

PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

B.E. AERONAUTICAL ENGINEERING

CURRICULUM

CBCS REGULATIONS 2016

SEMESTER I

Course Code	Course Title	L	T	P	C
MA16101	Matrices and Calculus	3	2	0	4
EN16101	Technical English I	3	0	0	3
PH16101	Engineering Physics	3	0	0	3
CH16101	Engineering Chemistry I	3	0	0	3
ME16101	Engineering Graphics	3	2	0	4
EE16101	Basic Electrical and Electronics Engineering	3	0	0	3
PC16101	Physics and Chemistry Laboratory I	0	0	2	1
AE16101	Basic Aero modeling Laboratory	0	0	2	1
GE16101	Engineering Practices Laboratory	0	0	4	2

SEMESTER II

Course Code	Course Title	L	T	P	C
MA16201	Differential Equations and Complex Analysis	3	2	0	4
EN16201	Technical English II	3	0	0	3
PH16202	Applied Physics	3	0	0	3
CH16201	Engineering Chemistry II	3	0	0	3
CS16201	Computer Programming	3	0	0	3
ME16201	Engineering Mechanics	3	2	0	4
PC16201	Physics and Chemistry Laboratory II	0	0	2	1
CS16202	Computer Programming Laboratory	0	0	2	1
EN16202	English Communication Skills Laboratory	0	0	2	1

OBJECTIVES

To enable students to

- understand the concepts of Eigen values and Eigen vectors of real matrices and its applications in the process of diagonalization of real symmetric matrices.
- study applications of Rolle's and Mean Value Theorems and also to understand the concept of maxima and minima using derivatives.
- learn the concept of partial differentiation and its applications to maxima and minima of functions of two or more variables.
- develop a thorough knowledge of definite and indefinite integrals
- learn the concepts of multiple integrals and their applications

15

UNIT I MATRICES

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II DIFFERENTIAL CALCULUS

15

Limit – Continuity, properties of limit and classification of discontinuities - Simple problems. Differentiation – Standard forms, Successive differentiation and Leibnitz theorem. Mean value theorem – Rolle's theorem – maxima, minima using first and second derivative tests.

UNIT III FUNCTIONS OF SEVERAL VARIABLES

15

Partial derivatives – Euler's theorem for homogeneous functions – Total derivatives – Differentiation of Implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrangian multipliers.

UNIT IV INTEGRAL CALCULUS

15

Indefinite and definite integrals - Properties of integrals, Integration of simple function. Methods of Integration – Integration by parts – Reduction formulae involving exponential and trigonometric functions, Bernoulli's formula.

UNIT V MULTIPLE INTEGRALS

15

Double integration – Cartesian and polar coordinates – Change of order of integration – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral.

TOTAL : 75 PERIODS

OUTCOMES

At the end of this course, the students will be able to

- determine eigen values and eigen vectors and diagonalize real symmetric matrices.
- classify various types of functions involved in engineering fields, their differentiation techniques and applications
- find partial derivatives and apply the same to find maxima and minima of two or more variables
- implement different methods of integration used in engineering problems
- execute suitable integration techniques to calculate surface areas and volumes.

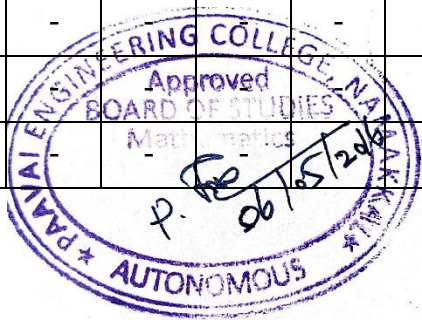
TEXT BOOKS

1. Grewal. B.S, “Higher Engineering Mathematics”, 41st Edition, Khanna Publications, Delhi, (2011).
2. P.Jayakumar, and Dr.B.Kishokkumar “Matrices and Calculus”, Global Publishers, Chennai.,(2015).
3. T. Veerarajan., “Engineering Mathematics”, 3rd Edition, Tata McGraw Hill, (2011).

REFERENCES

1. Erwin Kreyszig., “Advanced Engineering Mathematics” 10th Edition, Wiley Publications.
2. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd.,(2011).
3. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education,(2012).
4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, (2008).

