of homog	f chemical flame. Color in gas ic combusties of superior in liquid geneous p	Il and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilitiaseous and diffusion flame – Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET Is turbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlledby diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instabilityin rockets	mbust and the theo	ion in heat c	ramjet onvecti he burn 5 PERI	on 9 ning
Premixed UNIT - Combust superson peculiarit UNIT - Combust of homog	f chemical flame. Color in gas ic combusties of superior in liquid geneous p	Il and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilitiaseous and diffusion flame – Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET Is turbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlledby diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instabilityin rockets	mbust and the theo	ion in heat c	ramjet onvecti	on 9 ning
Premixed UNIT - Combust superson peculiarit UNIT - Combust of homog	f chemical flame. Color in gas ic combusties of superior in liquid geneous process of the color	It and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilitiaseous and diffusion flame – Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET Is turbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlledby diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instabilityin rockets OMES The basic concept of thermo chemistry to combustion related problems Instrate the concept of chemical kinetics in combustion reactions	mbust and the theo	ion in heat cry to the AL: 4:	ramjet onvecti he burn 5 PERI	oning
Premixed UNIT - Combust superson peculiarit UNIT - Combust of homog	f chemical flame. Color in gas ic combusties of superior in liquid geneous process of the color	Il and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilitiaseous and diffusion flame – Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET Is turbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlledby diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instabilityin rockets OMES the basic concept of thermo chemistry to combustion related problems	mbust and the theo	ion in heat cry to the AL: 45 Bloom	ramjet onvecti the burn 5 PERI ms Lev plying	on ing
COURSE CO2	f chemical flame. Color in gas ic combusties of supervision in liquid geneous process of the color of the col	Il and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilities as and diffusion flame — Examples Differences between premixed flame and a COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET Is turbine chambers, recirculation, combustion efficiency, flame holders, subsonic constion in scramjet. Subsonic and supersonic combustion controlled diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instability in rockets OMES The basic concept of thermo chemistry to combustion related problems instrate the concept of chemical kinetics in combustion reactions entiate between deflagration and detonation process and interpret the concept	mbust and the theo	ry to t AL: 4: Blood Ap Reme	ramjet onvecti the burn 5 PERI ms Lev plying	oning IOI rel
Combust of homogo	f chemical flame. Color IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilities as and diffusion flame — Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET sturbine chambers, recirculation, combustion efficiency, flame holders, subsonic constition in scramjet. Subsonic and supersonic combustion controlled by diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instability in rockets The basic concept of thermo chemistry to combustion related problems instrate the concept of chemical kinetics in combustion reactions entiate between deflagration and detonation process and interpret the concept imputationand analysis of the transition phenomenon instrate the peculiarities of supersonic combustion. ate the combustion processes taking place in different types of chemical rockets	mbust and the theo	ry to t AL: 4: Blood Ap Reme Ap	ramjet onvection he burness PERI ms Level plying embering plying	9 ning
Combust of homogo	f chemical flame. Color IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilities as and diffusion flame — Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET sturbine chambers, recirculation, combustion efficiency, flame holders, subsonic constition in scramjet. Subsonic and supersonic combustion controlled by diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instability in rockets The basic concept of thermo chemistry to combustion related problems instrate the concept of chemical kinetics in combustion reactions entiate between deflagration and detonation process and interpret the concept imputationand analysis of the transition phenomenon instrate the peculiarities of supersonic combustion. ate the combustion processes taking place in different types of chemical rockets	mbust and the theo	ry to t AL: 4: Blood Ap Reme Ap	ramjet onvecti the burn 5 PERI ms Lev plying emberia plying alyzing	9 ning
COURSE CO2 CO3 CO4	f chemical flame. Color of superior of sup	and physical variables on Burning velocity, Flame extinction, Ignition, Flamestabilities as and diffusion flame — Examples Differences between premixed flame and COMBUSTION IN GAS TURBINE, RAMJET AND SCRAMJET sturbine chambers, recirculation, combustion efficiency, flame holders, subsonic constition in scramjet. Subsonic and supersonic combustion controlled by diffusion mixing personic combustion COMBUSTION IN CHEMICAL ROCKET uid propellant rockets. Combustion of solid propellants- application of laminar flame propellants, Combustion in hybrid rockets- Combustion instability in rockets The basic concept of thermo chemistry to combustion related problems instrate the concept of chemical kinetics in combustion reactions entiate between deflagration and detonation process and interpret the concept imputationand analysis of the transition phenomenon instrate the peculiarities of supersonic combustion. ate the combustion processes taking place in different types of chemical rockets	mbust and the theo	ry to t AL: 4: Blood Ap Reme Ap	ramjet onvecti the burn 5 PERI ms Lev plying emberia plying alyzing	9 ning



3	Mukunda, HS, "Un	derstanding Com	bustion", 2nd edition	on, Orient Blacksv	van, 2009	
4	Mishra, DP, "Fund	amentals of Comb	oustion", Prentice	Hall of India, New	Delhi, 2008	PF CRIFFELS
VEBSITE	REFERENCE / NE	TEL/ SWAYAM	/ MOOC REFER	ENCE:		
1	https://archive.npte	l.ac.in/courses/11	2/106/112106290/			COUNTE OUR
2	https://archive.npte	l.ac.in/noc/course	s/noc22/SEM1/noc	c22-me33/	and the sign beauty with	at 1
3	https://onlinecourse	es.nptel.ac.in/noc2	22_me33/preview	his respect Joseph	onigher beginn nederland.	201
4	https://archive.npte	el.ac.in/courses/10	1/104/101104078/	talan pertuicins s	on to the application to	04
СО-РО М	APPING			stooms to make	nsellik stranista	ris .
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	- I	2	3	2	1 - 1141
CO2	or tate temperary extre	entbergen - lavs Rich "Tälsbaie II	2	2	3	vitoropidoje iš imario atmistr
CO3	2	- W6	3 0 10	2	3	H-IINI
CO4	at Four busi Bases Nanisch, Glöb Leinst	unbus of stagens on house of one	3	3	. 2	f inglandenia i Elementary rea
CO5	2		2	3	3	1



ARGS

PPAR2PE	16	GAS DYNAMICS	L	T	P	C
			3	0	0	3
COURSE O	BJECT	IVES:	el l'est	TOT	g	
1	To gain	insights into the steady one-dimensional fluid flow, its model and tool to solve the	ne flui	dflow	probl	ems.
2	To acqu	ire knowledge about the normal shock waves.	nviet,	AL	- 6	
3	To acqu	ire knowledge about the oblique shock and expansion waves.	OHI	MA)	(04-	ao'
4	To gain	knowledge about the basic measurements involved in compressible flows.				
5	To acqu	ire basic knowledge about the rarefied and high temperature gas dynamics			(0.0)	
UNIT -	I	STEADY ONE-DIMENSIONAL FLOW				9
Supersonic UNIT - I Introductio Stagnation	Flow Go II on – Equation Total	tions - Discharge from a Reservoir - Stream tube Area-Velocity Relation eneration-Diffusers - Dynamic Head Measurement in Compressible Flow - Press NORMAL SHOCK WAVES ations of Motion for a Normal Shock Wave - The Normal Shock Relations for a P Pressure across the Shock-Hugoniot Equation - The Propagating Shock Wave - on Wave - Shock Tube.	sure (Coeffic tGas -	Chan	9 ge of
UNIT - I	<u> </u>	OBLIQUE SHOCK AND EXPANSION WAVES			103	9
Oblique Sh and Non-si UNIT – I	imple Re	Supersonic Compression - Supersonic Expansion by Turning - The Prandtl-Meye gions. MEASUREMENTS IN COMPRESSIBLE FLOW	er Exp	ansion	ı - Sın	nple 9
		sure Measurements – Temperature Measurements - Velocity and Direction - Dens Visualization - High-Speed Wind Tunnels - Instrumentation and Calibration of				
UNIT -	V	INTRODUCTION TO RAREFIED AND HIGH TEMPERATURE GAS DY	YNA	MICS		9
Knudsen N High-Temp		Slip Flow Transition and Free Molecule Flow - Importance of High-Temperatur	reFlov	ws - N	ature o	of
	L	Flows			DED	
			TOTA	AL: 45	ILN	IOL
COURSE C				AL: 45		
COURSE C	OUTCO				ns Lev	vel
	OUTCO Be able	MES to solve the steady one dimensional compressible fluid flow problems vided with the knowledge on thermodynamic state of the gas behind normal		Bloon	ns Lev	v el
COI	Be able Be pro	MES to solve the steady one dimensional compressible fluid flow problems vided with the knowledge on thermodynamic state of the gas behind normal waves vided with the knowledge on thermodynamic state of the gas behind		Bloom	ns Lev mberi mberi	v el ng
CO1	Be able Be pro shock v Be pro oblique	MES to solve the steady one dimensional compressible fluid flow problems vided with the knowledge on thermodynamic state of the gas behind normal waves		Reme Reme Reme	ns Lev mberi mberi	ng ng
CO1 CO2	Be able Be pro shock v Be pro oblique Be pro	MES to solve the steady one dimensional compressible fluid flow problems vided with the knowledge on thermodynamic state of the gas behind normal waves vided with the knowledge on thermodynamic state of the gas behind e shock wavesand expansion waves		Reme Reme Reme	mberi mberi mberi	ng ng
CO1 CO2 CO3 CO4 CO5	Be able Be pro shock v Be pro oblique Be pro	MES to solve the steady one dimensional compressible fluid flow problems vided with the knowledge on thermodynamic state of the gas behind normal waves vided with the knowledge on thermodynamic state of the gas behind e shock wavesand expansion waves vided with the adequate knowledge on compressible flow measurements.		Reme Reme Reme	mberi mberi mberi mberi	ng ng
CO2 CO3	Be able Be pro shock v Be pro oblique Be pro Be pro	MES to solve the steady one dimensional compressible fluid flow problems vided with the knowledge on thermodynamic state of the gas behind normal waves vided with the knowledge on thermodynamic state of the gas behind e shock wavesand expansion waves vided with the adequate knowledge on compressible flow measurements.		Reme Reme Reme	mberi mberi mberi mberi	ng ng



3	Shapiro, AH, "Dynami	cs & Thermodynam	ics of Compressib	le Fluid Flow",	RonaldPress, 19	982
4	Houghton, EL and Car Series, 7th Edition 2017		ynamics for Engin	eering Students	s",Butterworth-He	einemann
WEBSITI	E REFERENCE / NPTE	L/ SWAYAM/ MO	OC REFERENCI	Ξ:		
1	https://archive.nptel.ac.	in/courses/101/106/	101106044/		RCSTSTR.	ao asano
2	https://nptel.ac.in/cours	es/101106044	tuff isooiensmilt	ans ybasiz mil) q	ini odgitar niego	4 1
3	https://nptel.ac.in/cours	ses/101108086	in one should land	ige about the Ro	acquire Enowler	
CO-PO M	IAPPING	sovav milateri	dique situels and e	de edi wada su	olwoni snujere o	
COs	PO1	PO2	PO3	PO4	PO5	PO6
COI	2		3	2	2	2
CO2	2	binsid tu school Mark Salat W	3	2	2	2
CO3	2	serigence in the first	3	2	2	2
CO ₄	2	ic Ivoraci Sinock S - Nic Propagator	1 - eve of deeple of	2	2	2
COS	_		3	2	2	2



PPAR2PE	E17	FATIGUE AND FRACTURE MECHANICS	L	Т	P	C
erour , wa	S ISBNORD	w representation and and and a comment of the configuration of the confi	3	0	0	3
OURSE (OBJEC.	TIVES:	T pay			
1	To lear	rn the fundamentals aspects of fatigue & fracture mechanics.				
2	To gai	in knowledge on the statistical aspects of fatigue behaviour of materials.	raid Suide	LA.		
3	To get	insights into the physical aspects of fatigue.	PLIT	LUN.	e trade	4 74
4	To eva	aluate the strength of the cracked bodies.	1	THE P	1	
5	To pro	ovide knowledge on fatigue design and testing of aerospace structures.	non	132	E	
UNIT -	-I	BASIC CONCEPTS & OVERVIEW	Mae	14		9
Theories -	– Atomic	t – Strain Hardening – Different Mechanisms of Failure – Typical Defects & El c View of Fracture – Fractographic Examination of Failure Surfaces of Different ch – Safe Life Design FATIGUE OF STRUCTURES				
Notches a	ind stress	lurance limit – Effect of mean stress – Goodman, Gerber and Soderberg relations as concentrations – Stress concentration factors – Notched S-N curves – Lowcycle a Manson's relation – Transition life – Cyclic Strain hardening and softening – Load I	and l	high c	ycle	
Cycle cou	inting tec	chniques–Cumulative damage theory		ory Ar		
Cycle cou UNIT - Fracture n transition	nting ted III nechanis - Final	chniques—Cumulative damage theory PHYSICAL ASPECTS OF FATIGUE sm in metals - Phase in fatigue life – Crack source – Cleavage initiation – Crack gro fracture – Dislocations – Fatigue fracture surface of inter and intra-granular fracture	owth	ı – Du Enviro	ctile-b	9 rittle
Cycle cou UNIT – Fracture in transition effects – T	mechanis Final from F	chniques—Cumulative damage theory PHYSICAL ASPECTS OF FATIGUE sm in metals - Phase in fatigue life - Crack source - Cleavage initiation - Crack gro	owth	ı – Du Enviro	ctile-b	9 rittle
Cycle cou UNIT - Fracture in transition effects - 7 Influencin UNIT - Stress and release ra thickness fracture - fracture th UNIT - General of Grooving CTOD te	mechanis Final forminology parameters Allysis and the Griff on fraction f	PHYSICAL ASPECTS OF FATIGUE sm in metals - Phase in fatigue life - Crack source - Cleavage initiation - Crack graftacture - Dislocations - Fatigue fracture surface of inter and intra-granular fractural logy and classification - Corrosion principles - Stresscorrosion cracking - Hydrogoneters on crack behaviour LINEAR ELASTIC FRACTURE MECHANICS and strength of a cracked body - Stress concentration - potential energy and surfaffith's theory - Irwin extension of Griffith's theory to ductile materials - Plastic zource toughness - Stress intensity factors for typical geometries - Instability of the Restrain fracture toughness - Mixed mode - Interaction of cracks - Limitations FRACTURE TOUGHNESS TESTING ations for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Str	owthee - l l en e e e e e e e e e e e e e e e e	n – Du Enviro mbritt energy shape /e – K the lir	y – Ender ela	9 rittle 9 ergy tt of illed astic 9 king eters
Cycle cou UNIT - Fracture n transition effects - 7 Influencin UNIT - Stress and release ra thickness fracture - fracture th UNIT - General of Grooving CTOD te	mechanis Final forminology parameters Allysis and the Griff on fraction f	PHYSICAL ASPECTS OF FATIGUE sm in metals - Phase in fatigue life - Crack source - Cleavage initiation - Crack graftacture - Dislocations - Fatigue fracture surface of inter and intra-granular fractural logy and classification - Corrosion principles - Stresscorrosion cracking - Hydrogoneters on crack behaviour LINEAR ELASTIC FRACTURE MECHANICS and strength of a cracked body - Stress concentration - potential energy and surfaffith's theory - Irwin extension of Griffith's theory to ductile materials - Plastic zource toughness - Stress intensity factors for typical geometries - Instability of the Restrain fracture toughness - Mixed mode - Interaction of cracks - Limitations FRACTURE TOUGHNESS TESTING ations for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Stress intensity factors for metallic specimens - Stress intensity factors for metallic specimens - Str	owthere – l en e e e e e e e e e e e e e e e e e	n – Du Enviro mbritt energy shape ve – K the lin – Pr crack sts – 0	y – Ender ela	9 rittle hl 9 ergy et of of of other of other of other of other of other of other ot
Cycle cou UNIT - Fracture n transition effects - 7 Influencin UNIT - Stress and release ra thickness fracture - fracture th UNIT - General of Grooving CTOD te	mechanis Final forminology parameters Alysis and the Griff on fraction fr	PHYSICAL ASPECTS OF FATIGUE sm in metals - Phase in fatigue life - Crack source - Cleavage initiation - Crack graffacture - Dislocations - Fatigue fracture surface of inter and intra-granular fracture logy and classification - Corrosion principles - Stresscorrosion cracking - Hydrogeneters on crack behaviour LINEAR ELASTIC FRACTURE MECHANICS and strength of a cracked body - Stress concentration - potential energy and surfaffith's theory - Irwin extension of Griffith's theory to ductile materials - Plastic zource toughness - Stress intensity factors for typical geometries - Instability of the Restrain fracture toughness - Mixed mode - Interaction of cracks - Limitations FRACTURE TOUGHNESS TESTING ations for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen	owthere – l en e e e e e e e e e e e e e e e e e	energyshape Precrack sts - CAL: 4	e- cracl	9 rittle hl 9 ergy et of of of of other of other of other of other of other of other other of other ot
Cycle cou UNIT - Fracture in transition effects - 7 Influencin UNIT - Stress and release ra thickness fracture - fracture th UNIT - General of Grooving CTOD te tests M	mechanis Final forming parametric parametri	PHYSICAL ASPECTS OF FATIGUE sm in metals - Phase in fatigue life - Crack source - Cleavage initiation - Crack graffacture - Dislocations - Fatigue fracture surface of inter and intra-granular fracture logy and classification - Corrosion principles - Stresscorrosion cracking - Hydrogeneters on crack behaviour LINEAR ELASTIC FRACTURE MECHANICS and strength of a cracked body - Stress concentration - potential energy and surfaffith's theory - Irwin extension of Griffith's theory to ductile materials - Plastic zource toughness - Stress intensity factors for typical geometries - Instability of the Restrain fracture toughness - Mixed mode - Interaction of cracks - Limitations FRACTURE TOUGHNESS TESTING ations for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen configuration - Stress intensity factors for metallic specimens - Specimen	owthere – l en e e e e e e e e e e e e e e e e e	energyshape - Pr crack sts - C AL: 4	e- cracle parametric p	9 rittle hl - 9 ergy et of of older stice 9 king eters &Izo
Cycle cou UNIT - Fracture in transition effects - 7 Influencin UNIT - Stress and release ra thickness fracture - fracture th UNIT - General of Grooving CTOD te tests M	mechanis Final forminology parameters It alysis and the Grift on fraction	PHYSICAL ASPECTS OF FATIGUE sm in metals - Phase in fatigue life - Crack source - Cleavage initiation - Crack graffacture - Dislocations - Fatigue fracture surface of inter and intra-granular fracture logy and classification - Corrosion principles - Stresscorrosion cracking - Hydrogateters on crack behaviour LINEAR ELASTIC FRACTURE MECHANICS and strength of a cracked body - Stress concentration - potential energy and surfaffith's theory - Irwin extension of Griffith's theory to ductile materials - Plastic zocure toughness - Stress intensity factors for typical geometries - Instability of the Restrain fracture toughness - Mixed mode - Interaction of cracks - Limitations FRACTURE TOUGHNESS TESTING ations for metallic specimens - Specimen configuration - Stress intensity factor Mechanism of metals - Determination Testing of metals in the ductile- brittle transition region - Quantitative toughness tical modelling concepts OMES lentify and describe the basic fracture and fatigue mechanisms and apply that	owthere – l en e e e e e e e e e e e e e e e e e	energyshape - Pr crack sts - G An	ctile-binmentalement / - End - Effectoristic error ela	9 rittle 9 ergy et of olled astic 9 king eters &Izo
Cycle cou UNIT – Fracture in transition effects – I Influencin UNIT – Stress and release ra thickness fracture – fracture th UNIT – General of Grooving CTOD te tests – M	mechanis Final forming parameters IV alysis and te - Griff on fraction f	PHYSICAL ASPECTS OF FATIGUE sm in metals - Phase in fatigue life - Crack source - Cleavage initiation - Crack graffacture - Dislocations - Fatigue fracture surface of inter and intra-granular fracture logy and classification - Corrosion principles - Stresscorrosion cracking - Hydrogeneters on crack behaviour LINEAR ELASTIC FRACTURE MECHANICS and strength of a cracked body - Stress concentration - potential energy and surfaffith's theory - Irwin extension of Griffith's theory to ductile materials - Plastic zour toughness - Stress intensity factors for typicalgeometries - Instability of the Restrain fracture toughness - Mixed mode - Interaction of cracks - Limitations FRACTURE TOUGHNESS TESTING ations for metallic specimens - Specimen configuration - Stress intensity fac M E-399 and similar standards - K-R curve - J-testing on metals - Determination Testing of metals in the ductile- brittle transition region - Quantitative toughness tical modelling concepts OMES lentify and describe the basic fracture and fatigue mechanisms and apply that eledge tofailure analysis	owthere – l en e e e e e e e e e e e e e e e e e	energy shape /e - K the lir CAL: 4 Bloo An	e- cracle parame Charpy	9 rittle 9 ergy et of olded astic 9 king eters &Izo
Cycle cou UNIT - Fracture in transition effects - I Influencin UNIT - Stress and release ra thickness fracture - fracture th UNIT - General of Grooving CTOD te tests - M COURSE CO1	mechanis Final forming parameters IV alysis and te - Griff on fraction f	PHYSICAL ASPECTS OF FATIGUE sm in metals - Phase in fatigue life - Crack source - Cleavage initiation - Crack graffacture - Dislocations - Fatigue fracture surface of inter and intra-granular fracture logy and classification - Corrosion principles - Stresscorrosion cracking - Hydrogeneters on crack behaviour LINEAR ELASTIC FRACTURE MECHANICS and strength of a cracked body - Stress concentration - potential energy and surfaffith's theory - Irwin extension of Griffith's theory to ductile materials - Plastic zoure toughness - Stress intensity factors for typicalgeometries - Instability of the R-strain fracture toughness - Mixed mode - Interaction of cracks - Limitations FRACTURE TOUGHNESS TESTING ations for metallic specimens - Specimen configuration - Stress intensity factor M E-399 and similar standards - K-R curve - J-testing on metals - Determination Testing of metals in the ductile- brittle transition region - Quantitative toughness tical modelling concepts OMES lentify and describe the basic fracture and fatigue mechanisms and apply that redded tofailure analysis recetly apply linear elastic fracture to predict material failure	owthere – l en e e e e e e e e e e e e e e e e e	energy shape /e - K the lir CAL: 4 Bloo An Rem	e- cracl parame Charpy S PER alyzing	9 rittle 9 ergy et of olled astic 9 king eters &Izo



