## **TULSIRAMJI GAIKWAD-PATIL** College of Engineering & Technology Mohgaon, Wardha Road, Nagpur - 441 108

A+

#### DEPARTMENT OF AERONAUTICAL ENGINEERING

### Structure & Curriculum

#### From

#### Academic Year 2021-22

eronau fulsirar fulsirar	B		Cum		Cour					11	10	9	8	7	6	S	4	ω	2	1	Sr.		
nji Gaikwad- Df Engineerii Df Engineerii	andreas	PROC	ulative Sum	Credits	se Category					MCC	ESC	PCC	PCC	PCC	ESC	PCC	PCC	PCC	PCC	BSC	Course Category		
Patil Patil		RESSIVE T	03	1	HSMC (H Soc. Sc, M					BAU2303	<b>BAE2310</b>	BAE2309	BAE2308	BAE2307	<b>BAE2306</b>	BAE2305	BAE2304	BAE2303	BAE2302	BAE2301 /	Course Code		
		OTAL			um., gmt.)	CT	CT	L-		Enviro	Meteor	Solid N	Fluid N Lab	Aero-T	Meteor	Solid N	Aero-T	luid M	ntroduc	pplied		5	Sche
Dean Ac fulsiramji G College Of	3	CREDITS: 35	22	04	BSC (Basic Sc.)	2- Class Test	1- Class Test	Lecture	101	nmental Scier	ology and Mo	<b>Iechanics</b> La	fechanics and	hermodynam	ology and Me	lechanics	hermodynami	lechanics and	ction to Aeros	Mathematics	Course T		me of Instr
ademics aikwad-Pat Engineerin	79	;+23 = 58	18	04	ESC (Engg. Sc.)	ť2 *	1		al	nce	easurement L	0	1 Machinery	ics Lab	easurement		ics	Machinery	space	3-111	ïtle		uctions: Se
9					PC (Prog Core C	* ESE-	TA/C	T-Tut	17	2	ab -	-	,	T.	ω	w	ω	ω	ω	ω	L		cond
Col			15	15	C ramme ourses	End Se	A- Tea	orial	L	A 1	1		1	1	1	1	1		1.	1	T		Year I
siRan	0			-	(P	emeste	cher F		0	• •	2	2	2	2		1		1	ı	1	Р		3. Tec
rinci Galikwa of Engline	Q	1	1	- 1	PEC rogramme Elective Courses)	er Examina	ssessment		64	7	2	2	2	2	ι u	ω	ω	3	ω	4	Hrs/Wk	Contant	h. in Aero
oal Ind Patil ering &				9	OEC Electiv fron disc	tion (For 1	c/Continuo	P-Practica	E.	11DNA	I I					ω	ω	ω	ω	4	Credits	Connea	onautical
Tuls			1	1	(Open e cours n other ipline)	aborat	us Ass		10	00 -				1	cI	15	15	15	15	15	1 1		Engin
p iramji Ga ineering					es	ory End	essment			00			1	,	CI	15	15	15	15	15	CT-2		eering S
ikwad Pat	and		-	:	rroject/ Seminar/ ndustrial Training	Semester				160	+25 10	77	25	C7	10	10	10	10	10	10	TA/CA	EXAI	emester
il Colle				_		periorii	n			460	+2C#	20	25	C7	00	60	60	60	60	60	ESE	M SCHI	111
ge Or				ICS	MCC (Mandatory Courses)	lance		5	-	008	#50	50	50	UC	50	100	IUU	100	100	100	TOTAL	EMIE	

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

SCHEME OF INSTRUCTION & SYLLABI

Collage Of Engineering Anas Technology, Nagpur.

-

College Of Engineering and Technology, Nagpur



----ł

Q	Tulsiramji Gaikwad-P T Wardha Ro NAAC Acc	atil College of Engineering and echnology oad, Nagpur-441 108 redited (A+ Grade)	G					
Second Year	· (Semester-III) B. Tech Aeron	autical Engineering	1					
	BAE2301: Appli	ed Mathematics III						
<b>Feaching Scher</b>	ne	Examination Scheme						
Jectures	3 Hrs/week	CT-1 15 Ma	irks					
<b>Futorial</b>	1 Hrs/week	CT-2 15 Ma	rks					
<b>Fotal Credit</b>	4	<b>TA</b> 10 Ma	rks					
		ESE 60 Ma	rks					
		Total 100 M	larks					
		Duration of ESE: 02 Hrs	s 30 Min.					
Course Outcon	nes (CO)							
students will b	e able to							
1	Apply the concept of Laplace Transf	form for Solving differential equation	motions					
2	Analyze numerical techniques to fin	nalyze numerical techniques to find the roots of equations different types of equations.						
3	and solve integral equations.	les and Transform for understanding periodi	C SIGNAIS					
4	Solve Partial Differential Equation u	sing appropriate method						
5	Understand Complex Variable and	its application.						
•	Course Conte	nts	Hours					
Unit I	Laplace Transforms: Laplace trans Transform & its properties, Con- Application for Laplace Transform including simultaneous Differential	sforms and its properties, Inverse Laplace volution Theorem, Unit Step Function, to solve ordinary differential equations Equations	(9)					
Unit II	NUMERICAL METHODS: Error approximation, Rounding of errors, Equation: Bisection method, Fals method and their convergence, So equations: Gauss elimination meth method, Crout's method.	including simultaneous Differential Equations NUMERICAL METHODS: Error in numerical calculations, Errors in series approximation, Rounding of errors, Solution of Algebraic and Transcendental Equation: Bisection method, False position method, Newton –Raphson method and their convergence, Solution of system of simultaneous linear equations: Gauss elimination method, Gauss Jordon method. Gauss Seidel method. Crout's method.						
Unit III	Fourier Series and Fourier Tran Fourier Expansions, Even and Odd Expansions, Fourier transform, Fourier Transform, Application of Fourier Transform, Fourier Transform, Application of Fourier Transform, Fourier	Fourier Series and Fourier Transform (FT): Periodic Functions and theirFourier Expansions, Even and Odd functions, change of interval, Half RangeExpansions, Fourier transform, Fourier Sine & Cosine transforms, DiscreteFourier Transform, Application of Fourier Transform to solve Integral equation						
Unit IV	Partial Differential equations: Partial Differential equations: Partial degree i. e. Lagrange's form. the Liconstant coefficient, method of separations solve Partial Differential Equations equation only).	rtial differential equation of first order first inear homogeneous PDE of nth order with aration of variables. Simple Applications to (Wave Equations & One-dimensional heat	(9)					

br. B. D. Deshponde

Unit V		Functions of a Complex Variable: Function of a complex variable, Analytic functions, Cauchy-Riemann conditions, Conjugate functions, singularities, Cauchy's integral theorem and integral formula, Taylor's and Laurent's theorem, Residue theorem (without proof), contour integration(8)					
Text Books							
1	1 Higher Engineering Mathematics by B.S. Grewal, 40th Edition, Khanna Publication						
	2 Advanced Engineering Mathematics by Erwin Kreysizig, 8th Edition, Wiley India						
	3	Applied Mathematics for Engineers & Physicist by L.R. Pipes and Harville.					
Reference Bo	ok	S					
	1	A Text Book of applied Mathematics, Volume II, by P.N. Wartikar & J.N. Wartikar, Poona Vidyarthi Griha Prakashan					
	2	Introductory methods of Numerical Analysis, by S.S. Sastry, PHI					
	3	Mathematics for Engineers by Chandrika Prasad John wiley & son					

br. B. D. Dechponde

#### Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108 NAAC Accredited (A+ Grade)