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	3
CO2	3	3	2	3	-	-	-	-	-	-	-	1	2	3
CO3	3	2	2	3	-	-	-	-	-	-	-	1	2	3
CO4	3	2	3	1	-	-	-	-	-	-	-	1	2	3
CO5	3	2	2	2	-	-	-	-	-	-	-	1	2	3



COURSE OBJECTIVES

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections

Concepts and Conventions (Not for Examination)

2

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING

14

Curves Used In Engineering Practices:

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, Epicycloid and Hypocycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Construction of spiral curve.

Free Hand Sketching:

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

14

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes -Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS

12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

14

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral

surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

14

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

INTRODUCTION TO INTERSECTION OF SOLIDS (Not for Examination)

5

Introduction to intersection of surfaces – Line of intersection – Intersection of solids

TOTAL: 75 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects
- draw the projections of points, straight lines and plane surfaces in given quadrant
- understand the projection of solids in various positions in first quadrant
- draw projections and solids and development of surfaces
- prepare isometric and perspective sections of simple solids

TEXT BOOKS

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. S.Prabhakaran, M.Makesh, V. Subburam, “Engineering Graphics”, Sams Publishers, Chennai, 2015.

REFERENCES

1. Gopalakrishnan K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

WEBLINKS

1. <http://www.nptel.ac.in/courses/112103019>
2. <http://www.engineeringdrawing.org/>
3. <http://www.mechanical.in/engineering-graphics/>

PUBLICATION OF BUREAU OF INDIAN STANDARDS

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO2	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO3	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO4	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO5	3	3	3	3	3	1	-	-	-	-	1	1	2	1



COURSE OBJECTIVES

- To analyze the various AC and DC circuits and find the circuit parameters.
- To introduce the principles of AC & DC fundamentals.
- To familiarize the relationship between Electric and Magnetic circuits.
- To study the basics of electronic devices and its applications.
- To learn various number systems and to realize the logic functions by using various gates.

UNIT I**ELECTRICITY AND MAGNETISM****9**

Coulomb's law, Fleming's law, Lenz law – Properties of Magnets, Laws of Magnetism, flux, flux density, Field strength, Permeability, Reluctance, Permeance, Types of Magnetic circuits – Comparison of Magnetic and Electric Circuits. Self and Mutual Inductance – Self and mutually induced emf.

UNIT II**DC & AC CIRCUITS FUNDAMENTALS****9**

DC: Ohm's Law- Limitations of Ohm's Law, Kirchhoff's' Laws, series– parallel resistive circuits, comparison of series and parallel circuits, Star - Delta Transformation – Problems.

AC Waveforms – RMS and Average value, Form Factor, Peak Factor. Single Phase AC Circuits – RL, RC, RLC series and parallel circuits– Impedance, Power, Power factor, Series and Parallel Resonance - Problems. Introduction to three phase AC circuits.

UNIT III**MEASUREMENTS****9**

Types of electrical measurement – construction and Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters. Types of errors.

UNIT IV**SEMICONDUCTOR DEVICES****9**

Characteristics of PN Junction Diode - Zener Effect - Zener Diode and its Characteristics - Half wave and Full wave Rectifiers - Voltage Regulation. Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics - Elementary Treatment of Small Signal Amplifier.

UNIT V**DIGITAL ELECTRONICS****9**

Binary Number System - Logic Gates - Boolean Algebra - Half and Full Adders - Flip-Flops - Registers and Counters - A/D and D/A Conversion.

TOTAL: 45 PERIODS**COURSE OUTCOMES**

At the end of this course, the students will be able to

- get the basic knowledge about the AC & DC Electric circuits.
- understand the basic quantities in measurements
- apply concepts and theories of electrostatics
- understand the concept of Semiconductor Devices and Applications
- acquire the knowledge of various types of digital electronics technique.

OBJECTIVES

To enable students to

- discuss a wide range of basic mathematical methods for solving different types of problems arising in the fields of Science, Mathematics and Engineering.
- acquire sound knowledge in solving ordinary differential equations that model engineering problems.
- understand the concept of vector calculus, which is applied in all engineering disciplines.
- know the standard techniques of complex variable theory.
- learn the purpose of using transforms and to create a new domain

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 15

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 15

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields. – Vector integration – verifications of Green's, Gauss divergence and Stokes' theorem – simple applications.

UNIT III ANALYTIC FUNCTIONS 15

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic

UNIT IV COMPLEX INTEGRATION 15

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Contour integration.