1	Barrois, W &Ripl	Barrois, W & Ripley, L, "Fatigue of Aircraft Structures", Pergamon Press, Oxford, 2013								
2	Brock,D, "Eleme	entary Engineering	Fracture Mechan	ics", Noordhoff	International Publi	shing Co., Londo				
3	Knott,JF, "Funda	mentals of Fracture	Mechanics", Butte	erworth & Co. Lt	d., London,1983.	tat I				
4	Publishing Co., N		etyl suginil ic ris	oned instraints of	nternational	pl i iq				
VEBSITI	E REFERENCE / I	NPTEL/ SWAYAM	MOOC REFER	ENCE:						
1	https://archive.np	tel.ac.in/courses/113	3/105/113105106/	of the crucked by	dignorité sin strangit	* East				
2	https://onlinecou	rses.nptel.ac.in/noc2	2_mm42/preview	ngieth anydd a	revide koowledge	a di				
3	https://archive.np	tel ac in/courses/11	2/106/112106065/	CONCLES DE MENUEL	School of the Company					
	ma Common a Dism	ici.ac.iii/codiscs/112	2/100/112100003/		destruction in					
	1APPING	hat Lening and a night	2/100/112100003/	aces and aces and aces and aces and aces aces aces aces aces aces aces aces	nother section of the control of the	Ocean Rose Eth Theories – Acor				
	IAPPING POI	PO2	PO3	PO4	PO5	PO6				
CO-PO M	MAPPING PO1	Tiest, A San Tiest Del San Trained Del Tantum Sentaces of	Mechanisms of Fa c Exemplemen of	ta Tecnologia Incredible gni incregorani se	PO5	PO6				
CO-PO M	AAPPING PO1	Tiest, A San Tiest Del San Trained Del Tantum Sentaces of	Mechanisms of Fa c Exemplemen of	ta Tecnologia Incredible gni incregorani se	PO5 1 2	PO6				
CO-PO M COs	PO1 1 1 2 2	PO2	PO3	PO4	10 (Daltak filikana posenib melimposiba sa musista noma	PO6 1 1				
CO-PO M COs CO1	PO1 1 1 2 2 3 3	PO2 1	PO3	PO4 1 2	1	PO6				



PPAR	3PE18	Vibration Isolation and Control	L	Т	P	C	
			3	0	0	3	
COUR	SE OBJ	TECTIVES:			a		
1	To get	insight into the basic aspects of vibration theory.		150 J. (A)			
2	To get	in-depth knowledge on different types of isolators and its effectiveness.		2 103			
3	To pro	vide the basic knowledge on dynamic vibration absorber.					
4	To rea	lize the importance of materials selection for appropriate applications.					
5	To get	knowledge on the principles of active vibration control.					
UNIT	NIT - I BASIC VIBRATION THEORY						
Dampe System Overvie	d Singles – Vibew of th	Theory – Determination of Natural Frequency of a Single Degree Of Freedom – See Degree of Freedom System – Role of Damping – Forced Vibrations of Discrete Practions of Beams and Shafts – Idealization of a Real System Into a Discrete Mose Different Methods of Vibration Control	Syst	ems –	Cont	inuous - An	
UNIT	'-II	VIBRATION ISOLATION				9	
Redesig	gn – Di	y - Numerical Examples - Necessity of Vibration Isolation - Vibration Reduction ferent Types of Isolators & Their Effectiveness - Pneumatic Suspension - Excitation Fecting Vibration Level - Source Classification - Control of Flow Induced & Self-Exc	on R	eduction	on at	Source	
UNIT	-III	DYNAMIC VIBRATION ABSORBER				9	
with ic	deal spr	ation Neutralizers – Self-tuned Pendulum Neutralizer - Optimum Design of Dampeding and viscous dashpot – Gyroscopic vibration absorbers – Impact Absorbers – tems – Field Balancing of Rotors – Resonance: Detuning and Decoupling – Remedial	Abs	orbers			
UNIT	- IV	SELECTION OF MATERIALS				9	
Linear	Hyster ng – Re	erties of Viscoelastic Material – Selection of Materials – Damping-Stress Relationship etic Material – Design for enhanced material damping – Linear Viscoelastic Modelaxation – Frequency and Temperature Dependence of the Complex Modulus – Over	el –	Consti	ained	Layer	
UNIT	$\Gamma - \mathbf{V}$	PRINCIPLES OF ACTIVE VIBRATION CONTROL				9	
Absorb	ers usi		solati g Eq	on usi uation	ng El s – Re	RF and sponse	
			ГОТ			RIODS	
		TCOMES		Bloo			
CO1	To re	alise the importance of vibration theory & its practical applications		Eva	ıluatir	ıg	
CO2		ork out response calculations		Eva	luatir	ıg	
CO3	To an	alyse and compare the different methods of vibration control		Ap	plyin	g	
	1			TO UT			



CO4	To exposure on vibration control using smart materials						Analyzing
CO5	To design a vibration control unit						Analyzing
REFE	RENCE BO	OOKS:		a		Ateria.	io izio
1	Malcolm J. Crocker, "Handbook of Noise and Vibration Control", Wiley; 1st edition, 2007.						
2	Mallik, AK, "Principles of Vibration Control", Affiliated East-West Press, India, 1990.						
3	Mead,DJ, "Passive Vibration Control", Wiley, 1st edition, 1999.						
4	Preumont, A"Vibration Control of Active Structures", Springer Netherlands, 3rd edition, 2011.						
WER			and the line of			attended the least	
1	SITE REFERENCE / NPTEL/ SWAYAM/ MOOC REFERENCE: http://www.digimat.in/nptel/courses/video/112107087/L10.html						
	PROSE POLICE START TO THE START OF THE START						
2	https://archive.nptel.ac.in/courses/112/104/112104211/						
3	https://www.youtube.com/watch?v=bcuS3DW88a4						
4	https://www.youtube.com/watch?v=vLaFAKnaRJU						
CO-P	O MAPPIN	NG		TIVA	AI	The sept to soll	in many
COs		PO1	PO2	PO3	PO4	PO5	PO6
CO1		3	2	1		1	
CO2		3	2	and land		1 and a supplemental supplement	er i pari in Artistani
CO3		3	2	1	OF MATERIALS	20273128	VI VE
CO4		3	2	showed fine cold	D to the state of	showing to miss	
CO5		3 - 11	2	programme logicalizated in		balli - loversi	



Pagn

	techniques, aircraft To get insights into To learn modern N testing methods To inspect the airc To get basic knowled UNIT – I ed for non-destructive ed fatigue – Crack growth pection using various N tical locations – UNIT – II Indamentals of optics – mation – Polarization lighter of microscopy (SEN croscopy (TEM) – Imag UNIT – III urces of acoustic emissingsors – Phased array	Non-Destructive Evaluation	L	T	P	С
	Surfame	ration assurant via na emperoral ent passers in the	3	0	0	3
COUR	SE OBJECTIV	ES:	a a			1
1		reledge on the fundamentals of non-destructive testing methoraft inspection methodology using NDT methods	ods and	.00	modiacio	1
2		into the basic aspects of electron microscopy.		Crantulus	3 J. J. J. S.	LOLIN
3		n NDT techniques like acoustic emission, ultrasonic and the	ermographi	Code & Ca	Culting	
4		ircraft structures using NDT techniques	esto a nam	de Companio	C TOTAL C	
5	To get basic kn	owledge on the structural health monitoring of aerospace s	tructures	The language of	and and	
10	UNIT – I	INTRODUCTION	эргэргэ 4	B. Murphy	anigned	9
inspect Critica	tion using variou 1 locations –	s NDT techniques – Overview and relative comparison of ELECTRON MICROSCOPY				
,		ELECTRON MICROSCOFT			rain Suita	
sensor charac	s - Phased arra	ission – Physical principals involving acoustic emission and y ultrasonics – Instrument parts and features for acception of cracks and other flaws in metals and composites tion	ustic emiss	sion and u	ltrasonics	- Defect
	UNIT – IV	AIRCRAFT INSPECTION				9
inspec Fluore metho	tion – Special Descent penetrate i	eneral Visual Inspection – During pre, or post flight – Detailed Inspection (SDET) – Uses of NDT Methods – Inspection – Airframe Loading – Fuselage Inspection – Could Padiography – Eddy Current Testing – Liquid Penderal	et Engine I	nspection - tions - Con	- Engine	overhaul – of different
	UNIT – V	STRUCTURAL HEALTH MONITORING	6		-	9
Health Applie	n Monitoring ver	tural Health Monitoring – Structural Health Monitoring sus Non-Destructive Evaluation – A Broad Overview of Aerospace Engineering – Structural health monitoring and future trends.	f Smart Ma	aterials App tes – Repair	plications r investig	Notableation using
				TO	ΓAL: 45	PERIODS
COUI	RSE OUTCOM	ES		Bloor	ns Level	
CO1	To realize the	importance of various NDT techniques		Eva	luating	
CO2	To identify sui	table NDT technique for a particular application.		Eva	luating	
				<u> </u>		1





	10 demon	strate the phy	sical principles	involved in acou	istic emission and	Ap	plying
	ultrasonic	S. 4			Non-Bustman		
CO4	To have k		the physical prin	nciples involved in	n the various other	Ana	alyzing
CO5	To realis		f-the-art in N	DT testing and	structural health	³ Ana	alyzing
REFE	RENCE BO	OOKS:		agraemidm	e aspects of electron	क्ष्में करी। एक्से स्टब्स्	or mg of 1
1	Cullity, B	D & Stock, SF	R, "Elements of I	X-ray diffraction"	, Prentice Hall, Inc. I	JSA, 2001.	mast of T
2	Daniel Ba	lageas, Claus-	Peter Fritzen, A	lfredo Güemes, "S	Structural Health Mo	nitoring", Wiley-	ISTE, 2006.
3	Douglas I	E Adams, "Hea	alth Monitoring	of Structural Mate	erials and Componen	s-Methods with A	Applications", Johr
	Wiley and	l Sons, 2007					
4	Douglas I	B. Murphy, "F	undamentals of l	light microscopy a	and electronic imagin	g", Wiley-Liss, Ir	nc. USA, 2001.
5	Annual Control of			Jr., Shaun Wilson, einemann, Boston	"Encyclopedia of M , USA, 1992.	aterials Character	ization, Surfaces,
WEB			The State of State of	M/ MOOC REFI		das TOM audice	Control of Control
1			in/courses/113/1		THE PROPERTY AND		SI - CAPAL
	inteps.//urc	m ve mpteriue.	in courses, 113/1	102 173 1000 101			
			/wilei/Nondestru	ctive testing	STATE OF THE PARTY		
2	https://en	.wikipedia.org	/ WIKI/ Nondesii u	icuve_testing			
3	HTGGGSMAR	lphitech.com/			ChMIxre8lP3ZhAM	VO9sWBR3rQQo	UEAAYASABEg.
DIE	https://do e_D_Bwl	lphitech.com/'		zgclid=EAIaIQob	ChMIxre8lP3ZhAM	VO9sWBR3rQQo	UEAAYASABEg
3	https://do e_D_Bwl https://on	lphitech.com/ 3 linecourses.np	?gad_source=2&	zgclid=EAIaIQob	ChMIxre8lP3ZhAM	VO9sWBR3rQQo	UEAAYASABEg
3	https://do e_D_Bwl	lphitech.com/ 3 linecourses.np	?gad_source=2&	zgclid=EAIaIQob	ChMIxre8lP3ZhAM	VO9sWBR3rQQo	UEAAYASABEg.
3	https://do e_D_Bwl https://on	lphitech.com/ 3 linecourses.np	?gad_source=2&	zgclid=EAIaIQob	ChMIxre8lP3ZhAM	VO9sWBR3rQQo	UEAAYASABEg.
3	https://do e_D_Bwl https://on	lphitech.com/	?gad_source=2&otel.ac.in/noc20_	gclid=EAIaIQobo	and appropriate a	nitrat preparal - 0	M31) ygaserotra m reterr mussa ki setan 2 jozeft adama
3	https://do e_D_Bwl https://on	lphitech.com/ linecourses.np NG PO1 3	PO2	gclid=EAIaIQobo	and appropriate a	nitrat preparal - 0	M31) ygaserotra m reterr mussa ki setan 2 jozeft adama
3	https://do e_D_Bwl https://on O MAPPIN COs CO1	lphitech.com/	?gad_source=2&otel.ac.in/noc20_	gclid=EAIaIQobo	PO4	nitrat preparal - 0	M31) ygaserotra m reterr mussa ki setan 2 jozeft adama
3	https://do e_D_Bwl https://on PO MAPPIN COs CO1	Iphitech.com/* Iinecourses.np NG PO1 3 3	PO2	mm07/preview PO3	PO4	PO5	M31) ygaserotra m reterr mussa ki setan 2 jozeft adama
3	https://do e_D_Bwl https://on COS CO1 CO2	lphitech.com/ linecourses.np PO1 3 3	PO2 2	pO3 1	PO4	PO5	METT y gaska otra m _ reterr manas ki sataw 2 joenst _ catains anties manas and



PPAR	R3PE20	Component Design of Aircraft Engines	L	T	P	C
10.75	ici y keen da	all months and refer than install a part of the second sec	3	0	0	3
COUR	RSE OBJ	ECTIVES:		Tak	7111	red.
1	This co	ourse provides the fundamental principles of fluid mechanics and thermodynamics on	jet ei	ngine c	lesign.	-
2	This co	ourse brings out the differences in the design of various types of gas turbine engines.	anto		tx .	
3	This co	ourse imparts knowledge on the effect of inlet design on aerodynamic and propulsive	aspec	ts of a	ircrafts	j.
4	This co	ourse also addresses the problems associated with the design of combustion chambers	· de di	i in	0	6
5	This co	ourse deals with the practical difficulties in the matching of compressor and turbine	Board	nini	ğı İ	þ.
UNI	Γ-Ι	DESIGN FUNDAMENTALS OF GAS TURBINE ENGINE	ar 31	de curso		9
Design – Perfo	Process	- Constraint Analysis - Preliminary estimates - Aircraft weight and fuel consumption cycle analysis - Engine installation drag and sizing - Current challenges in gas turbin	data e tech	- Miss	ion an	alysi
UNIT		INLET DESIGN	diw.p	e ano se		9
Elemei Operat System	ional Re	Inlet - Engine Integration - Subsonic inlet - Engine Operational Requirements - Suquirements - Engine Impact on Inlet Design - Inlet Impact on Engine Design- Va	iperso lidatio	onic In on of I	let - E Inlet-E	ngin ngin
UNIT	- 111	DESIGN OF ROTATING COMPONENTS		TTA.	7. 1 9	9
pressui	re ratio -	namics - Constant axial velocity — adiabatic - selected Mach number - Mean li Airfoil geometry - Radial variation - Turbine cooling - Engine life - Design Examples	ne sta	age De	esign -	tag
UNIT	- IV	COMBUSTION CHAMBER DESIGN			10	9
loss-Fu Diffuse holes-I Diffuse	iels-Igniter-types Dilution I	stem components- Chemical reactor theory - Combustor Stability map-Stirring and ion-Combustion Systems of Main Burner Design: Air partitioning- Main burn of burner-inner and outer casing Design-Fuel- nozzle-Dome and liner-Primary znoles- Transition duct-Example Design calculation: Design of Afterburners-Design patiection-Ignition-Flame stabilization-Flame spread and after burner length-Example designs.	er co one- irame	ompone swirle ters- C	ent De r-Secon	esign ndar nents
UNIT	Γ-V	EXHAUST NOZZLE DESIGN			40	9
		of Nozzles – design of nozzles - Jet control methods for reduction of infrared signature problem - One dimensional nozzle flow.	re on	militai	y aircr	afts
		Т	OTA	L: 45	PERI	ODS
COUR	RSE OUT	TCOMES		Bloom	s Leve	el
CO1	To suc	cessfully design a gas turbine engine for given requirements.		Eval	uating	H
CO2		e thorough knowledge with the operational behavior of the major components of bine engines		Eval	uating	
			<u> </u>	_		