340	_		NAAC Acciedited (A+ G	lauej				
	Se	cond Year (S	emester-III) B.Tech. Aer	onautical l	Enginee	ring		
		BAE230	2:Introduction to Aerospa	ace Engine	ering			
Teaching	Schem	ie			Exam	ination Scheme		
Theory		3 Hrs/Week		1 11.0	CT-I	15 Marks		
Tutorial		0 Hrs/Week			CT-II	15 Marks		
<b>Total Cre</b>	dits	3			CA	10 Marks		
Duration	of ESI	E: 3 Hrs		a 14	ESE	60 Marks		
			<b>Course Contents</b>	27 19				
Unit I	Pre Wright-Brothers era, Wright Flyer, history and evaluation of aircraft. Conventional airplane, progress in airplane design and application, Current status. Other kinds of heavier than air vehicle, helicopter, VSTOL machines, space vehicles, reusable space vehicles and space shuttle, Developments in aerodynamics, materials, structures and propulsion over the years.							
Unit II	Aircraft Configurations and Aircraft Systems Components of an airplane and their functions, Different parts of airplane. Different types of flight vehicles, classifications. Conventional control, Powered control, Basic instruments for flying, Typical systems for control actuation. Aircraft Systems: Elementary studies on hydraulic, pneumatic, pressurizing air- conditioning and oxygen systems. Landing gear and control surface actuating system. Aircraft electrical systems, elementary studies of generation and on-board distribution of electricity							
Unit III	Intro	duction to Aer	odynamics					
	Aerot princt of dr distri ratio, swee	foil nomenclatu iple; Lift and dr ag, factors aff bution over aero velocity of sou o, tapered ratio,	ure; Flow over aerofoil; Lift ag components – generation of ecting lift and drag; variation ofoil; centre of pressure and its and, Mach number and superso wash out, wash in, dihedral, and	and general lift and drag of lift with significance onic flight ef hedral angle,	tion of l ; lift curve h angle o ; aerodyn fects, win simple pu	lift by Bernoulli's e, drag curve, types of attack, pressure amic centre, aspect ag span, wing area, roblems.		
Unit IV	Airp in ma impo Detai Diffe Adva	lane Structures aterials: wooder rtance of weight ls of the structur rent types of manual nce composite 1	: Configuration of fuselage and n to all metal airplanes, streng t load factors, factors of safety i ral layout of wing, fuselage tail aterials for airplane and engine materials.	d wings. Eva gth to weigh in aeronautic planes. Coc application.	luation of t ratio of s and aero kpit and c Materials	aircraft materials, space applications. cabin configuration. for space vehicles.		
Unit V	<ul> <li>it V Introduction to Aircraft Propulsion         Difference between air-breathing and non-air-breathing engines, classification of aircraft based on power plant, location and principle operation, basics of piston engine, classification of aircraft engines, Brayton cycle and its application to the gas turbine engines, performance characteristics of turbofan, turbojet, turbo prop, ramjet and scramjet engines, basics of propeller theory, classification and working of compressors, turbine and combustion chamber, types of fuel used in commercial aircraft engines, principle operation of rocket     </li> </ul>							
I ext Bool	15		Tuto duction to Elicht" Ma Crow	Hill 3rd editi	on 1995			
1	John D	). Anderson, Jr., '	arma. Fundamentals of Flight, Vol	-I to Vol-IV, I	Himalayan	Books, 1st edition,		
2	2006.	iupta anu O I Sh						
3	John D. Anderson, Jr., "The Airplane - History of its Technology", AIAA Series, 1st edition, 2002.					1st edition, 2002.		

mpader e

-----

-

Reference	e Books
1	G. P. Sutton, O. Biblarz, "Rocket Propulsion Elements", John Wiley & Sons, 7th edition, 2001.
2	A. C. Kermode, "Flight without Formulae", Pearson Education, 5th edition, 2004.
3	S. K. Ojha, "Flight Performance of Aircraft", AIAA Series, 1st edition, 1995.
Useful L	inks
1	https://nptel.ac.in/courses/101/101/10101079/
2	https://nptel.ac.in/courses/101/105/101105059/
3	https://onlinecourses.nptel.ac.in/noc19_ae05/preview

	Course Outcomes	PO/PSO	CL	Class Sessions
BAE2302.1	<b>Understand</b> history of aviation and basic concepts of aerospace engineering and implement the knowledge acquired in design and development of aircrafts.	PO1, PO2, PO12, PSO1	2	9
BAE2302.2	<b>Understand</b> different components of aircraft, vehicle types and flight instrumentations and develop conceptual design of aircraft systems and subsystems.	PO1, PO2, PO12, PSO1	2	9
BAE2302.3	Apply the knowledge of aerodynamic forces and moments acting on airplane for understanding of different flight parameters.	PO1, PO2, PO3, PO12, PSO1	3	9
BAE2302.4	Apply the knowledge of aircraft structures and configurations in solving the problems on airplane layouts, load factor and factor of safety.	PO1, PO2, PO3, PO12, PSO1	3	9
BAE2302.5	<b>Investigate</b> the performance of the aircraft and rocket engines with the basic understanding of its working principles.	PO1, PO2, PO3, PO12, PSO1	4	9

Compord cars

Ë

	7		Techn	ology		
	3		Wardha Road, N	agpur-441 108		
			NAAC Accredit	ed (A+ Grade)		
2. 	Sec	cond Year (S	emester-III) B.Te	ech. Aeronautica	I Enginee	ring
		BAE	303:Fluid Mecha	nics and Machin	lery	
Teaching	Schem	e			Examina	tion Scheme
Theory	,	3 Hrs/Week		1.000	CT-I	15 Marks
Tutorial		0 Hrs/Week			CT-II	15 Marks
Total Cr	edit	3			CA	10 Marks
Duration	of ESE	: 3 Hrs			ESE	60 Marks
Pre-Regi	isites:	Engineering Ph	vsics			
TTC-Requ	11511051	Linginio or ing i i	Course Co	ontents		1 N.
TI 14 T	Intro	luction to Flui	d Machanics	p		
Unit I	Intro	fuction to Flui	Monton's low of w	consitu and its ann	lications P	ascal's law
	Proper	rties of fluids,	Newton's law of vi	iscosity and its app	Manamat	ascal 5 law, 1
	equati	on of fluid sta	tics, Fluid pressure a	ind its measurement	(Ivianomet	ers and Bourd
4	pressu	re gauge), Pres	sure variations in con	pressible and incom	pressible flu	uids.
Unit II	Kinen	natics and Dy	namics of Fluid Flow	V		
	Types	of flow. Stream	n line. Path line. Stre	ak line, Stream tube,	<b>Continuity</b>	equation, One
	Two	imensional flor	v Velocity and Accel	leration at a point. Po	otential lines	s. Flow net. St
	Iwou	Walasita no	tential Circulation V	ortex motion		
	Tunctio	on, velocity po	Elementario Circulation, V	mal mathad for flou	onalysis I	Fuler's equation
	Dynai	mics of Fluid	Flow: One dimensio	nal method for flow	allalysis, 1	amplications
	motion	n, Derivation of	Bernoulli's equation	for incompressible i	low and its	applications.
Unit III	Visco	us flow				
	Viscon	us flow on a	flat plate; Bounda	ry laver displacem	ent mome	entum and ent
	1 1 1 200	us now on a		ly lujoi, aispiacon.	ioni, mome	sintunin und en
	thickn	esses: Flow be	etween two plates, f	low in a pipe; Lam	ninar flow	vs. turbulent
	thickn	esses; Flow be	etween two plates, f	low in a pipe; Lam	inar flow volds numbe	vs. turbulent er: turbulence
	thickn Dimer	esses; Flow be nsional analysi	etween two plates, f s and Buckingham	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa	ninar flow yolds number	vs. turbulent er; turbulence
	thickn Dimer turbul	esses; Flow be nsional analysi ent flows; Fric	etween two plates, f s and Buckingham tional losses, losses	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa	ninar flow olds number ast cylinder	vs. turbulence er; turbulence , critical Reyn
	thickn Dimer turbul numbe	esses; Flow be nsional analysi ent flows; Fric ers; Incompress	etween two plates, f s and Buckingham tional losses, losses ible viscous flow past	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty	ninar flow olds number ast cylinder of drag	vs. turbulence er; turbulence , critical Reyn s.
Unit IV	thickn Dimer turbul numbe	esses; Flow be nsional analysi ent flows; Fric ers; Incompress pressible flow	etween two plates, f s and Buckingham tional losses, losses ible viscous flow pas	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty	binar flow olds number ast cylinder, opes of drag	vs. turbulent er; turbulence , critical Rey s.
Unit IV	thickn Dimer turbul numbe Comp Mach	esses; Flow be nsional analysi ent flows; Fric ers; Incompress pressible flow number and its	etween two plates, f s and Buckingham tional losses, losses ible viscous flow past importance in compr	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equat	inar flow olds number ast cylinder pes of drage	vs. turbulent er; turbulence , critical Rey s.
Unit IV	thickn Dimer turbul numbe Comp Mach flow in	esses; Flow be nsional analysi ent flows; Fric ers; Incompress pressible flow number and its n 1D, continuit	etween two plates, f s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and energy	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com	inar flow olds numbe ast cylinder pes of drag ion of motion	on for compression.
Unit IV	thickn Dimer turbul numbe Comp Mach flow in	esses; Flow be nsional analysi ent flows; Fric ers; Incompress pressible flow number and its n 1D, continuit	etween two plates, f s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener- ification of Hydraul	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for con <b>ic Machines:</b>	binar flow olds number of the st cylinder, opes of drags ion of motion opressible flor	on for compression.
Unit IV Unit V	thickn Dimer turbul numbe Comp Mach flow in <b>Princ</b>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener- ification of Hydraul	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equat ergy equation for con <b>ic Machines:</b> e. Constructional for	inar flow olds numbe ast cylinder, opes of drag ion of motion npressible flor catures. Inst	vs. turbulent f er; turbulence , critical Reyn s. on for compres low. tallation of Pe
Unit IV Unit V	thickn Dimen turbule numbe Comp Mach flow in Flow in Impul	esses; Flow be nsional analysi ent flows; Fricers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction	etween two plates, f s and Buckingham tional losses, losses ible viscous flow pass importance in compr y, momentum and ence ification of Hydraul n Turbines:- Principl	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for con <b>ic Machines:</b> e, Constructional fe	inar flow olds number olds cylinder, opes of drag ion of motion npressible flow eatures, Inst	vs. turbulent er; turbulence , critical Reyr s. on for compres low. tallation of Pe
Unit IV Unit V	thickn Dimer turbul numbe Comp Mach flow in Flow in Impul Kapla	esses; Flow be nsional analysi ent flows; Fric ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis	etween two plates, f s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener ification of Hydraul n Turbines:- Principl turbine, Velocity dia	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for con <b>ic Machines:</b> e, Constructional fe agram and analysis,	inar flow olds number ast cylinder pres of drag ion of motic npressible fl eatures, Inst Working p	vs. turbulent er; turbulence c, critical Reyr s. on for compres low. tallation of Pe proportions, D
Unit IV Unit V	thickm Dimer turbul numbe Comp Mach flow in <b>Princi</b> Impul Kaplar param	esses; Flow be nsional analysi ent flows; Fric ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener- ification of Hydraul n Turbines:- Principl turbine, Velocity dia ance characteristics,	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel	inar flow olds number of cylinder, pes of drags ion of motic npressible fl eatures, Inst Working p lection crite	on for compression of Period Compositions, Decision of the period of the
Unit IV Unit V	thickn Dimer turbul numbe Comp Mach flow in <b>Princ</b> Impul Kapla param turbin	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube c	etween two plates, f s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and energy iffication of Hydraul n Turbines:- Principl turbine, Velocity dia ance characteristics, lesign. Principles of	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree	inar flow olds number of cylinder, pes of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction,	on for compression of Period Comparison of Period Comparison of Comparis
Unit IV Unit V	<ul> <li>viscout</li> <li>thickn</li> <li>Dimer</li> <li>turbul</li> <li>number</li> <li>Comp</li> <li>Mach</li> <li>flow in</li> <li>Principarity</li> <li>Impulsion</li> <li>Kaplar</li> <li>parameter</li> <li>turbin</li> <li>pelton</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube conturbine, Deve	etween two plates, f s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener ification of Hydraul n Turbines:- Principl turbine, Velocity dia ance characteristics, lesign. Principles of lopment of reaction	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree of turbines, Classificati	inar flow olds number of cylinder pres of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft to	vs. turbulent er; turbulence c, critical Reyr s. on for compress low. tallation of Pe proportions, D eria. Cavitatio , Comparison ubes, Cavitatio
Unit IV Unit V	<ul> <li>viscout</li> <li>thickn</li> <li>Dimer</li> <li>turbuld</li> <li>number</li> <li>Comp</li> <li>Mach</li> <li>flow in</li> <li>Prince</li> <li>Impuls</li> <li>Kaplan</li> <li>param</li> <li>turbin</li> <li>pelton</li> <li>turbin</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompresses pressible flow number and its n 1D, continuit iples and Classe se and reaction n and Francis eters, Perform e, draft tube co turbine, Deve es. Francis turb	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow pass importance in compr y, momentum and ener ification of Hydraul n Turbines:- Principl turbine, Velocity dis ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T	inar flow blds number olds number st cylinder, pes of drag ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft to Types, Const	vs. turbulent er; turbulence , critical Reyn s. on for compress low. tallation of Pe proportions, Do eria. Cavitatio , Comparison ubes, Cavitatio structional feat
Unit IV Unit V	<ul> <li>viscout</li> <li>thickn</li> <li>Dimer</li> <li>turbuld</li> <li>number</li> <li>Comp</li> <li>Mach</li> <li>flow in</li> <li>Princi</li> <li>Impuls</li> <li>Kaplan</li> <li>param</li> <li>turbin</li> <li>pelton</li> <li>turbin</li> <li>Install</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and reaction n and Francis eters, Perform e, draft tube of turbine, Deve es. Francis turb ations, Velocit	etween two plates, f s and Buckingham tional losses, losses ible viscous flow pass importance in compr y, momentum and ener ification of Hydraul n Turbines:- Principle turbine, Velocity dis ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for con <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree of turbines, Classificati e, Kaplan turbine: T s.	inar flow binar flow olds number ast cylinder, pes of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft to Types, Cons	vs. turbulent er; turbulence , critical Reyr s. on for compress low. tallation of Pe proportions, D eria. Cavitation , Comparison ubes, Cavitation
Unit IV Unit V	<ul> <li>viscou</li> <li>thickn</li> <li>Dimer</li> <li>turbul</li> <li>numbe</li> <li>Comp</li> <li>Mach</li> <li>flow in</li> <li>Princi</li> <li>Impuls</li> <li>Kaplar</li> <li>param</li> <li>turbin</li> <li>pelton</li> <li>turbin</li> <li>Install</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube continuite turbine, Deve es. Francis turb ations, Velocity	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener- ification of Hydraul n Turbines:- Principle turbine, Velocity dia ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree of turbines, Classificati e, Kaplan turbine: T s.	inar flow binar flow olds number ast cylinder, pes of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft to Types, Cons	vs. turbulent er; turbulence c, critical Reyr s. on for compress low. tallation of Pe proportions, D eria. Cavitation , Comparison ubes, Cavitation structional feat