CO3	To identify engines.	the factors	those limit the	performance of t	he components of	gas turbine	Applying
CO4	To find sol	utions for the	compressor and t	urbine matching i	n gas turbine engine	es	Analyzing
CO5	To overcon	ne the probler	ns associated with	h inlet on aircrafts	3		Analyzing
REFE	RENCE BO	OKS:					ALL DAY 1
1				ress, 2nd edition, 2	vnamics and Thermo	odynamics Design	and Performanc
2	Mattingly.	JD,Heiser,WF	I and Pratt,DT,"A	ircraft Engine De	sign", 2nd Edition,	AIAA Education S	eries, 2002.
3	Oates. GC	,"Aircraft Pro	pulsion Systems	Technology and D	Design", AIAA Educ	ation Series, 1989.	
4	Saravanan	nuttoo, HIH a	ndRogers,GFC,"C	Gas Turbine Techr	nology", Pearson Ed	lucation Canada, 6t	h edition, 2008
5	Treager,IE	E,"Aircraft Ga	Turbine Engine	Technology", 3rd	edition, Glencoe M	IcGraw-Hill, Inc.19	995.
1 2 3	https://arc	hive.nptel.ac.i wikipedia.org	n/courses/101/10 /wiki/Aircraft_en m/watch?v=L24\	gine			July 30 Sussur 3
4	https://wv	vw.youtube.co	m/watch?v=KjiU	UJdPGX0		The same of the sa	Digital
CO-P	O MAPPIN	G			DIROLDARIA		1 10 - 7 1710
C	Os	PO1	PO2	PO3	PO4	PO5	PO6
C	01	3	2	nd gilbouranio	SUCK TRANSPORTED TO THE SUCK	1	
C	O2	3	2	1		1	
C	03	3.0 3.0 0.0	2	A condition A	St girld to anot	sa polisilimo len	of Inglishment
C	04	3	2	glest application	range Course	are free production of the	des Printers to
C	05	3	2	1	ASSESSED AL	KOK PILARY	V-3360



	R3PE21	Aircraft Systems Engineering	L	Т	P	C
		The state of the s	3	0	0	3
cour	RSE OB.	IECTIVES:	21110	A SHILLING	1 74	17
larti	To pro	vide exposure to basic concepts of Aircraft product system engineering and design	inag	er start	1 . 3	15
2	To pro	vide exposure to different fault and failure analysis methods in aircraft systems			Ĭ	
3	To pro	vide exposure on systems engineering process, System Architecture and				18
4	To pro	vide exposure on the importance of Maintainability, reliability and availability of the p	orodu	ct.		
5	To pro	vide exposure importance of formal planning and documentation in systems engineeri	ng.	Alf and		
UNI	T – I	INTRODUCTION TO SYSTEMS ENGINEERING	Ser.	ay ne		9
seven	steps Sys	stems Engineering- Systems Engineering Concept Map-Systems Definition-The tems Engineering-Conceptual System Design- System Engineering Processand Management-Trade Studies-Integrated Product And Process Development			1281.3	
UNI	T – II	THE AIRCRAFT SYSTEMS AND DESIGN	Ha	awatu		9
Cycle-	- Differer	veryday Examples of Systems-Aircraft Systems –Generic Systems-Product Life It Phases-Whole Life Cycle Tasks-Systems Analysis-Design Drivers in the t, Operating Environment-Interfaces with the Subsystems-Mission analysis	arans	e jini		
UNIT	L – III	SYSTEM ARCHITECTURE SAND INTEGRATION				9
Archit	ectures-	ystems Architectures –Modeling and Trade-Offs Evolution of Avionics Systems Integration Definition-Examples of Systems Integration-Integration nent of Systems Integration		PLAN	04-0	
	C XX/					
UNIT	1-10	PRACTICAL CONSIDERATIONS AND CONFIGURATION CONTROL			00	9
Stakeh Varyin	nolders- (PRACTICAL CONSIDERATIONS AND CONFIGURATION CONTROL Communications- Criticism- Configuration Control Process-Portrayal of a Systems Configurations- Compatibility-Factors Affecting Compatibility-Systems siderations and Integration of Aircraft Systems- Risk Management			00 -	9
Stakeh Varyin Evolut	nolders- (Communications- Criticism- Configuration Control Process-Portrayal of a Systems Configurations- Compatibility-Factors Affecting Compatibility-Systems			60	9
Stakeh Varyin Evolut UNI'	nolders- Cong System tion. Con	Communications- Criticism- Configuration Control Process-Portrayal of a System- is Configurations- Compatibility-Factors Affecting Compatibility-Systems siderations and Integration of Aircraft Systems- Risk Management			00 00 00	
Stakeh Varyin Evolut UNI' Systen Failure Design	nolders- Cong System tion. Con T - V ms and Conge Analysin.	Communications- Criticism- Configuration Control Process-Portrayal of a System- is Configurations- Compatibility-Factors Affecting Compatibility-Systems siderations and Integration of Aircraft Systems- Risk Management SYSTEMS RELIABILITYAND MAINTAINABILITY Imponents-Analysis- Influence, Economics, Design for Reliability-Fault and s-System Life Cycle cost-Case Study-Maintenance Types-Program-Planning and	ОТА	L: 45	PERI	9
Stakeh Varyin Evolut UNI Systen Failure Design	nolders- Cong System tion. Con T - V ms and Conge Analysin.	Communications- Criticism- Configuration Control Process-Portrayal of a System- is Configurations- Compatibility-Factors Affecting Compatibility-Systems siderations and Integration of Aircraft Systems- Risk Management SYSTEMS RELIABILITYAND MAINTAINABILITY omponents-Analysis- Influence, Economics, Design for Reliability-Fault and s-System Life Cycle cost-Case Study-Maintenance Types-Program-Planning and		L: 45		9 OD:



CO2	Categorize	different aircra	ft systems and w	ill be able to dif	ferentiate the avion	ics	Evaluating
	architectur	es		and the letter of the control			
CO3	Outline the	e different stages	s of product dev	elopment and fa	ctors influencing in	each stage	Applying
7 0						- 1	Analyzing
CO4	Analyze th	ne different alter	natives during d	esign process		124717	Anaryzing
CO5	Plan, orga	nize and docum	ent the task relat	ed to product de	sign, development	and testing.	Analyzing
REFE	RENCE BO	OOKS:	Z BST 18 III EUR	Hate Steam 2 30	itos ma mai mase		
1	Andrew P	.Sage& James E	E.Armstrong, "In	troduction to Sy	stems Engineering"	, 1st edition,2000	one per la la la la la la la la la la la la la
2	Erik Asla	ksen& Rod Belo	her, "Systems E	ngineering", Pre	entice Hall, 1992	and the state on the	
3	Ian Moire	&Allan Seabridg	ge, "Design and	Development of	Aircraft Systems",	Wiley, 2nd editio	n,2012.
4					al, electrical, and av	ionics	t-time
	subsyster	ns integration",	John Wiley &So	ons Ltd, 2011	straction Landston 2	annessa agel no	
5					ign",Artechhouse,I	nc,London,2003.	ment of agric clave
WEBS	SITE REFI	ERENCE / NPT	TEL/ SWAYAM	/ MOOC REFE	CRENCE:		THE SOURCE TO BOW S
1	https://or	linecourses.npte	el.ac.in/noc24_a	e05/preview		TEATING A	N TIN
2	https://er	n.wikipedia.org/v	wiki/Systems_er	ngineering	ACTION STREET	The parties of the state of the	urduledere in co Vele-Different Pl
3	https://w	ww.youtube.cor	n/watch?v=NZL	bTuBDhJg	Grae Saltroax		
4	https://nj	ptel.ac.in/course	s/101104071		of hearth and and	and the still made and	en e en tubon
COL	PO MAPPI	NG	magazit-solieng	STE CHEMING IN	endiner problems	i indialore suo	nege Sentembri
CO-1	OWATT				prime	of Systems Inte	PO(
	COs	PO1	PO2	PO3	PO4	PO5	PO6
	COI	3	14-1-2 apported	cord (Image) e	alinangi Vici Pinalad	engilians-Ca	of Trailors Tomi
	CO2	3	2	14 Sept - 2003	ation of A-people by	gent beal more	vote pan. Contides
	CO3	3	2	SHIALESS.	A 16 Clos FTL HE	illand ave	88 A 1884
			No. of Case Co.				
	CO4	3 _{prin ghi}	2	in Transaction	ski obutanes I-teor	slov à stut entr	ye a extract ordin



COURSE OBJECTIVES: 1 To get in-depth knowledge about the preliminary concepts of aircraft design 2 To provide with the basic knowledge on various aircraft loads 3 To learn the design of aircraft wing 4 To get exposed to different kinds of landing gear and its design 5 To provide with the basic knowledge on integration of wing, fuselage, empennage and power plant. UNIT-1 PRELIMINARY CONCEPTS Aircraft Design Requirements - Specifications - Role of user - Aerodynamic and Structural considerations - Importance of weight fractions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane-Airplane performance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performance UNIT-11 AIRCRAFT LOADS Ground loads - Flight Loads - Symmetrical loads in flight - Basic flight loading conditions - Load factor calculation during a manouverr - Velocity - Load factor diagram - Gust load and its estimation - Structural limits - Airplane weight estimation based on type of airplane - Trends in wing loading - Weight-estimation based on mission requirements - iterative approach - Span wise load distribution - Wing Loading. UNIT-111 WING DESIGN Selection of airfoil selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and landing considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all ment stressed skin construction for civil and military applications. UNIT-1V LANDING GEAR Different kinds of landing gears and associated arrangement for civil and military airplanes - Pretiminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation	PPAR	3PE22	get in-depth knowledge about the preliminary concepts of aircraft design provide with the basic knowledge on various aircraft loads learn the design of aircraft wing get exposed to different kinds of landing gear and its design provide with the basic knowledge on integration of wing, fuselage, empennage and power plant. PRELIMINARY CONCEPTS sign Requirements - Specifications - Role of user - Aerodynamic and Structural considerations - Importance tions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane- rformance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performa AIRCRAFT LOADS ds - Flight Loads - Symmetrical loads in flight - Basic flight loading conditions - Load factor calculation of airplane - Trends in wing loading - Weight-estimation based on mission requirements - iterative approach - Spution - Wing Loading. WING DESIGN of airfoil selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and cons - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin taircraft - types of associated structure - structural layout - features of light airplanes using advanced co Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design princ	С			
To get in-depth knowledge about the preliminary concepts of aircraft design To provide with the basic knowledge on various aircraft loads To provide with the basic knowledge on various aircraft loads To get exposed to different kinds of landing gear and its design To provide with the basic knowledge on integration of wing, fuselage, empennage and power plant. UNIT-1 PRELIMINARY CONCEPTS Aircraft Design Requirements - Specifications - Role of user - Aerodynamic and Structural considerations - Importance of weight fractions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane-Airplane performance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performance UNIT-11 AIRCRAFT LOADS Ground loads - Flight Loads - Symmetrical loads in flight - Basic flight loading conditions - Load factor calculation during a manouever - Velocity - Load factor diagram - Gust load and its estimation - Structural limits - Airplane weight estimation based on type of airplane - Trends in wing loading - Weight-estimation based on mission requirements - iterative approach - Span wise load distribution - Wing Loading. UNIT-111 WING DESIGN Selection of airful selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and landing considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT-1V LANDING GEAR Different kinds of landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropria	Sur		objects and extractionate arctical lends under Satisficial trading conspicuous	3	0	0	3
To provide with the basic knowledge on various aircraft loads To learn the design of aircraft wing To get exposed to different kinds of landing gear and its design To provide with the basic knowledge on integration of wing, fuselage, empennage and power plant. UNIT-1 PRELIMINARY CONCEPTS Aircraft Design Requirements - Specifications - Role of user - Aerodynamic and Structural considerations - Importance of weight fractions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane-Airplane performance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performance UNIT-II AIRCRAFT LOADS Ground loads - Flight Loads - Symmetrical loads in flight - Basic flight loading conditions - Load factor calculation during a manuever - Velocity - Load factor diagram - Gust load and its estimation - Structural limits - Airplane weight estimation based on type of airplane - Trends in wing loading - Weight-estimation based on mission requirements - iterative approach - Span wise load distribution - Wing Loading. UNIT-III WING DESIGN 9 Selection of airfoil selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and landing considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout of different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT-IV LANDING GEAR 9 Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears and associated arrangement fo	COUR	SE OB	JECTIVES:	0.11	Sirie n		
To pear the design of aircraft wing To get exposed to different kinds of landing gear and its design To provide with the basic knowledge on integration of wing, fuselage, empennage and power plant. UNIT - I PRELIMINARY CONCEPTS Aircraft Design Requirements - Specifications - Role of user - Aerodynamic and Structural considerations - Importance of weight fractions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane-Airplane performance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performance UNIT - II AIRCRAFT LOADS Ground loads - Flight Loads - Symmetrical loads in flight - Basic flight loading conditions - Load factor calculation during a manouever - Velocity - Load factor diagram - Gust load and its estimation - Structural limits - Airplane weight estimation based on type of airplane - Trends in wing loading - Weight-estimation based on mission requirements - iterative approach - Span wise load distribution - Wing Loading. UNIT - III WING DESIGN Selection of airfoil selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and landing considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT - IV LANDING GEAR 9 Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plan	1	To ge	in-depth knowledge about the preliminary concepts of aircraft design				
To get exposed to different kinds of landing gear and its design To provide with the basic knowledge on integration of wing, fuselage, empennage and power plant. UNIT - I PRELIMINARY CONCEPTS Aircraft Design Requirements - Specifications - Role of user - Aerodynamic and Structural considerations - Importance of weight fractions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane-Airplane performance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performance UNIT - II AIRCRAFT LOADS Ground loads - Flight Loads - Symmetrical loads in flight - Basic flight loading conditions - Load factor calculation during a manouever - Velocity - Load factor diagram - Gust load and its estimation - Structural limits - Airplane weight estimation based on type of airplane - Trends in wing loading - Weight-estimation based on mission requirements - iterative approach - Span wise load distribution - Wing Loading. UNIT - III WING DESIGN Selection of airfoil selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and landing considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT - IV LANDING GEAR Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plant Loading. UNIT - V INTEGRATION OF WING	2	To pro	ovide with the basic knowledge on various aircraft loads				
To provide with the basic knowledge on integration of wing, fuselage, empennage and power plant. UNIT - 1 PRELIMINARY CONCEPTS 9 Aircraft Design Requirements - Specifications - Role of user - Aerodynamic and Structural considerations - Importance of weight fractions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane-Airplane performance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performance UNIT - II AIRCRAFT LOADS 9 Ground loads - Flight Loads - Symmetrical loads in flight - Basic flight loading conditions - Load factor calculation during a manouever - Velocity - Load factor diagram - Gust load and its estimation - Structural limits - Airplane weight estimation based on type of airplane - Trends in wing loading - Weight-estimation based on mission requirements - iterative approach - Span wise load distribution - Wing Loading. UNIT - III WING DESIGN 9 Selection of airfoil selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and landing considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT - IV LANDING GEAR 9 Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plant Loading. UNIT - V INTEGRATION OF WING, FUSELAGE, EMPENNAGE AND POWER PLANT 9 Estimation of cen	3	To lea	rn the design of aircraft wing	orbe	7.34	HIP	GR -
Aircraft Design Requirements - Specifications - Role of user - Aerodynamic and Structural considerations - Importance of weight fractions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane-Airplane performance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performance UNIT - II	4				Table 1	7	
Aircraft Design Requirements - Specifications - Role of user - Aerodynamic and Structural considerations - Importance of weight fractions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane-Airplane performance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performance UNIT - II	5	To pro	ovide with the basic knowledge on integration of wing, fuselage, empennage and power	r plar	nt.		
weight fractions - Airworthiness requirements and standards Classification of airplanes - Special features of an airplane-Airplane performance aspects - Range and endurance - Take-off and landing - Climbing performance - Engine Performance UNIT - II	UNIT	- I	PRELIMINARY CONCEPTS				9
Ground loads - Flight Loads - Symmetrical loads in flight - Basic flight loading conditions – Load factor calculation during a manouever - Velocity - Load factor diagram - Gust load and its estimation - Structural limits - Airplane weight estimation based on type of airplane - Trends in wing loading - Weight-estimation based on mission requirements - iterative approach - Span wise load distribution - Wing Loading. UNIT - III WING DESIGN Selection of airfoil selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and landing considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT - IV LANDING GEAR Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plant Loading. UNIT - V INTEGRATION OF WING, FUSELAGE, EMPENNAGE AND POWER PLANT 9 Estimation of center of gravity - Introduction to advanced concepts - Aircraft Stability - Relaxed static stability - Controlled configured vehicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying controls and engine controls - Design of a wing-fuselage joint. TOTAL: 45 PERIODS COURSE OUTCOMES Blooms Level	weight Airplan	fraction e perfo	is - Airworthiness requirements and standards Classification of airplanes - Special feat	ures c	f an ai	rplane	e-
manouever - Velocity - Load factor diagram - Gust load and its estimation - Structural limits - Airplane weight estimation based on type of airplane - Trends in wing loading - Weight-estimation based on mission requirements - iterative approach - Span wise load distribution - Wing Loading. UNIT - III WING DESIGN 9 Selection of airfoil selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and landing considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT - IV LANDING GEAR 9 Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plant Loading. UNIT - V INTEGRATION OF WING, FUSELAGE, EMPENNAGE AND POWER PLANT 9 Estimation of center of gravity - Introduction to advanced concepts - Aircraft Stability - Relaxed static stability - Controlled configured vehicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying controls and engine controls - Design of a wing-fuselage joint. TOTAL: 45 PERIODS COURSE OUTCOMES Blooms Level	UNIT	– II	AIRCRAFT LOADS				9
Selection of airfoil selection - Influencing factors - Planform shapes of an airplane wing - Stalling, takeoff and landing considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT - IV LANDING GEAR Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plant Loading. UNIT - V INTEGRATION OF WING, FUSELAGE, EMPENNAGE AND POWER PLANT 9 Estimation of center of gravity - Introduction to advanced concepts - Aircraft Stability - Relaxed static stability - Controlled configured vehicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying controls and engine controls - Design of a wing-fuselage joint. TOTAL: 45 PERIODS COURSE OUTCOMES Blooms Level	manoue on type	of airp	elocity - Load factor diagram - Gust load and its estimation - Structural limits - Airpla lane - Trends in wing loading - Weight-estimation based on mission requirements - iter	ne we	ight es	timati	ion based
considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT - IV LANDING GEAR 9 Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plant Loading. UNIT - V INTEGRATION OF WING, FUSELAGE, EMPENNAGE AND POWER PLANT 9 Estimation of center of gravity - Introduction to advanced concepts - Aircraft Stability - Relaxed static stability - Controlled configured vehicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying controls and engine controls - Design of a wing-fuselage joint. TOTAL: 45 PERIODS COURSE OUTCOMES Blooms Level				and i	To all the		9
considerations - Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft passenger cabin layout for different aircraft - types of associated structure - structural layout - features of light airplanes using advanced composite materials - Structural design aspects - Bending moment and shear force diagram for wing and fuselage - Design principles of all metal stressed skin construction for civil and military applications. UNIT - IV LANDING GEAR 9 Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plant Loading. UNIT - V INTEGRATION OF WING, FUSELAGE, EMPENNAGE AND POWER PLANT 9 Estimation of center of gravity - Introduction to advanced concepts - Aircraft Stability - Relaxed static stability - Controlled configured vehicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying controls and engine controls - Design of a wing-fuselage joint. TOTAL: 45 PERIODS COURSE OUTCOMES Blooms Level	Calaati						
Different kinds of landing gears and associated arrangement for civil and military airplanes - Preliminary calculations for locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plant Loading. UNIT - V INTEGRATION OF WING, FUSELAGE, EMPENNAGE AND POWER PLANT 9 Estimation of center of gravity - Introduction to advanced concepts - Aircraft Stability - Relaxed static stability - Controlled configured vehicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying controls and engine controls - Design of a wing-fuselage joint. TOTAL: 45 PERIODS COURSE OUTCOMES Blooms Level	for diff materia	erations erent a ls – Str	- Wing drag estimation - High lift devices - Supercritical Airfoils - Cockpit and aircraft - types of associated structure - structural layout - features of light airplanes uctural design aspects - Bending moment and shear force diagram for wing and fusel	raft pa	asseng	er cab	oin layout omposite
locating main and nose landing gears - Integration of Structure and Power Plant - Estimation of Horizontal and Vertical tail volume ratios - Choice of power plant and various options of locations - Considerations of appropriate air-intakes- Power Plant Loading. UNIT-V INTEGRATION OF WING, FUSELAGE, EMPENNAGE AND POWER PLANT 9 Estimation of center of gravity - Introduction to advanced concepts - Aircraft Stability - Relaxed static stability - Controlled configured vehicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying controls and engine controls - Design of a wing-fuselage joint. TOTAL: 45 PERIODS COURSE OUTCOMES Blooms Level	UNIT	– IV	LANDING GEAR				9
Estimation of center of gravity - Introduction to advanced concepts - Aircraft Stability - Relaxed static stability - Controlled configured vehicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying controls and engine controls - Design of a wing-fuselage joint. TOTAL: 45 PERIODS COURSE OUTCOMES Blooms Level	locating volume	g main ratios	and nose landing gears - Integration of Structure and Power Plant - Estimation of F	Horizo	ontal a	nd Ve	rtical tail
configured vehicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying controls and engine controls - Design of a wing-fuselage joint. TOTAL: 45 PERIODS COURSE OUTCOMES Blooms Level							
COURSE OUTCOMES Blooms Level	configu	red vel	nicles - V/STOL aircraft & rotary wing vehicles - Design and layout of flying cont	rols a	and en	gine c	controls -
COL III C. III C	COUR	SE OU	TCOMES	10			



Have basi	c knowledge o	f aircraft rules an	d airworthiness rec	quirements impose	d by	Evaluating
governing	g bodies		(gless Aus			ETBREAK TO
Be able to	calculate and	estimate aircraft	loads under differe	nt loading condition	ons	Applying
Be able to	o configure an	aircraft wing base	ed on aerodynamic	considerations		Analyzing
Be expos	ed the role of a	ircraft stability ir	the aircraft design	process	विकार क्या है के कि	Analyzing
RENCE B	OOKS:			gal (Edit)	to the register artist	estal I
Daniel P	Raymer, "Airc	raft Design: A co	nceptual approach	", AIAA Education	al Series, 5th	B Marie P
edition 2	012				e alexande deservice.	rida al 1
DarrolSt	inton ,"The De	sign of Airplane"	, Wiley publishers	,, 2nd edition, 2001		T. THEL
John D A	Anderson, "Airj	plane Performanc	ce and Design", Mo	Graw Hill, 1st edi	tion,1999	
						anditiest in elevani.
						andresq seems of
						n_start
				XEITCE:		
			(A) (B)		aus – Zinad Maij	T shani biuryi.k
Manuacine a					Consult Control of the Control of th	Hart - Harton Chinese
			A SUPPLIES OF THE PARTY OF THE			necodius Duni 1
https://v	www.youtube.c	om/watch?v=WD	OkP8oEjzzg		A DESIGNATE	th-Title
PO MAPPI	NG	e designs on to				
COs	PO1	PO2	PO3	PO4	PO5	PO6
COI	3	2	annil mileson y	men on live a	d norma nois	heavely is early.
CO2	3	2	1		1	
CO3	3	2	of his Indiana	o traine busine a	and the same	no centre qui azzil
CO4	3	2	1	_	1	grift had .
CO4	3		and the same of			
	Be able to Be able to Be able to Be expose RENCE B Daniel P edition 2 DarrolSt John D A Nicholai Torenbe SITE REF https://o https://o https://o https://o COs CO1 CO2	Be able to calculate and Be able to calculate and Be able to configure and Be exposed the role of a RENCE BOOKS: Daniel P Raymer, "Airce edition 2012 DarrolStinton, "The De John D Anderson, "Air Nicholai, LM, "Fundant Torenbeek, Egbert, "Sy SITE REFERENCE / NITTE REFERENCE / N	Be able to calculate and estimate aircraft Be able to configure an aircraft wing base Be exposed the role of aircraft stability in RENCE BOOKS: Daniel P Raymer, "Aircraft Design: A conedition 2012 DarrolStinton, "The Design of Airplane" John D Anderson, "Airplane Performance Nicholai, LM, "Fundamentals of airplane Torenbeek, Egbert, "Synthesis of Subson SITE REFERENCE / NPTEL/ SWAYAN https://onlinecourses.nptel.ac.in/courses/101/11 https://en.wikipedia.org/wiki/Aircraft_coneditale.com/watch?v=WE PO MAPPING PO1 PO2 COS CO1 3 2 CO2 3 2 CO3 3 2	Be able to calculate and estimate aircraft loads under differed Be able to configure an aircraft wing based on aerodynamic Be exposed the role of aircraft stability in the aircraft design RENCE BOOKS: Daniel P Raymer, "Aircraft Design: A conceptual approachedition 2012 DarrolStinton, "The Design of Airplane", Wiley publishers. John D Anderson, "Airplane Performance and Design", Mondon Nicholai, LM, "Fundamentals of airplane Design", Univ. of Torenbeek, Egbert, "Synthesis of Subsonic Airplane Design SITE REFERENCE / NPTEL/ SWAYAM/ MOOC REFEIT https://onlinecourses.nptel.ac.in/courses/101/104/101104069/https://en.wikipedia.org/wiki/Aircraft_design_processhttps://www.youtube.com/watch?v=WDkP8oEjzzg **PO MAPPING** PO1 PO2 PO3 CO3 3 2 1 CO3 3 2 1	Be able to calculate and estimate aircraft loads under different loading conditions. Be able to configure an aircraft wing based on aerodynamic considerations. Be exposed the role of aircraft stability in the aircraft design process. RENCE BOOKS: Daniel P Raymer, "Aircraft Design: A conceptual approach", AIAA Education edition 2012 DarrolStinton, "The Design of Airplane", Wiley publishers,, 2nd edition, 2001 John D Anderson, "Airplane Performance and Design", McGraw Hill, 1st edit Nicholai, LM, "Fundamentals of airplane Design", Univ. of Dayton DHIO, 19 Torenbeek, Egbert, "Synthesis of Subsonic Airplane Design", Springer publis SITE REFERENCE / NPTEL/ SWAYAM/ MOOC REFERENCE: https://onlinecourses.nptel.ac.in/noc21 ae04/preview https://en.wikipedia.org/wiki/Aircraft_design_process https://en.wikipedia.org/wiki/Aircraft_design_process https://www.youtube.com/watch?v=WDkP8oEjzzg O MAPPING COS POI PO2 PO3 PO4 COS 1	Be able to calculate and estimate aircraft loads under different loading conditions Be able to configure an aircraft wing based on aerodynamic considerations Be exposed the role of aircraft stability in the aircraft design process RENCE BOOKS: Daniel P Raymer, "Aircraft Design: A conceptual approach", AIAA Educational Series, 5th edition 2012 DarrolStinton, "The Design of Airplane", Wiley publishers,, 2nd edition, 2001 John D Anderson, "Airplane Performance and Design", McGraw Hill, 1st edition, 1999 Nicholai, LM, "Fundamentals of airplane Design", Univ. of Dayton DHIO, 1975. Torenbeek, Egbert, "Synthesis of Subsonic Airplane Design", Springer publishers, 1982. SITE REFERENCE / NPTEL/ SWAYAM/ MOOC REFERENCE: https://onlinecourses.nptel.ac.in/noc21 ae04/preview https://archive.nptel.ac.in/courses/101/104/101104069/ https://en.wikipedia.org/wiki/Aircraft_design_process https://www.youtube.com/watch?v=WDkP8oEjzzg



FFRA

F	PPAR3PE23	Composite Product Processing Methods	L	T	P	С
		secondarid attroduces America in terration a	3	0	0	3
COLID	CE OB IEC	DIVEC.	- Barin	en i	12 WE 1	507
COUR	SE OBJECT	IVES:				
1	To impart	knowledge on the material selection for fabricating composite products	Jenny 6	84 1950 84 1950	SE OF	-CULI
2	To impart	an idea about the product development and manufacturing of composites	i sali	Tue o		100
3	To acquir	e adequate knowledge about the manufacturing of thermoset composites	gnicio a	TELEGO!	megi -	
4	To acquir	e adequate knowledge about the manufacturing of thermoplastic composi	tes	Vary was		155
5	To gain k	nowledge on joining, machining and cutting of composites				
UN	NIT – I	MATERIAL SELECTION				9
Dainfa	raomanta C	lass Fiber Manufacturing - Carbon Fiber Manufacturing - Aramid Fiber N	Aanufa	eturing	Matrix	Materia
		- Thermoplastic Resins - Fabrics - Prepregs - Preforms - Molding Con	-		D - H -	
		e Need for Material Selection - Reasons for Material Selection - Materia	I Prope	rty Info	rmation	- Steps
he Ma	terial Selecti	on Process - Material Selection Methods.			1	
UN	II – TIV	PRODUCT DEVELOPMENT AND DESIGN FOR MANUFACTU	URING	UNE CHI		9
						RES WES
_	A) - Design I	uct Life Cycle - Phases of Product Development - Design Review - Fai Problems - DFM – DFM Implementation Guidelines - Design Evaluation				
UN	III – III	MANUFACTURING PROCESSES FOR THERMOSET COMPO	SITES	Trade	and I	9
Duanna	a Lau IIIa Du	ocess - Wet Lay-Up Process - Spray-Up Process - Filament Winding Pro	2000	Dultenci	on Drog	acc Pac
		Process - Structural Reaction Injection Molding (SRIM) Process - Com	pression	n iviola	ing Pro	cess - Ro
Wrapp	ing Process -	Injection Molding of Thermoset Composites.				
UN	IIT – IV	MANUFACTURING PROCESSES FOR THERMOPLASTIC CO	MPOS	ITES		9
Therm	oplastic Tap	Winding - Thermoplastic Pultrusion Process - Compression Molding of	of GMT	Γ - Hot	Press 7	echnique
		ng - Diaphragm Forming Process - Injection Molding.				
rutoci	iave i recessi	ng Biapinagin vorning Process injection inclaing.				
Uľ	NIT – V	JOINING, MACHINING AND CUTTING OF COMPOSITES				9
Adhes	ive Ronding	- Failure Modes in Adhesive Bonding - Basic Science of Adhesive I	Ronding	o - Tvn	es of A	dhesives
	0	hesive Bonding over Mechanical Joints – Disadvantages of Adhesive		_		
	_					
		ce Preparation Guidelines – Design Guidelines for Adhesive Bonding-				
		echanical Joints - Preparation for the Bolted Joint-Purposes of Machinin				
	•	ilure Mode during Machining of Composites - Cutting Tools - Types of	Machi	ning O	peration	is - Cuttii
	tion Duillin					
Opera	tion - Drilling	g Operation.				
Opera	tion - Drilling	g Operation.		ТОТА	1. 45	PERIOD



OURS	E OUTCOM	ES	visual en la	des Prendent Bereiter	All Production of the Control of the	Blooms I	Level
COI	To select the	suitable n	naterial for making	g composite products.	ANTIMA .	Evaluat	ing
CO2	To gain know	wledge on	product developm	ent and manufacturing of	f composites.	Evaluat	ing
CO3		e most ap	ppropriate manufac	cturing process for fabric		Applyi	ng
CO4	To select	the mos		nanufacturing process	for fabricating	Analyz	ing
CO5				achining and cutting of co	omposites	Analyz	zing
REFER	RENCE BOO	KS:					
- 1-	Allen Baker	r, "Compo	site Materials for A	Aircraft Structures", AIA	A Series, 2nd Edition	n, 2004.	
2				e Materials", CRC Press,			
3				cs and Fibre Glass", Von		o., New York, 1	989.
4	Sanjay K. N	Mazumdar	, "Composites Ma	nufacturing: Materials, Pr			
WEDG	Washington			I/ MOOC REFERENCE	E:	207	
WEBS					10 10 10 10 10 10 10 10 10 10 10 10 10 1	or changer.	U EUDOR
dad.	https://en.v	vikipedia.	org/wiki/Composit	e_material	To Bound & Stoy 3	oir Lichard - g	il tourismit
2	https://onli	necourses	.nptel.ac.in/noc19	me67/preview			(10.00)
3	https://onli	inecourses	.nptel.ac.in/noc20	me29/preview		LANG III	Titl
4	https://ww vvD_BwE		ite.triovision.in/?g	clid=EAIaIQobChMIodn	n4q4HahAMVQxd7	Bx1BJAWNEA.	AYASAAE
CO-P	O MAPPING			opet Compatins	ranti io gininulii is	electric strans	gategory/
	COs	PO1	PO2	PO3	PO4	PO5	PO6
	CO1	3	2	Pulicusos: Piposs - Con oces - Inicolon Moldina	ije – Desempostii obasen Pannine B	tout Inii de	dquaris (i
	CO2	3	2	S AND CUTTING OF	HYBEART SYN	1 4	TIME.
Nicotl	CO3	3 111	2 4 4	rs2 sisusi - Ignisapsi svi	ovok ni tabolit si	diert Indone	alvigadā A
dhosin Solee		3	2	rez denst landanet eve terinial especial accioni rel contes (e. 1986)	olik ni sboth s Na dae saat Ma Tanton (sidelines	diet Indust and office to a	Auhesiva automatea Oslockipo