Unit IV Unit V Text Boo	<ul> <li>viscou</li> <li>thickn</li> <li>Dimer</li> <li>turbule</li> <li>numbe</li> <li>Comp</li> <li>Mach</li> <li>flow in</li> <li>Prince</li> <li>Impuls</li> <li>Kaplas</li> <li>param</li> <li>turbin</li> <li>pelton</li> <li>turbin</li> <li>Install</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube c turbine, Deve es. Francis turb ations, Velocity	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow pass importance in compr y, momentum and ener ification of Hydraul n Turbines:- Principl turbine, Velocity dis ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for con <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T s.	inar flow binar flow olds number ast cylinder, pes of drag ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft to Types, Cons	vs. turbulent er; turbulence , critical Reyn s. on for compress low. tallation of Pe proportions, D eria. Cavitatio , Comparison ubes, Cavitatio structional feat
Unit IV Unit V Text Boo 1	<ul> <li>viscout</li> <li>thickn</li> <li>Dimer</li> <li>turbuld</li> <li>number</li> <li>Comp</li> <li>Mach</li> <li>flow in</li> <li>Princi</li> <li>Impuls</li> <li>Kaplas</li> <li>param</li> <li>turbin</li> <li>pelton</li> <li>turbin</li> <li>Install</li> <li>bks</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube co turbine, Deve es. Francis turb ations, Velocit	etween two plates, f s and Buckingham tional losses, losses ible viscous flow pass importance in compr y, momentum and ener ification of Hydraul n Turbines:- Principle turbine, Velocity dis ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equat ergy equation for con <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T s.	inar flow binar flow olds number ast cylinder, pes of drag ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft to Types, Cons	vs. turbulent er; turbulence c, critical Reyn s. on for compres low. tallation of Pe proportions, De eria. Cavitation , Comparison ubes, Cavitation structional feat
Unit IV Unit V Text Boo 1	<ul> <li>viscou</li> <li>thickn</li> <li>Dimer</li> <li>turbul</li> <li>numbe</li> <li>Comp</li> <li>Mach</li> <li>flow in</li> <li>Princi</li> <li>Impuli</li> <li>Kaplar</li> <li>param</li> <li>turbin</li> <li>pelton</li> <li>turbin</li> <li>Install</li> <li>oks</li> <li>Fluid M</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube de turbine, Deve es. Francis turb ations, Velocit flechanics by Fran- lechanics and Flue	etween two plates, f s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener ification of Hydraul n Turbines:- Principle turbine, Velocity dia ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi nk M. White, Mcgraw-I nid Power Engineering	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T s. Hill, 7th Edition, 2011. by D. S. Kumar, S.K. I	inar flow binar flow olds number ast cylinder pres of drag ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft the Types, Const Kataria & So	vs. turbulent er; turbulence , critical Reyn s. on for compress low. tallation of Per proportions, De eria. Cavitation , Comparison ubes, Cavitation structional feat
Unit IV Unit V Text Boo 1 2	<ul> <li>viscou thickn</li> <li>Dimer turbule number</li> <li>Comp Mach flow in Prince</li> <li>Impuls Kaplar param turbin pelton turbin Install</li> <li>ks</li> <li>Fluid M 2015.</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube c turbine, Deve es. Francis turb ations, Velocit lechanics by Frant Iechanics and Flue	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener- ification of Hydraul n Turbines:- Principl turbine, Velocity dia ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi nk M. White, Mcgraw-I id Power Engineering	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T s. Hill, 7th Edition, 2011. by D. S. Kumar, S.K. I	inar flow binar flow olds number ast cylinder, pes of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction, Draft to Types, Cons Kataria & So	vs. turbulent er; turbulence c, critical Rey s. on for compres low. tallation of Pe proportions, D eria. Cavitatio , Comparison ubes, Cavitatio structional feat
Unit IV Unit V Text Boo 1 2 3	<ul> <li>viscou thickn</li> <li>Dimer turbuld</li> <li>number of turbuld</li> <li>number of turbuld</li> <li>Mach flow in</li> <li>Princi</li> <li>Impuls</li> <li>Kaplas</li> <li>param turbin</li> <li>pelton</li> <li>turbin</li> <li>Install</li> <li>bks</li> <li>Fluid M</li> <li>2015.</li> <li>Fluid M</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube c turbine, Deve es. Francis turb ations, Velocit lechanics by Francis lechanics for Eng	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener ification of Hydraul n Turbines:- Principle turbine, Velocity dia ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi nk M. White, Mcgraw-I nid Power Engineering	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T s. Hill, 7th Edition, 2011. by D. S. Kumar, S.K. I	inar flow binar flow olds number ast cylinder, pes of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft the Sypes, Const Kataria & So hers India, 1s	vs. turbulent er; turbulence c, critical Rey s. on for compress low. tallation of Po proportions, D eria. Cavitation , Comparison ubes, Cavitation structional feat
Unit IV Unit V Text Boo 1 2 3 Reference	<ul> <li>viscou thickn</li> <li>Dimer turbule number</li> <li>Comp Mach flow in Prince</li> <li>Impuls Kaplas param turbin pelton turbin Install</li> <li>ks</li> <li>Fluid M</li> <li>Fluid M</li> <li>2015.</li> <li>Fluid M</li> <li>ce Books</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube c turbine, Deve es. Francis turb ations, Velocity lechanics by Fran- lechanics for Eng	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener- ification of Hydraul n Turbines:- Principl turbine, Velocity dia ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi nk M. White, Mcgraw-I nid Power Engineering gineers by P.N. Chartter	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T s. Hill, 7th Edition, 2011. by D. S. Kumar, S.K. I jee, Macmillan Publis	inar flow binar flow olds number ast cylinder, pes of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft to Types, Cons Kataria & So	vs. turbulent er; turbulence c, critical Rey s. on for compression low. tallation of Po proportions, D eria. Cavitation , Comparison ubes, Cavitation structional fea
Unit IV Unit V Text Boo 1 2 3 Reference 1	<ul> <li>viscou thickn</li> <li>Dimer turbuld</li> <li>number Comp</li> <li>Mach flow in</li> <li>Princi Impula</li> <li>Kaplaa</li> <li>param</li> <li>turbin</li> <li>pelton</li> <li>turbin</li> <li>Install</li> <li>bks</li> <li>Fluid M</li> <li>2015.</li> <li>Fluid M</li> <li>2015.</li> <li>Fluid M</li> <li>2015.</li> <li>Fluid M</li> <li>2015.</li> <li>Fluid M</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube c turbine, Deve es. Francis turb ations, Velocit lechanics by Fran- lechanics for Eng a fechanics and hy	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and ener ification of Hydraul n Turbines:- Principle turbine, Velocity dia ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi nk M. White, Mcgraw-I nid Power Engineering gineers by P.N. Chartter	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equat ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T s. Hill, 7th Edition, 2011. by D. S. Kumar, S.K. I jee, Macmillan Publis K. Bansal, Laxmi Pub	inar flow binar flow olds number ast cylinder, pes of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft tu Types, Cons Kataria & So hers India, 1s	vs. turbulent er; turbulence c, critical Rey s. on for compress low. tallation of Po proportions, D eria. Cavitation, comparison ubes, Cavitation structional feat
Unit IV Unit V Text Boo 1 2 3 Reference 1 2	<ul> <li>viscou thickn</li> <li>Dimer turbule number</li> <li>Comp Mach flow in Prince</li> <li>Impuls Kaplas param turbin pelton turbin Install</li> <li>ks</li> <li>Fluid M</li> <li>Fluid M</li> <li>ce Books</li> <li>Fluid M</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube c turbine, Deve es. Francis turb ations, Velocity lechanics by Fran- lechanics for Eng fechanics and hy nics of Fluids by	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow past importance in compr y, momentum and energification of Hydraul n Turbines:- Principle turbine, Velocity dia ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi nk M. White, Mcgraw-I nid Power Engineering gineers by P.N. Chartter draulic Machines by R. B. S. Massey, PHI, 7th	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T s. Hill, 7th Edition, 2011. by D. S. Kumar, S.K. I jee, Macmillan Publisl K. Bansal, Laxmi Pub Edition, 2015.	inar flow binar flow olds number ast cylinder, pes of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft to Types, Cons kataria & So hers India, 1s	vs. turbulent er; turbulence c, critical Rey: s. on for compress low. tallation of Per proportions, D eria. Cavitation, comparison ubes, Cavitation structional feat
Unit IV Unit V Text Boo 1 2 3 Reference 1 2 3	<ul> <li>viscou thickn</li> <li>Dimer turbule</li> <li>numbe</li> <li>Comp</li> <li>Mach</li> <li>flow in</li> <li>Princi</li> <li>Impuli</li> <li>Kaplai</li> <li>param</li> <li>turbin</li> <li>pelton</li> <li>turbin</li> <li>Install</li> <li>oks</li> <li>Fluid M</li> <li>2015.</li> <li>Fluid M</li> <li>2015.</li> <li>Fluid M</li> <li>ce Books</li> <li>Fluid M</li> <li>Mechar</li> <li>Fluid M</li> </ul>	esses; Flow be nsional analysi ent flows; Frice ers; Incompress pressible flow number and its n 1D, continuit iples and Class se and reaction n and Francis eters, Perform e, draft tube of turbine, Deve es. Francis turl ations, Velocit flechanics by Fran lechanics for Eng flechanics for Eng flechanics and hy nics of Fluids by flechanics by A. I	etween two plates, f. s and Buckingham tional losses, losses ible viscous flow pass importance in compr y, momentum and energy ification of Hydraul n Turbines:- Principle turbine, Velocity dis ance characteristics, lesign. Principles of lopment of reaction bine, Propeller turbin y diagram and analysi nk M. White, Mcgraw-I nid Power Engineering gineers by P.N. Chartter draulic Machines by R. B. S. Massey, PHI, 7th X. Jain, Khanna Publish	low in a pipe; Lam pi theorem, Reyno in a pipe; Flow pa t an airfoil, wakes, ty essible flows; Equati ergy equation for com <b>ic Machines:</b> e, Constructional fe agram and analysis, Governing and sel operation, Degree turbines, Classificati e, Kaplan turbine: T s. Hill, 7th Edition, 2011. by D. S. Kumar, S.K. I jee, Macmillan Publist K. Bansal, Laxmi Pub- Edition, 2015. mers, 12th Edition, 2004	inar flow binar flow olds number ast cylinder, pres of drags ion of motion npressible flow eatures, Inst Working p lection crite of reaction, ion, Draft to Types, Cons Kataria & So hers India, 1s plications, 9th	vs. turbulent i er; turbulence , critical Reyn s. on for compres low. tallation of Pe proportions, Do eria. Cavitation, Comparison ubes, Cavitation structional feat