PPAR	R3PE24	Helicopter Aerodynamics	L	T	P	C
SIRC O	min .	solald recession to respect notions who we have	3	0	0	3
COUR	RSE OB	JECTIVES:		2675		-
1	This c	course will make students to provide with introductory concepts of types of rotorcraft	mort	1/2004		+
2		course imparts knowledge on the fundamental aspects of helicopter aerodynamics erformance of helicopters	e I	shai?		
3	This c	course will provide basic knowledge on the performance of helicopters				1
4	This c	course presents stability and control aspects of helicopters	100	1000		
5	This c	course will explore the basic aerodynamic design aspects of helicopters	1 68	miles i		
UNI	Γ-Ι	INTRODUCTION	Cana	ships?		9
Гуреs pitch c	of rotor	craft – autogyro, gyrodyne, helicopter, Main rotor system – articulated, semi rigid, ri cyclic pitch control, anti-torque pedals	gid	rotors	, Colle	ective
UNIT	Γ – II	HELICOPTER AERODYNAMICS	qn?	(agini)	1	9
rotor in	n hover,	actuator disc theory, Blade element theory, combined blade element and momentum rotor model with cylindrical wake and constant circulation along blade, free wake moders, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects	el, C	ory, vo Consta	ortex that chor	neory d an
rotor in ideal to UNIT	n hover, wist roto - III and vert	rotor model with cylindrical wake and constant circulation along blade, free wake mode ors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects PERFORMANCE tical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum level flight, Climb in forward flight, optimum speeds, Maximum level flight, Climb in forward flight, optimum speeds, Maximum level flight, Climb in forward flight, optimum speeds, Maximum level flight, Climb in forward flight, optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Maximum level flight, Optimum speeds, Optimum s	el, C ect.	Consta	nt chor	d and
rotor in ideal to UNIT	n hover, wist roto Y – III and vert pe – per	rotor model with cylindrical wake and constant circulation along blade, free wake mode ors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground efformation PERFORMANCE	el, C ect.	Consta	nt chor	d and
rotor in ideal to UNIT Hover envelo UNIT	and vert pe – per T – IV pter Trir	rotor model with cylindrical wake and constant circulation along blade, free wake mode ors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects PERFORMANCE tical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum leformance curves with effects of altitude.	vel, C	Speed	rotor	d and
rotor in ideal to UNIT Hover envelo UNIT	and vert pe – per pter Trip pance, Dy	rotor model with cylindrical wake and constant circulation along blade, free wake mode ors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects of PERFORMANCE tical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum leformance curves with effects of altitude. STABILITY AND CONTROL m, Static stability – Incidence disturbance, forward speed disturbance, angular velocity	vel, C	Speed	rotor	d and
Hover envelo	and vert pe – per T – IV pter Trip pance, Dy	rotor model with cylindrical wake and constant circulation along blade, free wake mode ors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects PERFORMANCE tical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum leformance curves with effects of altitude. STABILITY AND CONTROL m, Static stability – Incidence disturbance, forward speed disturbance, angular velocity ynamic Stability.	vel	speed	rotor	9 dimit
Hover envelo	and vert pe – per T – IV pter Trip pance, Dy	rotor model with cylindrical wake and constant circulation along blade, free wake mode ors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects of PERFORMANCE tical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum leaformance curves with effects of altitude. STABILITY AND CONTROL m, Static stability – Incidence disturbance, forward speed disturbance, angular velocity ynamic Stability. AERODYNAMIC DESIGN design, Blade tip shapes, Drag estimation – Rear fuselage upsweep, vibration problem of	vel di	speed,	rotor	9 llimit 9 9 gees.
Hover envelous UNIT Helico disturb	and vert pe – per Trip pance, Dy section of	rotor model with cylindrical wake and constant circulation along blade, free wake mode ors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects of PERFORMANCE tical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum leaformance curves with effects of altitude. STABILITY AND CONTROL m, Static stability – Incidence disturbance, forward speed disturbance, angular velocity ynamic Stability. AERODYNAMIC DESIGN design, Blade tip shapes, Drag estimation – Rear fuselage upsweep, vibration problem of	vel vel	speed, sturba	rotor	9 llimit 9 9 ess.
deal ty UNIT Hover envelo UNIT Helico disturb UNIT	and vert pe - per T - IV pter Trir pance, Dy section co	rotor model with cylindrical wake and constant circulation along blade, free wake mode ors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects of PERFORMANCE tical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum leformance curves with effects of altitude. STABILITY AND CONTROL m, Static stability – Incidence disturbance, forward speed disturbance, angular velocity ynamic Stability. AERODYNAMIC DESIGN design, Blade tip shapes, Drag estimation – Rear fuselage upsweep, vibration problem of TO	vel vel	speed, sturba	rotor nce, ya	9 Illimit 9 9 ess. (ODS)
Hover envelous UNIT	and vert pe – per T – IV pter Trip pance, Dy section of	rotor model with cylindrical wake and constant circulation along blade, free wake mode ors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effects of PERFORMANCE tical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum leformance curves with effects of altitude. STABILITY AND CONTROL m, Static stability – Incidence disturbance, forward speed disturbance, angular velocity ynamic Stability. AERODYNAMIC DESIGN design, Blade tip shapes, Drag estimation – Rear fuselage upsweep, vibration problem of TOTCOMES	vel vel	speed, sturba elicopt L: 45 Bloom	rotor nce, ya er blad s PERI	9 llimit 9 awin 9 es.



		and anticonco no	licopter stability			Analyzing
CO5 C	Gain knowledge of I	helicopter controls	and vibration I			1
6	L Wedge of	nencopiel controls	and vibration analy	sis of helicopter b	lades	Analyzing
REFERE	NCE BOOKS:				. isayonis	HBO 325500
		dan a sportan pinang			ur sgira Niv seni	regarding 5
1 G	essow.A and Meye ork,1982.	rs,GC,"Aerodynam	nics of the Helicopt	er", Macmillan and	d Co., New	2 Marsa
2 Jo	ohn Fay, "The Helio	copter", Himalayan	Books, New Delhi	i, 1995	Languago de Autoreo de la	Mary man
		pter Engineering",			Ann and an area	
					the conferred past	
K	anpur and Rotary V	licopter Technology Ving aircraft R&D	center HAL De	erospace Engineer	ing, IIT –	3 - I Kis oe
5 Se	eddon,J,"Basic Hel	icopter Aerodynam	ics", AIAA Educati	ion series, Blackwe	ell scientific	- LUTTU
рι	iblications, U.K, 19	990				
VEBSITE	REFERENCE /	NPTEL/ SWAYAN	// MOOC REFER	RENCE:	Jerush dalla si	ver lense er skall
	tps://nptel.ac.in/cou				and a city	11 11 11 11 11
		11363/10110401/				4 7 7 7 7 7 7
بنادات			0.46.1	a men skuah sh	seed to the sound	tos \ endesidos
2 htt	tps://www.youtube.	.com/watch?v=3gQ		PL2tY7KqPLKuRo	oxnHXr827FUD3	yFSF_o-2
2 htt	tps://www.youtube.			PL2tY7KqPLKuRo	oxnHXr827FUD3	States what test
2 htt	tps://www.youtube.	.com/watch?v=3gQ .com/watch?v=iG0	WC2ewM4I	PL2tY7KqPLKuRo	oxnHXr827FUD3	yFSF_o-2
2 htt	tps://www.youtube.	.com/watch?v=3gQ	WC2ewM4I	PL2tY7KqPLKuRo	oxnHXr827FUD3	States what test
2 htt3 htt4 htt	tps://www.youtube. tps://www.youtube. tps://en.wikipedia.o	.com/watch?v=3gQ .com/watch?v=iG0	WC2ewM4I	PL2tY7KqPLKuRo	oxnHXr827FUD3	States what test
2 htt3 htt4 htt	tps://www.youtube. tps://www.youtube. tps://en.wikipedia.o	.com/watch?v=3gQ .com/watch?v=iG0	WC2ewM4I	PL2tY7KqPLKuRo	oxnHXr827FUD3	States what test
2 htt 3 htt 4 htt	tps://www.youtube. tps://www.youtube. tps://en.wikipedia.o	.com/watch?v=3gQ .com/watch?v=iG0	WC2ewM4I	PL2tY7KqPLKuRo	PO5	The state of the s
2 htt 3 htt 4 htt CO-PO M.	tps://www.youtube.tps://www.youtube.tps://en.wikipedia.o	.com/watch?v=3gQ .com/watch?v=iG0* org/wiki/Helicopter	WC2ewM4I		A TEMATE	States what test
2 htt 3 htt 4 htt	tps://www.youtube.tps://www.youtube.tps://en.wikipedia.o	.com/watch?v=3gQ .com/watch?v=iG0 org/wiki/Helicopter	WC2ewM4I		A TEMATE	The state of the s
2 htt 3 htt 4 htt O-PO M.	tps://www.youtube.tps://www.youtube.tps://en.wikipedia.o	.com/watch?v=3gQ .com/watch?v=iG0* org/wiki/Helicopter	PO3		PO5	The state of the s
2 htt 3 htt 4 htt COPO M. COS CO1 CO2	tps://www.youtube.tps://www.youtube.tps://en.wikipedia.orgs://en.wikipedia.orgs://en.wikipedia.org/	com/watch?v=3gQ com/watch?v=iG0 org/wiki/Helicopter	WC2ewM4I		PO5	The state of the s
2 htt 3 htt 4 htt CO-PO M. COs CO1	tps://www.youtube.tps://www.youtube.tps://en.wikipedia.orgs://en.wikipedia.org/	.com/watch?v=3gQ .com/watch?v=iG0* org/wiki/Helicopter PO2	PO3		PO5	The state of the s
2 htt 3 htt 4 htt CO-PO M. COs CO1 CO2	tps://www.youtube.tps://www.youtube.tps://en.wikipedia.org/ APPING PO1 3 3 3	com/watch?v=3gQ com/watch?v=iG0v org/wiki/Helicopter PO2 2 2 2	PO3		PO5	The state of the s
2 htt 3 htt 4 htt CO-PO M. COs CO1 CO2 CO3	tps://www.youtube.tps://www.youtube.tps://en.wikipedia.orgs://en.wikipedia.orgs://en.wikipedia.org/	com/watch?v=3gQ com/watch?v=iG0 org/wiki/Helicopter	PO3		PO5	The state of the s



	PE25	High Speed Jet Flows	L	T	P	С
			3	0	0	3
COUR	SE OBJECT	TIVES:				
1	To get insig	tht into the basic aspects of jets and types of jets	- Service	1 - 21 - 250		
2	To learn the	basic properties of jets and its characteristics				
3	To get know	wledge on various active and passive jet control methods	त्रनीर	alemis		
4	To gain kno	owledge into the basic aspects of jet acoustics	NZ.	onlegan	2	
5		in-depth knowledge on how and what type of control methods can be	184	HIA		
UNI	1	TRODUCTION				9
Radial	of Jets-Plane jets- Wall je g Layers- Cor	TS free-jets. Round jets. Plane jets in a co-flowing stream. Round jet in Co flowing ss- Jet Characteristics & Entrainment, Mathematical treatment of jet profiles- Semputational and Experimental Techniques for Studying the Jets.				
	III	CTIVE IETCONTROL METHODS				0
Active	WE THE STREET	CTIVE JETCONTROL METHODS	MEN	4C C	-th atia	9
	control me	chods- Actuators-Fluidic, Thermal, Acoustic, Piezoelectric, Electromagnetic, Press, Applications.	MEN	MS,Syi	nthetic	
	control med	hods- Actuators-Fluidic, Thermal, Acoustic, Piezoelectric, Electromagnetic, I	MEN	MS,Syı	nthetic	
UNIT Passive	control metals and Senson - IV PA	chods- Actuators-Fluidic, Thermal, Acoustic, Piezoelectric, Electromagnetic, Nos, Applications.			100	Jets,
UNIT Passive	control media and Senson - IV PA e control tect //isualization,	chods- Actuators-Fluidic, Thermal, Acoustic, Piezoelectric, Electromagnetic, Piezoelectric, P			100	Jets,
UNIT Passive Flow V UNIT	control mer ls and Senson C – IV PA e control tect Visualization, T – V JE action to Jet A	chods- Actuators-Fluidic, Thermal, Acoustic, Piezoelectric, Electromagnetic, Piezoelectric, Piezoelec	ex g	generat	ors. O	Jets, 9 ptical 9
Passive Flow V UNIT Introdumulti-ottechnic	control mer ls and Senson F - IV PA e control tector visualization, F - V JE dimensional ques – applica	chods- Actuators-Fluidic, Thermal, Acoustic, Piezoelectric, Electromagnetic, Piezoelectric, Piezoel	ex g	ng way Noise	ve solut suppre	Jets, 9 ptical 9 tion—ession
Passive Flow V UNIT	control mer ls and Senson F-IV PA e control tech //isualization, F-V JE dimensional ques – applica	chods- Actuators-Fluidic, Thermal, Acoustic, Piezoelectric, Electromagnetic, Piezoelectric, Piezoelec	ex g	ng way Noise	ve solut	Jets, 9 ptical 9 tion—ession
Passive Flow V UNIT Introdumulti-ottechnic	control mer ls and Senson F-IV PA e control tech //isualization, F-V JE dimensional ques – applica	chods- Actuators-Fluidic, Thermal, Acoustic, Piezoelectric, Electromagnetic, Piezoelectric, Piezoel	ex g	ng way Noise	ve solut suppre	Jets, 9 ptical 9 tion—ession
Passive Flow V UNIT	control medis and Senson F - IV PA e control tector //isualization, F - V JE nection to Jet A dimensional ques - applica RSE OUTCO	chods- Actuators-Fluidic, Thermal, Acoustic, Piezoelectric, Electromagnetic, Piezoelectric, Piezoelec	ex g	ng way Noise AL: 45 Bloom	ve solur suppre	Jets, 9 ptical 9 tion—ession



CO4	To acc	quire knowledge	on jet acoustics ar	nd methods for sup	pression of jet noise		Analyzing
CO5	To de	monstrate variou	s experimental tec	hniques to determi	ne jet characteristic	S	Analyzing
REFE	RENCE	E BOOKS:				25.25d (200	II seo secono
1	Ethira	ijan Rathakrishna	an, "Applied Gas I	Dynamics", John V	/iley, New York, 20	10	un tele al 1
2					er Publishers, 2017	discount of and	London of T. L.
3	Ratha	krishnan E., "Ga	s Dynamics", Prei	ntice Hall of India,	New Delhi, 5th edi	tion, 2014	ed ing of 1. If
4	1	ro, AH, "Dynam onald Press, Nev		namics of Compre	ssible Fluid Flow, V	ols. I &	A The great K
WEBS	SITE R	EFERENCE / N	PTEL/ SWAYAN	A/ MOOC REFEI	RENCE:	Viteriosia fra	rensignal j
1	https:	//archive.nptel.ac	c.in/courses/101/1	05/101105024/	attender a letteren		in the setue new
2	https:	://onlinecourses.r	nptel.ac.in/noc24_	me36/preview	nt plante? marche) in zerial aler bu	genicke melude
3	https:	://archive.nptel.ac	c.in/courses/101/1	05/101105088/	ga reli-paono 1 m	griveoit of the viri	ast archidec Pai
4	https:	://www.youtube.	com/watch?v=2rw	XMwas5cU		e Beergers Reside	milification and
CO-P	O MAP	PPING	ng ist sometimes	ga charfaich easin		in Sua mayor	J-move Lenio
C		PO1	PO2	PO3	PO4	PO5	PO6
C	Os	3	2	1		1	
		3			METER HOMES	O P.H. TVICK	177-194
CO	02	3	2	1 segrados non	initial distributions	vie Francisch	o Tonnos delsa
C	03	3	2	1	-	. ensure parties.	in Maddiscript we
	Product of the second						The second second second
C	04	3	2	1	Salad rai W	1	the of moreodyna