myordcone

1	https://nptel.ac.in/courses/112/104/112104117/	· · · · · · · · · · · · · · · · · · ·	المريد المر		
2	https://nptel.ac.in/courses/112/105/112105206/			2. 123	1
3	https://nptel.ac.in/courses/112/105/112105182/				

	Course Outcomes	PO/PSO	CL	Class Sessions	Lab Sessions
BAE2303.1	<b>Comprehend</b> the basic principles of fluid mechanics and apply the knowledge in solving problems on fluid measurements.	PO1, PO2, PO3, PO12, PSO1	3	9	2
BAE2303.2	<b>Analyze</b> types and properties of the fluid flow and solve the problems on potential function, stream function and Bernoulli's principle.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2303.3	<b>Investigate</b> the viscous flow and solve the problems on boundary layer theory, laminar and turbulent and flow through pipes.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2303.4	<b>Solve</b> problems on the compressibility effect and governing equations of fluid flow.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2303.5	<b>Estimate</b> the performance of different fluid machineries, study their application and classification.	PO1, PO2, PO3, PO4, PO12, PSO3	4	9	2

: Conford care

Ë

#### Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441 108 NAAC Accredited (A+ Grade) Second Year (Semester-III) B.Tech. Aeronautical Engineering **BAE2304:** Aero- Thermodynamics **Teaching Scheme Examination Scheme** Theory 3 Hrs/Week CT-I **15 Marks Tutorial** 0 Hr/Week **CT-II 15 Marks**

<b>Total Cr</b>	edits 3				CA	10 Marks				
Duration	of ESE: 3 I	Irs			ESE	60 Marks				
			Course Co	ontents						
Unit I	Fundame	ntal Conc	epts and Definition	1	4 A	2				
	Basic conc	epts: Syste	m boundary, surroundined heat transfers equil	ngs, state, extensive and i	intensive prop	erties, energy				
	equilibrium	and irrev	ersible processes. Thern	nodynamic state, state poi	nt, state diagr	am, path and				
	process, q	uasi-static	process, cyclic and	non-cyclic processes; Th	ermodynamic	equilibrium;				
	definition,	mechanica	l equilibrium; diatherm	ic wall, thermal equilibri	um, chemical	equilibrium.				
Unit II	First Law	Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.								
Chit II	Closed Syst	ems (Cont	ol mass system), Work o	lone, change in internal ene	rgy, Heat trans	sferred during				
	various the	ermodynan	ic processes, P-V dia	ngrams. Open systems (	Control volu	ne systems),				
	Thermodyn enthalpy.	amic analy	vsis of control volumes	, Conservation of energy	principle, Flo	w work and				
Unit III	Second La	w of The	rmodynamics							
	Introduction	(Law of	legradation of energy),	Thermal energy reservoirs,	Kelvin-Plank	and Clausius				
	Irreversible	statements, Heat engines, Retrigerator and Heat pump, Perpetual motion machines, Reversible and reversible processes. Carnot cycle. Thermodynamic temperature scale. Entropy: The Clausius								
	inequality,	Entropy, P	inciple of increase of er	tropy, Change in entropy	for Closed and	I Steady flow				
	open syste	ms. Secon	d law analysis of er	ngineering systems: Avai	lability, Reve	rsible work,				
Unit IV	Properties	of stean	ature-entropy diagram.	e heat I atent heat Super	heat Wet st	am Dryness				
Unitiv	fraction, Int	ternal ener	gy of steam, External v	vork done during evapora	tion, T-S diag	gram, Mollier				
	chart, Work	and Heat	transfer, Simple and M	Iodified Rankine cycle wi	th reheat and	regeneration,				
	Conditions	for exac	t differentials. Maxwe	Il relations, Clapeyron	equation, Jou	le-Thompson				
	compressibi	lity.	sion curve. Coefficient	of volume expansion,	Autabatic all	u isotnerinai				
Unit V	Air Stand	ard and	Gas power cycles: Cl	osed and open systems, po	olytrophic pro	cesses, cyclic				
	processes, C	arnot cycl	e, Otto cycle, Diesel cycl	e, Stirling and Ericsson cyc	ele, Brayton cy	cle, ideal and				
	real cycles,	design poir	it analysis. des and Diffusers ii) Turl	hine and Compressors iii) T	hrottle Valves					
	Basics of A	ero Engine	s operations, cycles invol	ved types of engines, applie	cation in aeros	pace.				
Text Boo	ks									
1	Thermodynam 9th Edition, 2	mics: An e 2019.	ngineering approach by Y	unus Cengal, M. A. Boles,	, McGraw Hill	Education,				
2	Thermodynam	nics by C.	P. Arora, Tata Mc-Graw	Hill Publication, 1st Editio	n,2004.					
3	Fundamental Wiley & Son	s of classic s, 4th Editi	al Thermodynamics by C on, 2014.	B. J. V. Wylen, R. E. Sonnta	ag, C. Borgnak	ke, John				
Reference	e Books									
1	Engineering '	Thermodyr	amics by P. K. Nag, Tata	a Mc-Graw Hill Publication	,6th Edition,2	017.				
2	Fundamental	s of engine	ering Thermodynamics b	y R. K. Rajput, Laxmi Pub	lications, 4th H	Edition 2016.				
Useful Li	nks									

https://nptel.ac.in/courses/112/105/112105123/ 1

ampandere

3 https://nptel.ac.in/courses/112/104/112104113/

	Course Outcomes	PO/PSO	CL	Class Sessions	Lab Sessions
BAE2304.1	Apply the basic concepts of thermodynamics in solving related problems.	PO1, PO2, PO3, PO12, PSO1	3	9	2
BAE2304.2	<b>Evaluate</b> heat transfer problems by appreciating the first law of thermodynamics and its application.	PO1, PO2, PO3, PO4,PO12, PSO1	4	9	2
BAE2304.3	Solve problems on Carnot cycle, Clausius inequality, availability and irreversibility by interpreting the application of second law of thermodynamics to heat engines, heat pumps and refrigerators.	PO1, PO2, PO3, PO4,PO12, PSO1	4	9	2
BAE2304.4	Work out problems on change of entropy through understanding of the concepts of available energy.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2304.5	<b>Solve</b> problems on operation of engines by comprehending the basics of different air standard, gas power and refrigeration cycles and concerned engines.	PO1, PO2, PO3, PO4, PO12, PSO1	3	9	2