PPAR3PE2	26	Smart Materials and Structural Health Monitoring	L	Т	P	С
		The state of the s	3	0	0	3
COURSE	OBJECTIV	YES:				
1 7	To get basic	idea on the fundamentals of structural health monitoring		CECUMA US		
2 7 p	To impart kr piezo electrio	nowledge in the areas of vibration based techniques in structural heats sensors	lth monit	oring,	fibre opt	ics and
	To gain knostructures	wledge on the fundamentals of fabrication, modelling, analysis, and	design	of smar	t materi	als an
4 7	To get expos	ed to the state of the art of smart materials and systems				
	To impart kn materials and	owledge on spanning piezoelectrics, shape memory alloys, electro act	tive poly	mers, m	echanoc	hromi
UNI	T-I	STRUCTURAL HEALTH MONITORING				9
DUIN MOL	able Applica	ations of SHM - Aerospace Engineering. Structural health monit	oring of	compo	sites -	Repai
nvestigation	on using SHI T – II	M.		ine long	2	9
investigatio UNI7 Introductio Polycrystal Magnetosti	on using SHI T – II on to Smart Illine System: riction and	M. OVERVIEW OF SMART MATERIALS Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic s, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth M Magneto-resistance Effect, Introduction to Electro-active Materials,	Materia Iagnetost Electroi	ls, Sing	materials terials, E	, Gian Electro
Investigation UNIT UNIT Introduction Polycrystal Magnetosti active Poly Polymers,	on using SHI T – II on to Smart Illine System: riction and ymers, Ionic Electro-rheo	M. OVERVIEW OF SMART MATERIALS Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic s, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth M Magneto-resistance Effect, Introduction to Electro-active Materials, Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Me logical Fluids, Magneto Rheological Fluids.	Materia Iagnetost Electroi	ls, Sing	materials terials, E	tals v s, Gian Electro nory
Investigation UNIT Introduction Polycrystal Magnetostra active Poly Polymers, UNIT	on using SHI T – II on to Smart Illine Systems riction and ymers, Ionic Electro-rheo Γ – III	M. OVERVIEW OF SMART MATERIALS Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic s, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magneto-resistance Effect, Introduction to Electro-active Materials, Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Melogical Fluids, Magneto Rheological Fluids. SMART COMPOSITES	Materia Iagnetost Electroi mory All	ls, Sing rictive in nic Mat oys, Sha	materials terials, E ape Mem	tals v s, Gian Electro nory
Investigation UNIT Introduction Polycrystal Magnetostractive Polymers, Interest of UNIT Review of Laminated Finite Eler Constitutive Precision Interest Inte	on using SHI T – II on to Smart Illine Systems riction and ymers, Ionic Electro-rheo T – III f Composite Plate Theory ment Model ye Relationsl	M. OVERVIEW OF SMART MATERIALS Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic s, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth M Magneto-resistance Effect, Introduction to Electro-active Materials, Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Me logical Fluids, Magneto Rheological Fluids.	Materia Iagnetost Electron mory Alle Composite Governin introduct Element	ls, Sing rictive in nic Matoys, Sha es base ng Equa ion to Mass M	materials, Eterials, Eteri	tals v , Gian Electro nory 9 lassica Motion ulation r High
Investigation UNIT Introduction Polycrystal Magnetostractive Polymers, UNIT Review of Laminated Finite Eler Constitutive Precision F Layer.	on using SHI T – II on to Smart Illine Systems riction and ymers, Ionic Electro-rheo T – III f Composite Plate Theory ment Model ye Relationsl	M. OVERVIEW OF SMART MATERIALS Materials, Principles of Piezoelectricity, Perovskyte Piezoceramics, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magneto-resistance Effect, Introduction to Electro-active Materials, Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Melogical Fluids, Magneto Rheological Fluids. SMART COMPOSITES Materials, Micro and Macro-mechanics, Modelling Laminated Coy, Effect of Shear Deformation, Dynamics of Smart Composite Beam, ling of Smart Composite Beams, Vibration Control using SHM — mip - Element Stiffness Matrix for High Precision Finite Element - I	Materia Iagnetost Electron mory Alle Composite Governin introduct Element	ls, Sing rictive in nic Matoys, Sha es base ng Equa ion to Mass M	materials, Eterials, Eteri	tals v , Gian Electro nory 9 lassica Motion ulation r High
Investigation UNITING	on using SHI T – II on to Smart Illine Systems riction and ymers, Ionic Electro-rheo T – III f Composite Plate Theory ment Model ye Relations Finite Eleme T – IV al evaluation	Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic s, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magneto-resistance Effect, Introduction to Electro-active Materials, Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Melogical Fluids, Magneto Rheological Fluids. SMART COMPOSITES Materials, Micro and Macro-mechanics, Modelling Laminated Cy, Effect of Shear Deformation, Dynamics of Smart Composite Beam, ling of Smart Composite Beams, Vibration Control using SHM—nip - Element Stiffness Matrix for High Precision Finite Element -Int - Developing Actuator and Sensor Influence Matrix Delamination INTELLIGENT SYSTEMS AND NEURAL NETWORKS -Data acquisition- Feature extraction-Statistical model development	Materia Iagnetost Electron mory Alle Composite Governin introduct Element n Sensin	ls, Sing rictive in nic Matoys, Sha es base ng Equa ion to Mass M g using	materials, Eterials, Eteri	tals variations, Giar Electronory 9 Iassica Motion ulation r Higherson
Introduction Polycrystal Magnetostractive Polymers, Deliver of UNIT Review of Laminated Finite Eler Constitutive Precision F Layer. UNIT Operationa Cleansing	on using SHI T – II on to Smart Illine System riction and ymers, Ionic Electro-rheo T – III f Composite I Plate Theory ment Model ye Relations Finite Eleme T – IV al evaluation – Normaliz	Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic s, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magneto-resistance Effect, Introduction to Electro-active Materials, Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Melogical Fluids, Magneto Rheological Fluids. SMART COMPOSITES Materials, Micro and Macro-mechanics, Modelling Laminated Coy, Effect of Shear Deformation, Dynamics of Smart Composite Beam, ling of Smart Composite Beams, Vibration Control using SHM—nip - Element Stiffness Matrix for High Precision Finite Element -I ent - Developing Actuator and Sensor Influence Matrix .Delamination INTELLIGENT SYSTEMS AND NEURAL NETWORKS Data acquisition- Feature extraction-Statistical model development ation-Data Fusion - Compression - Statistical model building - St	Materia flagnetost Electron mory Alle Composite Governin introduct Element n Sensin for featur	ls, Sing rictive inic Mat oys, Shares base ng Equa ion to Mass M g using	materials, Eterials, Eteri	tals v , Gian Electro nory
Investigation UNIT Introduction Polycrystal Magnetostractive Polymers, UNIT Review of Laminated Finite Eler Constitutive Precision For Layer. UNIT Operationa Cleansing Unsupervise Unit Precision For Layer.	on using SHI T – II on to Smart Illine Systems riction and rmers, Ionic Electro-rheo T – III f Composite I Plate Theory ment Model re Relations Finite Eleme T – IV al evaluation – Normaliz sed pattern r	Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic s, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magneto-resistance Effect, Introduction to Electro-active Materials, Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Melogical Fluids, Magneto Rheological Fluids. SMART COMPOSITES Materials, Micro and Macro-mechanics, Modelling Laminated Coy, Effect of Shear Deformation, Dynamics of Smart Composite Beam, ling of Smart Composite Beams, Vibration Control using SHM — hip - Element Stiffness Matrix for High Precision Finite Element - Point - Developing Actuator and Sensor Influence Matrix Delamination INTELLIGENT SYSTEMS AND NEURAL NETWORKS -Data acquisition- Feature extraction-Statistical model development ation-Data Fusion — Compression — Statistical model building - Statistical model building - Statistical model building - Statistical model Fusion — Signal processing — Fuzzy C means- K means — Kohence	Materia flagnetost Electron mory Alle Composite Governin introduct Element n Sensin for featur	ls, Sing rictive inic Mat oys, Shares base ng Equa ion to Mass M g using	materials, Eterials, Eteri	tals v , Gian Electro nory
Investigation UNIT Introduction Polycrystal Magnetostractive Poly Polymers, UNIT Review of Laminated Finite Eler Constitutive Precision For Layer. UNIT Operational Cleansing Unsupervise Fundament	on using SHI T – II on to Smart Illine Systems riction and rmers, Ionic Electro-rheo T – III f Composite I Plate Theory ment Model re Relations Finite Eleme T – IV al evaluation – Normaliz sed pattern r	Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic s, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magneto-resistance Effect, Introduction to Electro-active Materials, Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Melogical Fluids, Magneto Rheological Fluids. SMART COMPOSITES Materials, Micro and Macro-mechanics, Modelling Laminated Coy, Effect of Shear Deformation, Dynamics of Smart Composite Beam, ling of Smart Composite Beams, Vibration Control using SHM—nip - Element Stiffness Matrix for High Precision Finite Element -I ent - Developing Actuator and Sensor Influence Matrix .Delamination INTELLIGENT SYSTEMS AND NEURAL NETWORKS Data acquisition- Feature extraction-Statistical model development ation-Data Fusion - Compression - Statistical model building - St	Materia flagnetost Electron mory Alle Composite Governin introduct Element n Sensin for featur	ls, Sing rictive inic Mat oys, Shares base ng Equa ion to Mass M g using	materials, Eterials, Eteri	tals v , Gian Electro nory
Investigation UNIT Introduction Polycrystal Magnetostractive Polymers, Introduction Polymers, Introduction UNIT Review of Laminated Finite Eler Constitutive Precision For Layer. UNIT Operationa Cleansing Unsupervis Fundament UNIT	on using SHI T – II on to Smart Illine System: riction and ymers, Ionic Electro-rheo T – III f Composite I Plate Theory ment Model ye Relations Finite Eleme T – IV al evaluation – Normaliz sed pattern r tals of Wave T – V	Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic s, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magneto-resistance Effect, Introduction to Electro-active Materials, Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Me logical Fluids, Magneto Rheological Fluids. SMART COMPOSITES Materials, Micro and Macro-mechanics, Modelling Laminated Cy, Effect of Shear Deformation, Dynamics of Smart Composite Beam, ling of Smart Composite Beams, Vibration Control using SHM — hip - Element Stiffness Matrix for High Precision Finite Element - Port - Developing Actuator and Sensor Influence Matrix .Delamination INTELLIGENT SYSTEMS AND NEURAL NETWORKS -Data acquisition- Feature extraction-Statistical model development ation-Data Fusion — Compression — Statistical model building - Statistical — Signal processing — Fuzzy C means- K means — Koheno let analysis — Life Prediction.	Materia flagnetost Electron mory Alle Composite Governin introduct Element n Sensin for featur upervised on's Self	ls, Sing rictive inic Mat oys, Shates base as Equation to Mass Mass Mass Mass Mass Mass Mass Mas	materials, Eape Mem d on Clation of Memory Matrix for Piezo Similarion recognization ma	tals value tals value



COURS	SE OUTCOMES				I	Blooms Level
CO1	To familiarize with	the fundamentals o	f history of SHM.	i baa shiinniili i'r		Evaluating
CO2	To provide a syster	natic approach to SI	HM process			Evaluating
CO3	To have knowledge	e of the various smar	rt materials used f	or aerospace applicat	tions	Applying
CO4	To familiarize with	the non-destructive	test techniques re	elevant to SHM	I topicy weeks there	Analyzing
CO5	To provide hands-o	on experience with e	xperimental moda	ıl analysis	of part your is	Analyzing
REFER	ENCE BOOKS:					log for the second
1	Brian Culshaw, "Si	mart Structures, and		1 House, 2000	erja anni ura en	27-20-
2	Daniel Balageas, C ISTE, 2006.	laus-Peter Fritzen, A	Alfredo Güemes, '	'Structural Health Mo	onitoring", Wiley	L-EHA Distance of Of community
3		"Health Monitoring n Wiley and Sons, 20		terials and Componer	nts-Methods with	promote trans
4	Laurene Fausett, "l	Fundamentals Of Ne	eural Networks", I	Pearson publishers, 19	994	
5	Inc, 2007.			afer Active Sensors".	, Academic Press	z aneliawert zwo konstruktungski
WEBSI	TE REFERENCE /	NPTEL/ SWAYAM	1/ MOOC REFE	RENCE:	Maria Maria Maria	iale i paratri
1	https://archive.npte	el.ac.in/courses/112/	104/112104160/	e a management		
2		es.nptel.ac.in/noc23		Company (College)		stall forman
3	https://www.aendt.			ng clid=EAIaIQobChM	ItqzC34PahAMV	aYJLBR2zOA1s
CO-PO	AYASAAEgLLpfT MAPPING	D_BWE				
CC	Os PO1	PO2	PO3	PO4	PO5	PO6
CC	01 3	2	1	e man de la la		0 2 - 900 -
CC	D2 3	2	1	and the state of	aigration particles	e deserva della So elettropickon
CC	3	2	1	医原性 医皮肤	SAYUA	to time
CC	D4 3	2	1	eld gyrsmi seb er	nasit grosses	E gosajok isto
CC	05 3	2	3 may 1924	Louis Acoustic	na - special sol	geb oglijnadi



	R3PE27	Artificial Intelligence and Machine Learning	L	T	P	C
, brie	bril .ess	reland. "Idnohuse Learning - An Algoribania Perspective", Cingman and Hell-CRC Pr	3	0	0	3
COU	RSE OF	BJECTIVES:	TUE_E	unita_i	+	
1	To ga	nin knowledge on artificial intelligence	10.1	myayı		
2	To ur	nderstand the concepts of Machine Learning	in A	medi -		-
3	To ap	preciate supervised learning and their applications				
4	То ар	preciate the concepts and algorithms of unsupervised learning	, and			
5	To un	nderstand the theoretical and practical aspects of Probabilistic Graphical Models			1583	W.
UNI	I – T	ARTIFICIAL INTELLIGENCE	HIJICO	and the second		9
reduct	ion and	lligence – Basics – Goals of artificial intelligence – AI techniques – problem represent solution techniques - Application of AI and KBES in Robots.	ation	in AI	– Pro	blen
	L – II	INTRODUCTION TO MACHINE LEARNING				9
aiguin	iiiis, tu	rning-Types of Machine Learning -Machine Learning process- preliminaries, testing training data into Probabilities, and Statistics for Machine Learning - Probability - Decision Theory.	g - N	Aachin ory –	e Lea Proba	rning bilit
UNIT Linear	Models	SUPERVISED LEARNING for Regression – Linear Models for Classification- Discriminant Functions, Probabilist	tic G	enerati	ve Mo	9 odels
UNIT Linear Probab Baggir Vector	Models illistic D ng, Boos Machin	for Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es.	En	combl	Mat	dels
UNIT Linear Probab Baggir Vector UNIT	Models pilistic D ng, Boos Machin	for Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es. UNSUPERVISED LEARNING	– En propa	semblagation	e Met	odels hods ppor
UNIT Linear Probab Baggir Vector UNIT	Models politistic Eng, Boos Machin Y – IV	for Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es.	– En propa	semblagation	e Met	odels hods ppor
UNIT Linear Probab Baggir Vector UNIT	Models bilistic Eng, Boos Machin Y – IV ring- K- Analysis	for Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es. UNSUPERVISED LEARNING means – EM Algorithm- Mixtures of Gaussians – Dimensionality Reduction, Linear I	– En propa	semblagation	e Met	odels hods ppor
UNIT Linear Probab Baggir Vector UNIT Cluster Factor UNIT	Models bilistic E ng, Boos Machin - IV ring- K- Analysis C-V cal Models	for Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es. UNSUPERVISED LEARNING means – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear Iss, Principal Components Analysis, Independent Components Analysis. PROBABILISTIC GRAPHICAL MODELS dels – Undirected Graphical Models – Markov Random Fields – Directed Graphic and Independence properties – Markov Random Fields- Hidden Markov Models –	– Enpropa	agation agation iminan lodels adition	t Ana	9 ysis, 9 essian dom
UNIT Linear Probab Baggir Vector UNIT Cluster Factor UNIT	Models bilistic Eng, Boos Machin Y - IV ring- K- Analysis F - V cal Models rks - Co (CRFs).	for Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes Sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es. UNSUPERVISED LEARNING means – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear Iss, Principal Components Analysis, Independent Components Analysis. PROBABILISTIC GRAPHICAL MODELS dels – Undirected Graphical Models – Markov Random Fields – Directed Graphic anditional Independence properties – Markov Random Fields- Hidden Markov Models –	Discription	ininan Iodels adition	t Ana Bayeal Ran	9 lysis, 9 ODDS
UNIT Linear Probab Baggir Vector UNIT Cluster Factor UNIT	Models bilistic Eng, Boos Machin - IV ring- K- Analysis - V cal Models ring- K- Corks - Co (CRFs).	for Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es. UNSUPERVISED LEARNING means – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear I s, Principal Components Analysis, Independent Components Analysis. PROBABILISTIC GRAPHICAL MODELS dels – Undirected Graphical Models – Markov Random Fields – Directed Graphic anditional Independence properties – Markov Random Fields- Hidden Markov Models – TCOMES	Discription	agation agation iminan lodels adition	t Ana Bayeal Ran	odels hods ppor 9 lysis, 9
UNIT Linear Probab Baggir Vector UNIT Cluster Factor UNIT Graphi Networ Fields	Models bilistic Eng, Boos Machin Y - IV ring- K- Analysis F - V cal Moders crks - Co (CRFs).	For Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es. UNSUPERVISED LEARNING Imeans – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear Is, Principal Components Analysis, Independent Components Analysis. PROBABILISTIC GRAPHICAL MODELS Idels – Undirected Graphical Models – Markov Random Fields – Directed Graphic anditional Independence properties – Markov Random Fields- Hidden Markov Models – TCOMES ize the robots using Artificial Intelligence	Discription	ininan Iodels adition	t Ana Baye al Ran	odels hods ppor 9 lysis, 9
UNIT Linear Probab Baggir Vector UNIT Cluster Factor UNIT Graphi Networ Fields	Models bilistic Eng, Boos Machin T – IV ring- K- Analysis T – V cal Moo rks – Co (CRFs). Optim Design	For Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es. UNSUPERVISED LEARNING means – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear Is, Principal Components Analysis, Independent Components Analysis. PROBABILISTIC GRAPHICAL MODELS dels – Undirected Graphical Models – Markov Random Fields – Directed Graphic anditional Independence properties – Markov Random Fields- Hidden Markov Models – TCOMES ize the robots using Artificial Intelligence n a learning model appropriate to the application	Discription	iminan lodels adition 2: 45	t Ana Bayeal Ran PERIO	odels hods ppor 9 lysis, 9
UNIT Linear Probab Baggir Vector UNIT Cluster Factor UNIT Graphi Networ Fields	Models bilistic Eng, Boos Machin Y - IV ring- K- Analysis T - V cal Moorks - Co (CRFs). SE OUT Optim Design Impler	For Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es. UNSUPERVISED LEARNING Imeans – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear Is, Principal Components Analysis, Independent Components Analysis. PROBABILISTIC GRAPHICAL MODELS Idels – Undirected Graphical Models – Markov Random Fields – Directed Graphic anditional Independence properties – Markov Random Fields- Hidden Markov Models – TCOMES ize the robots using Artificial Intelligence	Discription	ininan Iodels adition 2: 45	t Ana Bayeal Ran PERIO	odels hods pppor 9 lysis 9
UNIT Linear Probab Baggir Vector UNIT Cluster Factor UNIT	Models bilistic Eng, Boos Machin Y - IV ring- K- Analysis F - V cal Models criss - Co (CRFs). SE OUT Design Impler your cl	For Regression – Linear Models for Classification- Discriminant Functions, Probabilist Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes sting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back es. UNSUPERVISED LEARNING means – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear Iss, Principal Components Analysis, Independent Components Analysis. PROBABILISTIC GRAPHICAL MODELS dels – Undirected Graphical Models – Markov Random Fields – Directed Graphic anditional Independence properties – Markov Random Fields- Hidden Markov Models – Markov Random Fields – Directed Graphic and Independence properties – Markov Random Fields – Hidden Markov Models – TCOMES ize the robots using Artificial Intelligence n a learning model appropriate to the application ment Probabilistic Discriminative and Generative algorithms for an application of	Discription	iminan lodels adition Evalu Evalu	t Ana Baye al Ran PERIO Leve ating ating	odels hods ppor 9 lysis, 9



EFE	RENCE	BOOKS:					
1	Christo	opher Bishop,"Pa	attern Recognition a	and Machine Learn	ing" Springer, 2007		
	Oil 15th	Manaland "Ma	ochine Learning — A	an Algorithmic Pers	spective", Chapman	and Hall,CRC Pre	ss, Second
2			ichnie Learning – P	III / II goriumio 1 ori			
		n,2014		1 1 1'l' d' - Davana	ative" MIT Press	2012	
3	· ·				ctive", MIT Press, 2		D1 1
4	Ethem	Alpaydin, "Intro	oduction to Machine	e Learning", MIT F	Press, Third Edition,	, 2014	Mail 1
5	Tom N	Mitchell, "Machin	ne Learning", McG	raw-Hill,1997	DANK TOTA CHI OREMON TO	SERVISORE SERVERIGO	E.01 1 E
WED			PTEL/ SWAYAM/		INCE:		
WED					Market version in vive a	costo oto bilaski suo	U.V.
1			ptel.ac.in/noc22_cs				A TANKE
2	https:/	//en.wikipedia.or	g/wiki/Artificial_in	ntelligence			the last of a start of a
3	https:	//www.youtube.c	com/watch?v=mJeN	lghZXtMo	A Tomorphonic >	enema subject	has noncess
4		//nptel.ac.in/cou	The second secon	MAT AT LEGITING BUILD	The grand were stated		THE TENER
				公司 医肾上孔 1 31	OH JON OT FOR	E AIRLINE SEE	
CO-1	PO MAP	PING	enimilara manora	some Length	white Learning	PO5	PO6
C	Os	PO1	PO2	PO3	PO4	PUS grant	gena intaC
C	01	3	2	-1	A griftani	restalos	in Thu
C	CO2	3	2	1	A constant and	An appropriate and the	Station words
C	CO3	3	2	1	-	1	ibaki jolasi
					Transport School	an yearsaldinist t	
	04	3	2			1	