Ë

mondane

	T	ulsiramji Ga	<b>ikwad-Patil Col</b> Wardha Roa	<b>lege of Engineering ar</b> d, Nagpur-441 108	nd Techn	ology	
2			NAAC Accre	dited (A+ Grade)		0	9
	Se	cond Year (S	emester-III) B.	Tech. Aeronautical H	Engineer	ing	
			BAE2305:So	lid Mechanics			
<b>Teaching So</b>	ehem	e			Examir	nation S	cheme
Theory	5	3 Hrs/Week		1 6 6	CT-I	15 Ma	rks
Tutorial		0 Hr/Week			CT-II	15 Ma	rks
Total Credi	ts	3			CA	10 Ma	rks
<b>Duration</b> of	ESE	: 3 Hrs			ESE	60 Ma	rks
			Course	Contents		1	
	and Pla rela rela met pro	I their relationship ne strain conditi ations, compatibi ations, generalize thods of analysis blems in 2-D (reciple.	bs, Thermal Stresses ions, Mohr's circle lity conditions, nat d Hooke's Law - Is s. Concepts of line ectangular and pole	, Analysis of the state of stress, of stress, equilibrium e cural and kinematic bour sotropy, Orthotropy, Anisot ear and nonlinear problem ar co-ordinates), stress fur	ress at a poi equations, s indary cond tropy. Disp s. Linear o inction appr	int, Plane strain dis itions, st lacement elasticity oach, St.	stress and splacement ress-strain and force solutions, Venant's
	bea ford load diag stre ben mod	m, simply suppor ce and bending n ds, Sign. Conven grams for beams sses in beams:- I ding stress, deriv dulus for various	ted beam, overhung noment diagrams for tions for bending m subjected to couple, Pure bending, theory vation of bending ec shapes of beam secti	beam etc) Types of loads (( r different types of beams s oment and shear force, she Relation between load, she of simple bending with as juation, bending stresses in ons.	Concentrate subjected to ear force an ear force an sumptions a symmetric	ed and UI o differen d bendin ad bendin and expre al section	DL), Shear at types of g moment g moment essions for ns, section
Unit III	Def in con met Cor con	<b>flection of beams</b> it. Deflection and centrated load, U hod, area mome neept, derivation nmon symmetrica	: Derivation of different and slope of cantile IDL, Relation between the method to detern of shear stress dis l sections, maximum	rential equation of elastic cu ever, simply supported, or een slope, deflection and ra mining deflection of beam stribution formula, shear st and average shear stress.	rve with the verhung be dius of cur s. <b>Shear s</b> rress distrib	e assumpt eams sub vature. N tresses i pution dia	ions made bjected to facaulay's <b>n beams:</b> agram for
Unit IV	Stra subj unia inde met Col Buc with met	ain energy and jected to graduall axial tension an eterminate beams hod. umns kling of columns n eccentric loadin hod. Beam Colum	<b>impact loading:</b> I y applied load, sudd d compression, be and frames, Clapeyr with various end co g, South well plot, sl m.	Definition of strain energy lenly applied loads and imp ending and torsion. Castin ron's three moment equation onditions, column curves, C nort column formulae like R	stored in a act loads. S ngliano's t method, M Columns wit ankine's Jol	a body v Strain ene heorem. Ioment d th initial hnsons, et	when it is orgy under Statically istribution curvature, tc. Energy
Unit V	Prin met one dire Der men	ncipal Stresses a hod of determining plane in mutual ct stresses in two ivation of maxim nber is subjected	and Strains: Defining stresses on oblique by perpendicular two mutually perpendicular uum and minimum to different types of	tion of principal planes and ue section when member is o planes, when member is cular planes, Mohr's circle principle stresses and maxin stresses simultaneously (i.e.	d principal subjected t subjected t for represe mum shear combined s	stresses, o direct s to shear s ntation o stresses stress).	analytical stresses in stress and f stresses. when the
Text Books	Ctar	oth of Matarial L	C Domomuthow	nd P. Narovanan Dhannat I	Rai Dublich	ing Com	any Dut
1	Stren	16th Edition, 201	y 5. Kamamurtham a 1.	inu K. Narayanan, Dhanpat I	Nai ruolishi	ing Comp	ally FVI.

- 2 Strength of Material by R. K. Rajput, S. Chand Publishing, 7th Edition, 2018.
  - 3 Strength of Material by A. Singer and F. L. Singer, Longman, 4th Edition, 1990.

mandane

- The second

<b>Reference</b> B	ooks				
1	Strength of materials by S. Timoshenko, CBS, 3rd Edition, 2002.				
2	A Textbook of Strength of Materials by R.K. Bansal, Laxmi Publications, 4th Edition, 2018.				
3	Strength of Materials by S. S. Bhavikatti, Vikas Publishing House, 4th Edition, 2013.				
Useful Link	S				
1	https://nptel.ac.in/courses/112/102/112102284/				
2	https://onlinecourses.nptel.ac.in/noc20_me84/preview				
3	https://nptel.ac.in/courses/105/106/105106049/				

	Course Outcomes	PO/PSO	CL	Class Sessions	Lab Sessions
BAE2305.1	<b>Evaluate</b> St. Venant's principle by assessing the basic concepts related to stress and strains.	PO1, PO2, PO3, PO4, PO12, PSO1, PSO2	4	9	2
BAE2305.2	<b>Calculate</b> the shear force, bending moment, stresses in a beam under given load conditions.	PO1, PO2, PO3, PO4, PO12, PSO1, PSO2	3	9	2
BAE2305.3	<b>Analyze</b> deflection of beams by Macaulay's and area moment methods and evaluate stresses in beams.	PO1, PO2, PO3, PO4, PO12, PSO2, PSO3	4	9	2
BAE2305.4	<b>Investigate</b> the buckling of column at different end conditions using Rankine's, Johnsons and Energy method.	PO1, PO2, PO3, PO4, PO12, PSO3	4	9	2
BAE2305.5	<b>Investigate</b> the principle stresses and strains and its effect on different structures.	PO1, PO2, PO3, PO4, PO12, PSO1, PSO3	4	9	2

Ë

mondare

Jeles	
1 .1	
1 1	



		TELETER X A A A A A A A A A A A A A A A A A A			
	Second Year (	Semester-III) B.Tech. Aeronaut	tical E	ngineer	ing
	BAI	2306:Meteorology and Measur	rement	t	
Teaching	Scheme		]	Examinat	tion Scheme
Theory	<sup>*</sup> 3 Hrs/Week	1	0	CT-I	15 Marks
Tutorial	0 Hr/Week		(	CT-II	15 Marks
Total Cre	dits 3			CA	10 Marks
Duration	of ESE: 3 Hrs		1	ESE	60 Marks
		<b>Course Contents</b>	4		
Unit I	<b>Basics of Meteoro</b> Introduction to Environment, their Types, Control, Ty	logy: Metrology, Need, Elements, Work effect on Precision and Accuracy, pes of standards.	c piece Errors,	e, Instru Errors ir	ments, Persons, 1 Measurements,
Unit II	Linear and Angul Linear Measuring design, terminolog Angular measuring levels sine bar, Ang	Instruments, Evolution, Types, Clas y, procedure, concepts of interchange instruments, Types, Bevel protractor gle alignment telescope, Autocollimator	ssificati e ability r clinon r, Appli	on, Limit y and sel- neters ang cations.	t gauges, gauge ective assembly, gle gauges, spirit
Unit III	Advances in Mete Basic concept of I Lasers interferome Types of CMM, Basic concepts of N Form Measureme Principles and Mete measurement surfa	asers Advantages of lasers, laser Inter, Applications, Straightness, Aligr Constructional features, Probes, Acce Machine Vision System, Element, Apple <b>nt:</b> hods of straightness, Flatness measure ce finish measurement, Roundness measure	erferom nment. essories lications ement, T	eters, typ Basic co , Softwar s. Thread mo	ees, DC and AC ncept of CMM, re, Applications, easurement, gear cations.
Unit IV	Measurement, surre Force, torque, po measurement: Ven strip, thermocoup Readability and Re	ower, Flow and Temperature: wer, mechanical, Pneumatic, Hydra turimeter, Orifice meter, rotameter, pir es, electrical resistance thermometer liability.	ulic an itot tube er, Rel	d Electri , Temper iability a	ical type. Flow ature: bimetallic and Calibration,
Unit V	Aircraft Instrume Flight Instruments Indicators, TAS, E. types of engine inst and Principles.	nts: and Navigation Instruments, Gyrosc AS, Mach Meters, Altimeters, Principle ruments, Tachometers, Temperature ga	cope, A es and o auges, F	ccelerom peration, Pressure g	eters, Air speed Study of various auges, Operation
Text Bool	KS				-
1	Gupta. I.C., "Engineer	ing Meteorology", Dhanpatrai Publication	is, 1st Ed	lition, 2005	
2	Jain R.K. "Engineerin	g Meteorology", Khanna Publishers, 20th I	Edition,	2017.	ents" Oxford
3	Raghavendra, N. V., k Academic Publication	rishnamurthy, L., "Engineering Meteorolo 1st Edition, 2013.	bgy and		ciits, Oxioru
4	Pallet, E.H.J., "Aircrat	t Instruments & Principles", Pearson Educ	cation, 20	009.	
Reference	Books	· · · · · · · · · · · · · · · · · · ·	MaCarr	U:11 D 4	nation 1st Edition
1	Bewoor, N. A., Kulka 2017.	ni, V., "Meteorology and Measurement", I	McGraw	HIII Educ	cation, 1st Edition,
2	Rajput, R. K., "Mecha Systems)", S.K. Katar	nical Measurements and Instrumentation (la & Sons, 2nd Edition, 2021.	Includin	g Meteoro	logy and Control
2	W/11: O A 64	aft Instruments & Dringinlas" Calastia D	hlipotio	1072	