3

CO₅



PPAR3	SPE28	Aircraft Guidance and Control	L	T	P	C
		the language of the property of the second s	3	0	0	3
COURS	SE OBJ	JECTIVES:				
1	To lear	rn about the aircraft equations of motion and method of linearization.	501	ratioC		
2	To imp	part knowledge on the operating principle of guidance law.	District	ar(Vic)		
3	To gain	n knowledge on various augmentation systems	G	la la la la la la la la la la la la la l		
4	To get	familiarize with the concepts of longitudinal stability and to design the longitudinal aut	topi	lot.		
5	To stud	dy lateral stability and to design the lateral autopilot	179	nw so	1283	77
UNIT	- I	INTRODUCTION		en digital		9
Introduc Lineariz		Guidance and control-Definition, Historical background - Coordinate Frame - Ed	quat	tions o	of mot	ion -
UNIT -	- II	AUGMENTATION SYSTEMS	1950	Later 1	T	9
authority	y and F	natic flight control systems, Stability augmentation systems, control augmentation system of the full Authority Augmentation systems - Gain scheduling concepts.	ms,	Desigi	I OI EI	
authority UNIT - Displace	y and F - III ement		SI	ope C	Couple	9
unit - Unit - Displace Automat Unit -	y and F - III ement tic Flar - IV	Cull Authority Augmentation systems - Gain scheduling concepts. LONGITUDINAL AUTOPILOT Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide re Control and Flight path stabilization, Longitudinal control law design using back step LATERAL AUTOPILOT	SI ping	ope C	Coupler ithm.	9 r and
UNIT - Displace Automat UNIT - Damping Automat	y and F - III ement tic Flar - IV g of the ticlaters	Cull Authority Augmentation systems - Gain scheduling concepts. LONGITUDINAL AUTOPILOT Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide re Control and Flight path stabilization, Longitudinal control law design using back step LATERAL AUTOPILOT The Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system alBeamGuidance.IntroductiontoFly-by-wireflightcontrol systems, Lateral control law	SI ping	ope C	Coupler ithm.	9 r and 9 ration
UNIT - Displace Automat UNIT - Damping Automat	y and F - III ement tic Flar - IV g of th ticlater; g algorit	Cull Authority Augmentation systems - Gain scheduling concepts. LONGITUDINAL AUTOPILOT Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide re Control and Flight path stabilization, Longitudinal control law design using back step LATERAL AUTOPILOT The Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system alBeamGuidance.IntroductiontoFly-by-wireflightcontrol systems, Lateral control law	SI ping	ope C	Coupler ithm.	9 r and 9 ration
UNIT - Displace Automat UNIT - Damping Automat stepping UNIT	y and F - III ement tic Flar - IV ng of the ticlaters g algorit - V ng prine	Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide to Control and Flight path stabilization, Longitudinal control law design using back step. LATERAL AUTOPILOT The Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system alBeamGuidance.IntroductiontoFly-by-wireflightcontrol systems, Lateral control law thm. MISSILE AND LAUNCH VEHICLE GUIDANCE ciples and design of guidance laws, homing guidance laws-short range, Medium range-Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q general control guidance, Q guidance schemes, Explicit guidance, Q guidance, Q guidance, Q guidance, Q guidance, Q g	n, to	ope Cg algorurn codesign	Coupler ithm. mpens using	9 ation back
UNIT - Displace Automat UNIT - Damping Automat stepping UNIT	y and F - III ement tic Flar - IV ng of the ticlaters g algorit - V ng prine Vehicle	Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide re Control and Flight path stabilization, Longitudinal control law design using back step LATERAL AUTOPILOT The Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system alBeamGuidance.IntroductiontoFly-by-wireflightcontrol systems, Lateral control law thm. MISSILE AND LAUNCH VEHICLE GUIDANCE ciples and design of guidance laws, homing guidance laws-short range, Medium range-Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q and Company of the Control	n, to	ope Cg algorurn codesign	Coupler ithm. Impens using /R mischeme	9 ation back 9 ation back 1000S
UNIT - Displace Automat UNIT - Damping Automat stepping UNIT	y and F - III ement tic Flar - IV ng of the ticlaters galgorit - V ng prine Vehicle	Autopilot-Pitch Orientation Control system, Acceleration Control System, Glidere Control and Flight path stabilization, Longitudinal control law design using back step. LATERAL AUTOPILOT The Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system alBeamGuidance.IntroductiontoFly-by-wireflightcontrol systems, Lateral control law thm. MISSILE AND LAUNCH VEHICLE GUIDANCE ciples and design of guidance laws, homing guidance laws-short range, Medium range-Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q guidance and control systems.	n, to	ope Cg algorurn codesign	Coupler ithm. Impens using /R mischeme	9 ation back 9 ation back 1000S
UNIT - Displace Automate UNIT - Damping Automate Stepping UNIT - Operating Launch	y and F - III ement tic Flar - IV ng of the ticlaters g algorit - V ng princ Vehicle SE OU' Explai	Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide re Control and Flight path stabilization, Longitudinal control law design using back step LATERAL AUTOPILOT The Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system alBeamGuidance.IntroductiontoFly-by-wireflightcontrol systems, Lateral control law thm. MISSILE AND LAUNCH VEHICLE GUIDANCE ciples and design of guidance laws, homing guidance laws-short range, Medium range-Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q of TCOMES in the equations governing the aircraft dynamics and the process of linearizing them.	n, to	ope Cg algor urn co design and BV lance s Bloom	Coupler ithm. Impens using /R mischeme	9 ation back 9 ation back 1000S
UNIT - Displace Automat UNIT - Damping Automat stepping UNIT - Operatir Launch	y and F - III ement tic Flar - IV ng of the ticlaters g algorit - V ng princ Vehicle SE OU' Explai	Autopilot-Pitch Orientation Control system, Acceleration Control System, Glidere Control and Flight path stabilization, Longitudinal control law design using back step. LATERAL AUTOPILOT The Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system alBeamGuidance.IntroductiontoFly-by-wireflightcontrol systems, Lateral control law thm. MISSILE AND LAUNCH VEHICLE GUIDANCE ciples and design of guidance laws, homing guidance laws-short range, Medium range-Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q guidance and control systems.	n, to	ope Cg algor urn co design and BV lance s Bloom	Coupler ithm. mpens using /R mischeme	9 ation back 9 ation back 1000S
UNIT - Displace Automate UNIT - Damping Automate Stepping UNIT - Operating Launch	y and F - III ement tic Flar - IV g of the ticlaters g algorit - V ng print Vehicle SE OU' Explai	Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide re Control and Flight path stabilization, Longitudinal control law design using back step LATERAL AUTOPILOT The Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system alBeamGuidance.IntroductiontoFly-by-wireflightcontrol systems, Lateral control law thm. MISSILE AND LAUNCH VEHICLE GUIDANCE ciples and design of guidance laws, homing guidance laws-short range, Medium range-Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q of TCOMES in the equations governing the aircraft dynamics and the process of linearizing them.	n, to	ope Cg algor urn co lesign and BV lance s L: 45 Bloom Eval	Coupler ithm. Impens using /R mischeme	9 rance 9 ration back 9 ssiles ss.
UNIT - Displace Automate UNIT - Damping Automate stepping UNIT - Operatir Launch	y and F - III ement tic Flar - IV ng of the ticlaters g algorit - V ng prine Vehicle Explai Explai	Cull Authority Augmentation systems - Gain scheduling concepts. LONGITUDINAL AUTOPILOT Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide re Control and Flight path stabilization, Longitudinal control law design using back step LATERAL AUTOPILOT The Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control systems alBeamGuidance.IntroductiontoFly-by-wireflightcontrol systems, Lateral control law thm. MISSILE AND LAUNCH VEHICLE GUIDANCE ciples and design of guidance laws, homing guidance laws-short range, Medium range-Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q guidance schemes and the process of linearizing them. TCOMES in the equations governing the aircraft dynamics and the process of linearizing them. the the various guidance schemes & requirements for aircrafts and missiles	n, to	ope Og algor urn co lesign and BV lance s Bloom Eval	Coupler ithm. Impension using VR mischemes S PER ins Level luating	9 ation back 9 ssiles ss.



1	Thomas R Ye						
F		chout, St	even L Morris, D	avid E Bossert, Wa	yne F Hallgren,	James K Hall,	
	"Introduction	to Aircra	ıft Flight Mechan	ics", AIAA Educat	ion series, 2014		
2	Pierre T. Kaba	amba, An	ouck R. Girard, "	'Fundamentals of A	Aerospace Navig	ation and	
	Guidance", C	ambridge	e university press,	, 2014.	Managa and in-	po fictivia att mode mus	161 1, 1
3	CollinsonRPC	G,"Introd	uctionto Avionics'	",ChapmanandHal	l,India,1996		
4	BlakeLock,JF	I, "Autor	naticcontrolofAir	rcraftandmissiles",	JohnWileySons,	NewYork, 1990	2 d L
5	Stevens BL a	nd Lewis	FL, "Aircraft co	ntrol &simulation"	,JohnWileySons	, NewYork,1992	01.7 - 2
WEBS	TE REFERE	NCE / N	PTEL/ SWAYA	M/ MOOC REFE	RENCE:	iti a pilidere imajsh dau	2 1.164
N EDS				and the same			
1	https://archiv	e.nptel.ad	c.in/courses/101/3	108/101108056/			
2	https://archiv	e.nptel.a	c.in/courses/101/	104/101104062/	and proceedings of the	to Cumpange and Congress	neithireath)
3	http://www.d	igimat.in	/nptel/courses/vio	deo/101108057/L1	6.html		THE STREET
,	The part of the same						
4	https://archiv	e.nptel.a	c.in/courses/101/	108/101108054/		Feil Authority Assument	turn interest to a
		*					
CO-P	O MAPPING						
20/00	PC)1	PO2	PO3	PO4	PO5	PO6
CC	Mark Company of the Park Company			The second of		The state of the s	
CC	01	3	2	1	- 1000	1	
CC	02	3 10111103	2	Entho que trata	egatinada ta e	is all most process to	N. SPANIEL Militar - Russ

CO3

CO4

CO₅



PPCC1A0	C01	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		The state of the s	2	0	0	0
COURSE	OBJEC	TIVES:	A Longity			
,1.	Teach	how to improve writing skills and level of readability	no-injuri		Ť	1
2	Tell al	pout what to write in each section	v. cedina		ă.	
3	Summ	narize the skills needed when writing a Title	40717	United 5	FIELK	
4	Infer t	he skills needed when writing the Conclusion			vI	
5	Ensur	e the quality of paper at very first-time submission		67	,	
UNIT -	- I	INTRODUCTION TO RESEARCH PAPER WRITING		10		6
		paration, Word Order, Breaking up long sentences, Structuring Paragraphs and dundancy, Avoiding Ambiguity and Vagueness	Sentenc	es, Be	eing C	oncise
UNIT -	- II	PRESENTATION SKILLS		6/6	0	6
		id What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing an cts, Introduction	dPlagia	rism, S	Section	ıs
UNIT –	III	TITLE WRITING SKILLS		an	9-1	6
The Final UNIT -	Check IV	RESULT WRITING SKILLS				6
		when writing the Methods, skills needed when writing the Results; skills are sare needed when writing the conclusions.	neededv	vhen v	vriting	the
UNIT -	- V	VERIFICATION SKILLS				6
Useful ph	rases, cl	necking Plagiarism, how to ensure paper is as good as it could possibly be the f	rst- tim	esubm	ission	
			TOT	AL: 3	0 PER	IODS
COURSE	OUTC	OMES		Bloor	ns Le	vel
CO1	Unde	rstand that how to improve your writing skills and level of readability		Ana	lyzing	3
CO2	Learn	about what to write in each section		Ana	lyzing	3
CO3	Unde	rstand the skills needed when writing a Title		Reme	mberi	ng
CO4	Unde	rstand the skills needed when writing the Conclusion		Ana	alyzing	3
CO5		re the good quality of paper at very first-time submission		Reme	mberi	ng
REFERE	NCE BO	OOKS:				
1	Adria 2011	nn Wallwork, English for Writing Research Papers, Springer New York Dordre	cht Heid	lelberg	g Lond	lon,
2	Day l	R How to Write and Publish a Scientific Paper, Cambridge University Press 200)6			
3	Gold	bort R Writing for Science, Yale University Press (available on Google Books)	2006			

2PRA

4	Highman N, Handb	ook of Writing fo	r the Mathematical	Sciences, SIAM	I. Highman's book 1	998
WEBSIT	E REFERENCE / NP	TEL/ SWAYAM	MOOC REFERI	ENCE:	ŧ	PROCESOR
1	https://archive.npte	l.ac.in/courses/11	0/105/110105091/			
2	https://onlinecourse	es,nptel.ac.in/noc2	0_hs06/preview			rouksi ot
3	https://onlinecourse	es.nptel.ac.in/noc2	2_hs05/preview	s allok galifina s	Engine of well does.	
4	https://www.youtub	e.com/watch?v=2	Xp2PVO3do34	vitore dosa ot ore	wer halve brode He'	
CO-PO M	IAPPING		alo Ta guin	necded when w	ellik seb sersembe	3 8
COs	PO1	PO2	PO3	PO4	PO5	PO6
COI	1		1 3 1 3 1 3 1 3 1 3 1	STOPPE	igornii -	- mar-r

CO₂

CO₃

CO₄

CO₅



verest leh

15 1 1 1

71/201

r . . .

	02	DISASTER MANAGEMENT	L	T	P	С
1005,40	entocitationiam New Pe	. Discussibilities and apprint Amiliation of Amiliania (A.	2	0	0	0
OURSE	OBJECTIVES:	FINEROLISMANIANI MODE BENERICE	TARK.	red T		17
1 S	ummarize basics of disaste	(2.8) kiji kis (2.8) kiji kis (2.8) kiji kis (2.8) kiji kis (2.8) kiji kis (2.8) kiji kis (2.8) kiji kis (2.8)	ais as law	elv egni	1 1	
2 E	xplain a critical understand	ing of key concepts in disaster risk reduction and human	nitarian i	response.		
3 II	lustrate disaster risk reduct	ion and humanitarian response policy and practice from	multiple	e perspect	ives.	
	escribe an understanding of isasters and conflict situation	f standard so humanitarian response and practical relevants.	ance in s	pecific ty	pes of	
5 E	evelop the strengths and w	eaknesses of disaster management approaches				
UNIT-	I INTRODUCTIO	N 463 E01 E01	104		et list	6
	Definition, Factors and Signe, Nature, Types and Magr	gnificance; Difference between Hazard And Disaster; N nitude	atural ar	d Manma	ade Dis	asters
UNIT -	II REPERCUSSION	NS OF DISASTERS AND HAZARDS			di n	6
Nuclear I	Reactor Meltdown, Industri flicts.	loods, Droughts And Famines, Landslides And Avalance al Accidents, Oil Slicks And Spills, Outbreaks Of Disease	hes, Mar	n-made d Epidemic	isaster: s, War	
UNIT -	III DISASTER PRO	NE AREAS IN INDIA				6
Coastal I	Hazards with Special Refere	e To Floods and Droughts, Landslides And Avalanches ence To Tsunami; Post- Disaster Diseases and Epidemic		Tone To		
Coastal I UNIT -	Hazards with Special Reference IV DISASTER PROPERTY OF PROPERTY OF THE PROPERT	ence To Tsunami; Post- Disaster Diseases and Epidemic EPAREDNESS AND MANAGEMENT Omena Triggering a Disaster or Hazard; Evaluation of I	es Risk: Ap	plication	of Ren	6 note
Coastal I UNIT – Prepared Sensing, UNIT –	Hazards with Special Reference IV DISASTER PROPERTY The special R	ence To Tsunami; Post- Disaster Diseases and Epidemic EPAREDNESS AND MANAGEMENT omena Triggering a Disaster or Hazard; Evaluation of I And Other Agencies, Media Reports: Governmental and ENT	es Risk: Ap d Comm	oplication unity Prep	of Ren	6 mote ess.
Coastal I UNIT – Prepared Sensing, UNIT – Disaster Risk As	Hazards with Special Reference IV DISASTER PRI The special Reference IV DISASTER PRI The special Reference IV DISASTER PRI The special Reference IV RISK ASSESSM Risk: Concept and Elementer Risk: Concept and Element	ence To Tsunami; Post- Disaster Diseases and Epidemic EPAREDNESS AND MANAGEMENT omena Triggering a Disaster or Hazard; Evaluation of I And Other Agencies, Media Reports: Governmental and	Risk: Ap d Comm er Risk S ticipatio	oplication unity Prep	of Renoaredne	6 mote ess. 6 ques essmen
Coastal I UNIT – Prepared Sensing, UNIT – Disaster Risk As Strategie	Hazards with Special Reference IV DISASTER PROPOSED TO PROPOSE A SPECIAL RESEARCH PROPOSED TO PROPOSE A SPECIAL RESEARCH PROPOSE	ence To Tsunami; Post- Disaster Diseases and Epidemic EPAREDNESS AND MANAGEMENT omena Triggering a Disaster or Hazard; Evaluation of Italian And Other Agencies, Media Reports: Governmental and ENT es, Disaster Risk Reduction, Global and National Disaster	Risk: Ap d Comm er Risk S ticipatio	oplication unity Prep ituation.	of Renoaredne	6 mote ess. 6 ques essmen
Coastal I UNIT - Prepared Sensing, UNIT - Disaster Risk As Strategie	Hazards with Special Reference IV DISASTER PROPOSED TO DISASTER PROPOSED	ence To Tsunami; Post- Disaster Diseases and Epidemic EPAREDNESS AND MANAGEMENT omena Triggering a Disaster or Hazard; Evaluation of I And Other Agencies, Media Reports: Governmental and ENT es, Disaster Risk Reduction, Global and National Disaster ation in Risk Assessment and Warning, People's Par	Risk: Ap d Comm er Risk S ticipatio	oplication unity Prep ituation. in Risk	of Renovaredne	6 mote ess. 6 ques essmer
Coastal I UNIT - Prepared Sensing, UNIT - Disaster Risk As Strategie	Hazards with Special Reference IV DISASTER PRODUCES RISK ASSESSM Risk: Concept and Element Ressment, Global Co-Oper Sport Survival COUTCOMES Ability to summarize basics Ability to explain a critical und humanitarian response.	ence To Tsunami; Post- Disaster Diseases and Epidemic EPAREDNESS AND MANAGEMENT omena Triggering a Disaster or Hazard; Evaluation of I And Other Agencies, Media Reports: Governmental and ENT is, Disaster Risk Reduction, Global and National Disaster ation in Risk Assessment and Warning, People's Particular of disaster and Warning, People's Particular of disaster and Warning of key concepts in disaster risk reduction	Risk: Ap d Comm er Risk S ticipatio	ituation. TOTAL: Blooms Rememb	of Renoarednee	6 mote ess. 6 ques essmen
Coastal I UNIT – Prepared Sensing, UNIT – Disaster Risk As Strategie	Hazards with Special Reference IV DISASTER PRODUCES RISK ASSESSM Risk: Concept and Element Ressment, Global Co-Oper Sport Survival COUTCOMES Ability to summarize basics Ability to explain a critical und humanitarian response.	ence To Tsunami; Post- Disaster Diseases and Epidemic EPAREDNESS AND MANAGEMENT omena Triggering a Disaster or Hazard; Evaluation of Dand Other Agencies, Media Reports: Governmental and ENT es, Disaster Risk Reduction, Global and National Disaster ation in Risk Assessment and Warning, People's Parent of Management of Management of Management (Management of Management of Manag	Risk: Ap d Comm er Risk S ticipatio	ituation. TOTAL: Blooms	of Renoarednee	6 mote ess. 6 ques osmen
Coastal I UNIT - Prepared Sensing, UNIT - Disaster Risk As Strategie	Hazards with Special Reference IV DISASTER PROPORTION Data from Meteorological VRISK ASSESSM Risk: Concept and Element Ressment, Global Co-Oper Special For Survival COUTCOMES Ability to summarize basics and humanitarian response. Ability to illustrate disaster practice from multiple personal proportion of the practice from multiple personal proportion of the practice from multiple personal practice from multip	ence To Tsunami; Post- Disaster Diseases and Epidemic EPAREDNESS AND MANAGEMENT omena Triggering a Disaster or Hazard; Evaluation of Dand Other Agencies, Media Reports: Governmental and ENT es, Disaster Risk Reduction, Global and National Disaster ation in Risk Assessment and Warning, People's Parent of Management of Management of Management (Management of Management of Manag	Risk: Ap d Comm er Risk S ticipatio	ituation. TOTAL: Blooms Rememb	of Renovaredne	6 mote ess. 6 ques cosmen