myandares

Usef	ful Li	inks	
1.2	1	https://nptel.ac.in/courses/112/104/112104250/	
	2	https://nptel.ac.in/courses/112/106/112106179/	
	3	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-me70/	

	<b>Course Outcomes</b>	PO/PSO	CL	Class Sessions	Lab Sessions
BAE2306.1	<b>Illustrate</b> the basics concepts of measurements by understanding various meteorological instruments.	PO1, PO2, PO12, PSO3	2	9	2
BAE2306.2	<b>Summarize</b> the principles of linear and angular measurement tools used for industrial applications.	PO1, PO2, PO12, PSO3	2	9	2
BAE2306.3	Elucidate the procedure for conducting computer aided inspection.	PO1, PO2, PO12, PSO3	2	9	2
BAE2306.4	<b>Exhibit</b> the different techniques of form measurement used for industrial components.	PO1, PO2, PO12, PSO3	2	9	2
BAE2306.5	<b>Illustrate</b> working and operating principles of various aircraft instruments.	PO1, PO2, PO12, PSO3	2	9	2

Ö

ampondare

- Carlos

10 A





414							
	Second Ye	ear (Semest	ter-III) B.Tech.	Aeronau	tical En	gineering	
		<b>BAE2307</b>	: Aero- Thermo	dynamic	s Lab		
Teaching Sc	heme			1	Examina	tion Scheme	
Practical		2 Hrs/week			CA	25 Mark	s
Total Credit		1			ESE	25 Mark	(S
					Total	50 Mark	s
					Duration	of ESE: 02 Hrs	00 Min.
<b>Course Out</b>	comes (CO)			1	5		
Students will	l be able to	. •		£		2	λ.
BAE2307.1	Apply the bas	ic concepts of th	ermodynamics in solvin	ng related pro	oblems.		
BAE2307.2	Evaluate heat	transfer problem	ns by appreciating the fi	irst law of the	ermodynami	ics and its applicati	on.
BAE2307.3	Solve problem	ns on Carnot cy	cle, Clausius inequalit	ty, availabili	ty and irrev	versibility by inter	preting the
	application of	second law of th	ermodynamics to heat e	engines, heat	pumps and	refrigerators.	
BAE2307.4	Work out pro	blems on change	e of entropy through und	derstanding o	f the concep	ots of available ener	:gy.
BAE2307.5	Solve problem	ns on operation	of engines by comprehe	ending the b	asics of diff	terent air standard,	gas power
	and refrigerati	on cycles and co	oncerned engines.	• •			00
Sr. No.			List of Experi	iment			
1	Performing M	orse test on 4-sti	roke petrol engine				
2	Performance e	evaluation of 4-s	troke petrol engine with	out Morse te	st		
3	3 Performance test on single cylinder 4-stroke diesel engine						
4	Performance t	est of reciprocat	ing air compressor				2
5	Study of stean	n Turbine Engine	e				2
6	Determination	of specific heat	of solid	4 41			3
7	Determination	of Thermal Cor	ductivity of solid (meta	al rod)			3
8	Determination	of Thermal Cor	ductivity of insulating p	powder			4
9	Determination	of Thermal Cor	ductivity of liquid				4
10	Determination	of Thermal Res	istance of Composite w	all	C.		5
<b>Text Books</b>	*				1.14.0		11
1	Thermodyna Education, 9	mics: An engin th Edition, 201	eering approach by Y 9.	unus Cenga	al, M. A. B	oles, McGraw Hi	11
2	Thermodyna	mics by C. P. A	Arora, Tata Mc-Graw	Hill Publica	ation, 1st E	dition, 2004.	
3	Fundamental	s of classical T	hermodynamics by G	i. J. V. Wyle	en, R. E. So	onntag, C. Borgna	akke,
	John Wiley &	& Sons, 4th Edi	ition, 2014.			2	
Reference <sup>B</sup>	ooks						0017
1	Engineering	Thermodynam	ics by P. K. Nag, Tata	a Mc-Graw	Hill Public	ation, 6th Edition	<u>, 2017.</u>
2	Fundamental 2016.	s of engineerin	g Thermodynamics by	y R. K. Raj	put, Laxmi	Publications, 4th	Edition
Useful Link	S						
1	https://nptel.a	ac.in/courses/1	12/105/112105123/				
2	https://nptel.a	ac.in/courses/1	12/105/112105266/				
3	https://nptel.a	ac.in/courses/1	12/104/112104113/	a fair	6		

mand care





	Second Y	ear (Semes	ter-III) B.Tech. A	Aeronautical Engin	eering
	, BA	<b>E2308:Flu</b>	id Mechanics an	d Machinery Lab	
Teaching Se	cheme			Examination	n Scheme
Practical		2 Hrs/week		СА	25 Marks
<b>Total Credi</b>	t	1		ESE	25 Marks
				Total	50 Marks
				Duration of I	ESE: 02 Hrs 00 Min.
<b>Course Out</b>	comes (CO)				J 3
Students wil	l be able to	¢			2
DA DOGO A	Comprehen	d the basic p	rinciples of fluid me	chanics and apply the	knowledge in solving
BAE2308.1	problems on	fluid measurer	nents.		5 A
BAE2308.2	Analyze typ	es and proper	ties of the fluid flow	and solve the problems	on potential function,
	stream functi	ion and Bernou	Illi's principle.		
BAE2308.3	Investigate	the viscous fl	ow and solve the pro	blems on boundary laye	er theory, laminar and
	turbulent and	flow through	pipes.		
BAE2308.4	Solve problem	ms on the com	pressibility effect and g	governing equations of flu	uid flow.
BAE2308.5	Estimate the	performance of	of different fluid machi	ineries, study their applica	ation and classification.
Sr. No.		ŵ	List of Experin	nent	CO
1	Determination	of coefficient o	f discharge of Venturime	ter	1
2	Determination of coefficient of discharge of orifice meter				1
3	Determination	of pipe flow los	ses	×	2
4	Verification of	f Bernoulli's the	orem		2
5	Determination	of meta-centric	height of float vessel		3
6	Performance te	est on reciprocat	ing pumps		4
7	Performance to	est on variable s	peed pump	3 <sup>1</sup>	4
8	Performance te	est on axial flow	pump		4
9	Performance te	est on piston wh	eel turbine		5
10	Performance te	est on Francis tu	rbine		5
<b>Text Books</b>					
1	Fluid Mechan	nics by Frank N	A. White, Mcgraw-Hill	l, 7th Edition, 2011.	
2	Fluid Mechar	nics and Fluid	Power Engineering by	D. S. Kumar, S.K. Katari	a & Sons, 9th Edition,
یے ہور	2015.				
3.	Fluid Mechan	nics for Engine	ers by P.N. Chartterjee	, Macmillan Publishers In	idia, 1st Edition, 1995.
<b>Reference B</b>	ooks				
1	Fluid Mechar	nics and hydrau	ilic Machines by R. K.	Bansal, Laxmi Publicatio	ons, 9th Edition, 2018.
2	Mechanics of	Fluids by B. S	S. Massey, PHI, 7th Ed	ition, 2015.	
3	Fluid Mechar	nics by A. K. Ja	ain, Khanna Publishers	, 12th Edition, 2004	
Useful Links	S				
1	https://nptel.a	ic.in/courses/11	12/104/112104117/	and a start of the	
2	https://nptel.a	ic.in/courses/11	12/105/112105206/		
3	https://nptel.a	.in/courses/1	2/105/112105182/		

myordene





	Second Ye	ear (Semest	er-III) B.Tech. Aeronau	itical Enginee	ring
	т. Т.	BAE	<b>2309:Solid Mechanics La</b>	ab	
Teaching Scheme				Examination Scheme	
Practical		2 Hrs/week		СА	25 Marks
Total Credit		1		ESE	25 Marks
				Total	50 Marks
				Duration of ESH	E: 02 Hrs 00 Min.
<b>Course Out</b>	comes (CO)				
Students will	be able to	***			1
BAE2309.1	Evaluate St.	Venant's princ	ciple by assessing the basic conc	epts related to stres	ss and strains.
BAE2309.2	Calculate the	e shear force, b	ending moment, stresses in a be	am under given loa	ad conditions
BAE2309.3	Analyze def	lection of bear	ns by Macaulay's and area mor	ment methods and	evaluate stresses in
	beams.				
BAE2309.4	Investigate	the buckling o	f column at different end cond	litions using Rank	ine's, Johnsons and
	Energy meth	od.			
BAE2309.5	Investigate t	he principle str	esses and strains and its effect o	n different structur	es.
Sr. No.			List of Experiment		СО
1	Performing direct tension test on the given mild steel specimen			1	
2	Performing torsion test on given cylindrical/ square/ rectangular specimen			1	
3	Determining b	ending load on s	simply supported beam		2
4	4 Determining bending load on cantilever beam		2		
5	Determining h	ardness of the g	iven material using Brinell hardness	stest	3
6	Determining h	ardness of the g	iven material using Rockwell hardn	ess test	3
7	Determining s	tiffness constant	of the spring		4
8	Evaluating cor	npression streng	th of the given aluminum block		4
9	Determining in	npact load on th	e given mild steel specimen using I	-Zod impact test	5
10	Determining in	npact load on th	e given mild steel specimen using C	Charpy impact test	5
11	Determining s	hear strength of	the given mild steel specimen using	Punch shear test	5
<b>Text Books</b>					
1	Strength of M	laterial by S. F	amamurtham and R. Narayanan	, Dhanpat Rai Pub	lishing Company
	Pvt. Ltd., 16t	h Edition, 201	L.	7th Edition 2018	
2	Strength of M	laterial by R. F	. Rajput, S. Chand Publishing,	n Ath Edition 199	0
3	Strength of N	laterial by A. S	Singer and F. L. Singer, Longina		0.
Reference Bo	OKS Strongth of m	atorials by S	Timoshenko CBS 3rd Edition	2002	
1	A Textbook	of Strength of I	Materials by R.K. Bansal, Laxmi	Publications, 4th	Edition, 2018.
3	Strength of N	faterials by S.	S. Bhavikatti, Vikas Publishing	House, 4th Edition	, 2013.
Useful Links	Sublight of It		,		
1	https://nptel.a	c.in/courses/11	2/102/112102284/		
2	https://online	courses.nptel.a	c.in/noc20 me84/preview		
3	https://nptel.a	c.in/courses/10	05/106/105106049/	al contraction of the second sec	

madan



110		IVIA.	ac acciences (in and	)			
	Second Ye	ear (Semest	er-III) B.Tech. Aeron	nautical Engi	neering		
	B	AE2310:Me	teorology and Measu	irement Lab			
Teaching Sc	heme		8/	Examinatio	n Scheme		
Practical	intine	2 Hrs/week		CA	25 Marks		
Total Credit	÷	1		ESE	25 Marks		
Total Cicult		1		Total	50 Marks		
				Duration of	ESE: 02 Hrs 0	0 Min.	
Course Out	comes (CO).	Students will	be able to				
Course Out	Illustrate t	he basics con	cepts of measurements by	y understanding	various meteo	rologica	
BAE2310.1	instruments.			l al			
DAE2210.2	Summarize principles of linear and angular measurement tools used for industrial application						
DAE2310.2	Flucidate th	a procedure for	conducting computer aided	inspection.			
BAE2310.3	Encluate in	different techni	auos of form measurement u	sed for industrial	components		
BAE2310.4	Exhibit the		ques of form measurement u	aronartias in indus	trial application	c	
BAE2310.5	Illustrate va	rious measuring	g techniques of mechanical j	properties in indus	that applications	S.	
Sr. No.			List of Experiment	1	Venier	0	
1	Calibration a height gauge	ind use of meas -using gauge b	uring instruments: Vernier c	aliper, micrometer	r, vernier	2	
2	Calibration a	and use of meas	uring instruments: depth mic	crometer, bore gau	ige, telescopic	2,3	
2	gauge.					2	
3	Measuremen	t of linear dime	ensions using Comparators			3	
4	Measuremen	t of angles usin	g bevel protractor and sine b	oar		1	
5	Measurement of screw thread parameters: Screw thread Micrometers and Three wire method (floating carriage micrometer)					1	
6	Measuremen	t of gear param	eters: disc micrometers, gea	r tooth vernier cal	iper	2	
_	Measuremen	t of features in	a prismatic component using	g Coordinate Meas	suring	4	
7	Machine (CMM)						
8	Programmin identical con	g of CNC Coor	dinate Measuring Machines	for repeated meas	urements of	5	
9	Non-contact	(Optical) meas	urement using Toolmakers r	nicroscope / Profil	le projector	5	
	Measuremen	t of Surface fin	ish in components manufact	tured using various	s processes	2	
10	(turning, milling, grinding, etc.,) using stylus based instruments.				5		
11	Machine tool metrology: Level tests using precision level; Testing of straightness of a				5		
11	machine too	l guide way usin	ng Autocollimator, spindle t	ests.			
12	Measuremen	nt of force, torqu	ie and temperature			5	
<b>Text Books</b>							
1	Gupta. I.C.,	"Engineering N	leteorology", Dhanpatrai Pu	blications, 1st Edi	tion, 2005.		
2	Jain R.K. "E	ngineering Met	eorology", Khanna Publishe	ers, 20th Edition, 2	.017.	0.6.1	
3	Raghavendra Academic P	a, N. V., Krishn ublication, 1st I	amurthy, L., "Engineering N Edition, 2013.	Meteorology and N	1easurements", (	Uxford	
Reference B	ooks					1.	
1	Bewoor, N.	A., Kulkarni, V	" "Meteorology and Measur	rement", McGraw	Hill Education,	1st	
1	Edition, 201	7.					
2	Rajput, R. K	., "Mechanical tems)", S.K. Ka	Measurements and Instrume taria & Sons, 2nd Edition, 2	entation (Including 021.	, Meteorology an	nd	
Iseful Link	s control byst	, SILLING		14 - 11 - 11 - 11 - 11 - 11 - 11 - 11 -			
1	https://nptel	ac.in/courses/1	12/104/112104250/				
2	https://nptel	ac_in/courses/1	12/106/112106179/				
2	https://nptel	ac in/noc/course	es/noc19/SEM2/noc19-me7	0/			
J	inteps.//iiptei.	44.111 1100/ 00415					

onyordana