1	GoelS.L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt.Ltd., New Delhi, 2009.
2	NishithaRai,SinghAK,"DisasterManagementinIndia:Perspectives,issuesandstrategies "NewRoyalbookCompany,2007.
3	Sahni, Pardeep Et. Al., "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001
1	https://nptel.ac.in/courses/105104183
1 2	

CO-PO MAPPING

					the second second second second	
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	Marcal P. Louis	a same [1]
CO2	2	2		2	2	1
СОЗ	and an instance of	2	Lander 1 Throng	3	3	
CO4	2	2	1	2	2	miles i had
CO5	2	2	1	2	2	1



EPSIA

PPCC2AC01		CONSTITUTION OF INDIA	L ,	T	P	C		
		S. (Versoner) - 1 don limetro Dissipor ne gris de la Sessiogni n	2	0	0	0		
COURS	SE OBJEC	TIVES:	error A roma	ier, meir,	2.80			
1 T	Understand	the premises in forming the twin theme so liberty and freedom from a continuous continuo	civil right	s pers	spective.			
2 7	To address	the growth of Indian opinion regarding modern Indian intellectuals' cons	titutional					
	Role and entitlement to civil and economic rights as well as the emergence nationhood in the early year s of Ind nationalism.							
t	the initial d	To address the role of socialism in India after the commencement of the BolshevikRevolutionin1917 and its impact the initial drafting of the Indian Constitution.						
5 I	Understand	the premises informing the twin the mesofliberty and freedom from a civil right the premises of the premise o	perspecti	ve.	ESTABLE			
UN	II – I	HISTORY OF MAKING OF THE INDIAN CONSTITUTION				5		
Histor	y, Drafting	Committee, (Composition & Working)	101		etra			
- 20	IT – II	PHILOSOPHY OF THE INDIAN CONSTITUTION			i i	5		
Pream	ıble, Salient	t Features						
UNI	II – III	CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	8		- 512-1	5		
Funda	mental Rig	l hts, Right to Equality, Right to Freedom, Right against Exploitation, Rig	ht to Free	dom of	Religion	Cultura		
		Rights, Right to Constitutional Remedies, Directive Principles of StatePo						
UNI	IT – IV	ORGANS OF GOVERNANCE				5		
Parlia		position, Qualifications and Disqualifications, Powers and Functions,		e, Presid	lent, Gov	5		
Parlia: Counc	ment, Com			e, Presid	lent, Gov	5		
Parlian Counce UN District Representations	ment, Com cil of Minist IT – V ct's Admin esentative, (CEO Zila Role of Ele	position, Qualifications and Disqualifications, Powers and Functions, Iters, Judiciary, Appointment and Transfer of Judges, Qualifications, Power LOCAL ADMINISTRATION Inistration head: Role and Importance, Municipalities: Introduction CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat: Position and role. Block level: Organizational Hierarchy ceted and Appointed officials, Importance of grass root democracy.	on, Mayo	e, Presidenctions.	role of	5 Electe and the Village		
Parlian Counc UN District Repre- roles, level:I	ment, Com cil of Minist IIT – V ct's Admir esentative, (CEO Zila Role of Ele	position, Qualifications and Disqualifications, Powers and Functions, Iters, Judiciary, Appointment and Transfer of Judges, Qualifications, Power LOCAL ADMINISTRATION mistration head: Role and Importance, Municipalities: Introduction CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pathayat: Position and role. Block level: Organizational Hierarchy cted and Appointed officials, Importance of grass root democracy. ELECTION COMMISSION	on, Mayo chayat. E	e, Presidenctions. or and Elected cent depart	role of officials artments),	5 Vernor, 5 Electer and the Village 5		
Parliar Counc UN District Repre- roles, level:I UNI	ment, Com cil of Minist IT – V ct's Admin esentative, (CEO Zila Role of Ele IT – VI on Commiss	position, Qualifications and Disqualifications, Powers and Functions, Iters, Judiciary, Appointment and Transfer of Judges, Qualifications, Power LOCAL ADMINISTRATION Inistration head: Role and Importance, Municipalities: Introduction CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat: Position and role. Block level: Organizational Hierarchy ceted and Appointed officials, Importance of grass root democracy.	on, Mayo chayat. E	e, Presidenctions. or and Elected cent depart	role of officials artments),	5 vernor, 5 Electer and the Village 5		
Parliar Counc UN District Repre- roles, level:I UNI	ment, Com cil of Minist IT – V ct's Admin esentative, (CEO Zila Role of Ele IT – VI on Commiss	position, Qualifications and Disqualifications, Powers and Functions, Iters, Judiciary, Appointment and Transfer of Judges, Qualifications, Power LOCAL ADMINISTRATION Inistration head: Role and Importance, Municipalities: Introduction CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pathayat: Position and role. Block level: Organizational Hierarchy cted and Appointed officials, Importance of grass root democracy. ELECTION COMMISSION ion: Role and Functioning. Chief Election Commissioner and Election Commission	on, Mayo chayat. E	e, Presidenctions. or and Elected cent departments -In	role of officials artments),	5 Electer and the Village 5 d Bodie		
Parlian Counc UN District Repres roles, level:I UNI Election for the	ment, Com cil of Minist IT – V ct's Admin esentative, (CEO Zila Role of Ele IT – VI on Commiss	position, Qualifications and Disqualifications, Powers and Functions, Iters, Judiciary, Appointment and Transfer of Judges, Qualifications, Power LOCAL ADMINISTRATION Inistration head: Role and Importance, Municipalities: Introduction CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pathayat: Position and role. Block level: Organizational Hierarchy ceted and Appointed officials, Importance of grass root democracy. ELECTION COMMISSION ion: Role and Functioning. Chief Election Commissioner and Election Centres Commissioner and Election Centres Commissioner and Election Centres Commissioner and Election Centres Commissioner and Election Centres Commissioner and Election Centres Cen	on, Mayo chayat. E	e, Presidenctions. or and Elected of the department of the depart	role of officials artments),	5 Vernor, 5 Electer and the Village 5 d Bodie		
Parliar Counce UN District Representation roles, level:I UNI Election for the	ment, Comcil of Ministrative (CEO Zila Role of Electron Commiss welfare of State (CEO Zila and Commiss commiss welfare of State (CEO Zila and Commiss commiss welfare of State (CEO Zila and COmmiss commiss welfare of State (CEO Zila and CEO	position, Qualifications and Disqualifications, Powers and Functions, Iters, Judiciary, Appointment and Transfer of Judges, Qualifications, Power LOCAL ADMINISTRATION Inistration head: Role and Importance, Municipalities: Introduction CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pathayat: Position and role. Block level: Organizational Hierarchy ceted and Appointed officials, Importance of grass root democracy. ELECTION COMMISSION ion: Role and Functioning. Chief Election Commissioner and Election Centres Commissioner and Election Centres Commissioner and Election Centres Commissioner and Election Centres Commissioner and Election Centres Commissioner and Election Centres Cen	on, Mayo chayat. E	e, Presidenctions. or and Elected of the department de	role of officials authents), stitute an	5 Electer and the Village 5 Id Bodie ERIOD		
Parlian Counce UN District Representation of the COUR COUR COUR CO1	ment, Comcil of Minist IIT – V ct's Administrative, CEO Zila Role of Electory In Commiss welfare of Security Discuss the of Indians Discuss the	position, Qualifications and Disqualifications, Powers and Functions, Iters, Judiciary, Appointment and Transfer of Judges, Qualifications, Power LOCAL ADMINISTRATION Inistration head: Role and Importance, Municipalities: Introduction, PRI: Zila Patha Pachayat: Position and role. Block level: Organizational Hierarchy ceted and Appointed officials, Importance of grass root democracy. ELECTION COMMISSION ion: Role and Functioning. Chief Election Commissioner and Election Commiss	on, Mayo chayat. E	or and Elected of the	role of officials autments), stitute an	5 Electer and the Village 5 d Bodie		
Parlian Counce UN District Representation of the COUR COUR CO1 CO2 CO3	ment, Com cil of Minist IIT – V ct's Admin esentative, (CEO Zila Role of Ele IT – VI on Commiss welfare of S ESE OUTC Discuss the of Indians Discuss the formed the in India. Discuss the Congress Nehru and	position, Qualifications and Disqualifications, Powers and Functions, Iters, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers, Introduction, Powers, Introduction, Powers, Introduction, Powers, Introduction, Powers, Introduction, Powers, Position, Powers,	on, Mayo chayat. E	e, Presidenctions. or and Elected of the department of the depart	role of officials authority and stitute and L: 30 Pl	5 Electer and the Village 5 d Bodie ERIOD		



REF	ERENCE	BOOKS:						
1	TheConstitution of India,1950(BareAct),Government Publication.						160742.3098	
2	Dr.S.N.Busi, Dr.B.R.Ambedkar framing of IndianConstitution, 1st Edition, 2015.							
3	M.P.Jain,Indian Constitution Law,7thEdn.,LexisNexis,2014.						odo azanoo	
4	D.D.Basu,Introduction to the Constitution of India,LexisNexis, 2015.							
WEE	BSITE RE	FERENCE / N	PTEL/ SWAYA	M/ MOOC REFI	ERENCE:	if to divide our set	mble of	
1	https://archive.nptel.ac.in/courses/129/106/129106003/							
2	https://onlinecourses.nptel.ac.in/noc20_lw03/preview							
3	https://archive.nptel.ac.in/courses/129/106/129106002/					and off		
CO-	PO MAPP	ING		3 87/3 d85L865	on Stocked do	Unovania i	1- 160E	
	COs	PO1	PO2	PO3	PO4	PO5	PO6	
	CO1	1	- 1	BENERAL PIE	OCT SHE TO KE	ERRADORY		
						251USBy Lines	de standadi	
(CO2	2	2	Rais Lyon	2	2	in - meul	

CO₃

CO₄

CO5



etromelium



PPCC2AC02	நற்றமிழ் இலக்கியம்	L	T	P	C
		2	0	0	0
COURSE OB	JECTIVES:	255 U.S.	MACT COLOR	Li .	
JNIT – I	சங் க இலக்கியம்	0.4		e [†]	6
1. தமிழ	ின் Fவக்க நூல் ததொல்கொப்பியம் –எழுத்F, த□ொல், தபொருள்	-4-			
2. அகத	த ொனூறு)82) - இயற்கக இன்னிகB அரங்கம்				
3. குறிஞ	ந்சிப் பொட்டின் மலரக் ொட்சி				
4. புற ெ	ானூறு) 95,195) - பபொகர ிறுத்திய ஒளகவயொர்				
JNIT – II	அறநநறித்தமிழ்		Q(B)	or gra	6
1. அற	த றி வகுத்த திருவள்ளுவர்				
- આં	றம் வலியுறுத்தல், அன் புகடகம, ஓப்புரவறிதல் அறிதல், ஈகக	, புகு	ģ		
2. பிற	அறநூல்கள் -இலக்கிய மரு ்F				
ஏலொதி, சி	றுபஞ்Bமூலம், திரிகடுகம், ஆ□ொரக்பகொகவ (தூய் கமகய வலி	யுறுத்	Fம் ந	<u> </u> ரல்)	
					Γ.
	இரட்டடக் காப்பியங்கள் எணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத	Ti legal		Libra	6
1. கண் BமூகபB		பசாவ	ப செ	ாகத	6
1. கண் துமைக JNIT – IV	ாணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத எவ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டெ அ ருள் நநறித் தமிழ்		- EI-		6
1. கண் சூமகபக JNIT – IV 1. சிற	r ணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத எவ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டெ	F, பப	. கன்	மய	6
1. கண் சூகபைக JNIT – IV 1. சிற	r ணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத எவ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டெ அருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்த! பாரக் வ தகொடுத்தF, அதியமொன் அவ் கவக்கு த ல் லிக்கனி த	F, பப	. கன்	மய	6
1. கண் தமூகபக JNIT – IV 1. சிறு படெ புக	r ணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத எவ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டெ அருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்த! பாரக் வ தகொடுத்தF, அதியமொன் அவ் கவக்கு த ல் லிக்கனி த	F, பப	. கன்	மய	6
1. கண் தமூகபக JNIT – IV 1. சிறு படெ புகல	r ணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத கவ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டவெ அருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்தி பாரக் வ தகொடுத்தF, அதியமொன் அவ் கவக்கு தல் லிக்கனி தெ	F, பப	. கன்	மய	6
1. கண் Bமூகபக JNIT – IV 1. சிறு படெ புக 2. ற்ற 3. திரு	r ணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத வ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டவெ அ ருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்தி பாரக் வ தகொடுத்தF, அதியமொன் அவ் கவக்கு தல் லிக்கனி தென் மிகண - அன் கனக்குரிய புன் கன சிறப்பு	F, பப	. கன்	மய	6
1. கண் Bமூகபக JNIT – IV 1. சிறு படெ புக 2. ற்ற 3. திரு 4. தர்ம	r ணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத எவ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டவெ அ ருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்தி பாரக் வ தகொடுத்தF, அதியமொன் அவ் கவக்கு தல் லிக்கனி தென் மிகண - அன் கனக்குரிய புன் கன சிறப்பு ம ்திரம் (617, 618) இயமம் ியமம் விதிகள்	F, பப	. கன்	மய	6
1. கண் Bமூகபக JNIT – IV 1. சிறு படெ புக்க 2. ற்ற 3. திரு 4. தர்ம 5. புற	ாணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத எவ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டெ அ ருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்தி பாரக் வ தகொடுத்தF, அதியமொன் அவ் கவக்கு தல் லிக்கனி தென் றிகண - அன் கனக்குரிய புன் கன சிறப்பு ம ்திரம் (617, 618) இயமம் ியமம் விதிகள் பட்டொகலகய ிறுவிய வள்ளலொர்	F, பப	. கன்	மய	6
1. கண் Bமூகப B JNIT – IV 1. சிறு படெ புக்க 2. ற்ற 3. திரு 4. தர்ம 5. புற 6. அக	ாணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத வ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டெ அருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்து பாரக் வ தகொடுத்தF, அதியமொன் அவ் கவக்கு தல் லிக்கனி தென் றிகண - அன் கனக்குரிய புன் கன சிறப்பு ம ்திரம் (617, 618) இயமம் ியமம் விதிகள் வடைகலகய ிறுவிய வள்ளலொர் ொனூறு - சிறுவபன வள்ளலொனான்	F, பப	. கன்	மய	6
1. கண் Bழேகப B JNIT – IV 1. சிறு படெ புக்க 2. ற்ற 3. திரு 4. தர்ம 5. புற 6. அக	ாணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத வ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டெ அருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்த! பாரக் வ தகொடுத்தF, அதியமொன் அவ் கவக்கு தல் லிக்கனி தென் றிகண - அன் கனக்குரிய புன் கன சிறப்பு ம ்திரம் (617, 618) இயமம் ியமம் விதிகள் படிடாகலகய ிறுவிய வள்ளலொர் ொனூறு - சிறுவபன வள்ளலொனான்	F, பப	. கன்	மய	6
1. கண் BமூகபB DNIT – IV 1. சிறு படெ புக்க 2. ற்ற 3. திரு 4. தர்ம 5. புற 6. அக ற்ற கலித்	ாணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத வ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டெ அருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்தி பாரக் வ தகொடுத்தச, அதியமொன் அவ் கவக்கு தல் லிக்கனி தென் றிகண - அன் கனக்குரிய புன் கன சிறப்பு ம ்திரம் (617, 618) இயமம் ியமம் விதிகள் விரைகலகய ிறுவிய வள்ளலொர் ொனூறு - சிறுவபன வள்ளலொனான் ொனூறு (4) – வண்டு	F, பப	. கன்	மய	6
1. கண் Bமூகப B DNIT — IV 1. சிறு படெ புக்க 2. ற்ற 3. திரு 4. தர்ம 5. புற 6. அக ற்ற கலித்	ாணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத வ இலக்கியம் மணிபமககல - சிகறக்பகொட்டம் அறக்பகொட்டெ அருள் நநறித் தமிழ் பொணொற்றுப்பகட - பொரி முல் கலக்குத் பதர் குடுத்து பாரக் வ தகொடுத்தF, அதியமொன் அவ் கவக்கு தல் லிக்கனி தென் றிகண - அன் கனக்குரிய புன் கன சிறப்பு ம ்திரம் (617, 618) இயமம் ியமம் விதிகள் மெடைகலகய ிறுவிய வள்ளலொர் ொனூறு - சிறுவபன வள்ளலொனான் ொனூறு (4) – வண்டு	F, பப	. கன்	மய	6



- 1. உகர கடத்தமிழ்
 - தமிழின் முதல் புதினம்
 - தமிழின் முதல் சிறுககத
- கட்டுகர இலக்கியம்
- பயண இலக்கியம்
- ொடகம்
- 2. ொட்டு விடுதகல பபொரொட்டமும் தமிழ் இலக்கியமும்
- 3. கமுதொய விடுதகலயும் தமிழ் இலக்கியமும்
- 4. தபண் விடுதகலயும் விளிம் பு ிகலயனரின் பமம்பொட்டில் தமிழ் இலக்கியமும்
- 5. அறிவியல் தமிழ்
- 6. இகணயத்தில் தமிழ் சுற்றுசூழல் பமம்பொட்டில் தமிழ் இலக்கியமும்

TOTAL: 30 PERIODS

தமிழ் இலக்கிய நெளியீடுகள் / புத்தகங் கள்

1.4	
1	தமிழ் இகணய கல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org
2	தமிழ் விக்கிப்பீடியொ - (Tamil Wikipedia) - https://ta.wikipedia.org
3	தர்மபுர ஆதீன தவளியீடு
4	வொழ்வியல் களஞ்சியம் - தமிழ்ப் பல்ககலக்கழகம், தஞ்⊡ொவூர்
5	தமிழ்ககலக் களஞ்சியம் –தமிழ் வளர□் ்சித்Fகற (thamilvalarchithurai.com)
6	அறிவியல் களஞ்சியம் - தமிழ்ப் பல்ககலக்கழகம், தஞ் □ொவூர்



EPSA