UNIT V LAPLACE TRANSFORM 15

Laplace transform – Transform of elementary functions – Basic properties – Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 75 PERIODS

OUTCOMES

At the end of this course, the students will be able to

- solve differential equations
- study the basics of vector calculus comprising of gradient, divergence and curl and line, surface and volume integrals and the classical theorems.
- know the concepts of analytic functions and its properties and apply it in conformal mapping.
- gain knowledge in the basics of complex integration and the concept of contour integration which is an important tool for evaluation of certain integrals encountered in practice.
- solve Laplace transform and its properties and give sufficient exposure to the solution of certain linear differential equations.

TEXT BOOKS

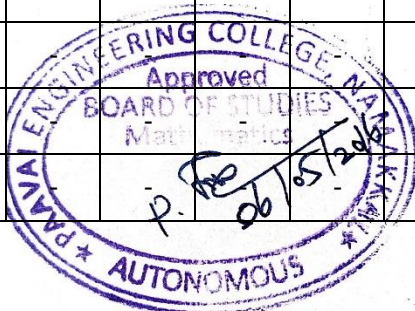
1. Grewal. B.S, “Higher Engineering Mathematics”, 41st Edition, Khanna Publications, Delhi,(2011).
2. P.Jayakumar, and Dr.B.Kishokkumar, “Differential Equations and Complex Analysis”, Global Publishers, Chennai.,(2015).
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REFERENCES

1. Dass, H.K., and Er. RajnishVerma, “Higher Engineering Mathematics”, S. Chand Private Ltd.,(2011).
2. T. Veerarajan., “Engineering Mathematics”, 3rd Edition, Tata McGraw Hill, 2011.
3. Peter V. O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, (2012).
4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, (2008).

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CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	3
CO4	3	2	3	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	3	-	-	-	-	-	-	-	3	3	3



COURSE OBJECTIVES

- To solve basic concepts of engineering problems such as force, displacement, velocity and acceleration.
- To gain knowledge in the concepts involved in equilibrium of rigid bodies.
- To impart analytical skills to solve problems in moments of surfaces and solids
- To develop knowledge in the dynamics of particles due to force.
- To understand the rigid body problems subjected to friction and elements.

UNIT I	BASICS & STATICS OF PARTICLES	15
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Introduction - Units and Dimensions - Laws of Mechanics - **Lame's theorem, Parallelogram and triangular**
Law of forces - Vectors - Vectorial representation of forces and moments - Vector operations: additions,
subtraction, dot product, cross product - Coplanar Forces - Resolution and Composition of forces - Equilibrium
of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of
transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES 15

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS 15

Determination of Areas and Volumes - First moment of area and the Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, - Angle section, Hollow section by using standard formula - second and product moments of plane area - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia

UNIT IV DYNAMICS OF PARTICLES 15

Displacements, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 15

Frictional force - Laws of Coloumb friction - simple contact friction - Rolling resistance - Belt friction.
Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.

TOTAL: 75 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to

- apply the differential principles to solve engineering problems.
- gain in-depth knowledge in the equilibrium of rigid bodies.
- identify and calculate the various properties of surfaces and solids
- categorize the various forces analysis in structures.
- solve rigid body problems subjected to dynamic forces.

TEXT BOOKS

1. Dr.N.Kottiswaran., “Engineering Mechanics”10th Edition, Sri Balaji Publications 2010.
2. Palanichamy, M.S., Nagam, S., "Engineering Mechanics - Statics & Dynamics", Tata McGraw-Hill, (2001).

REFERENCES

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).
2. Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education AsiaPvt. Ltd.,
3. Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics”,4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, Third Edition, John Wiley & Sons,1993.
5. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", VikasPublishing House Pvt. Ltd., (2000).

WEBLINKS

1. <http://www.nptel.ac.in/courses/112103109/>
2. <https://www.coursera.org/learn/engineering-mechanics-statics/home/info>
3. <http://www.myopencourses.com/subject/engineering-mechanics-2>

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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CO5	3	3	3	3	2	-	-	-	-	-	-	2	2	3



COURSE OBJECTIVES:**To enable the students to**

- Instill the basic communication concepts to enhance students' communication skills through various lab sessions.
- Help students develop the ability to communicate effectively in spoken English.
- Help students develop their soft skills and interpersonal skills.
- Increase employability by developing students' communication skills in English.

UNIT I FORMAL & INFORMAL CONVERSATION PRACTICE**9**

Role Play conversations - with family members, neighbors, friends, relatives etc. Simple expressions - agreeing/disagreeing, persuading, wishing, consoling, advising, arguing, expressing opinion etc. - Professional dialogues with superiors - Conversation with different professionals in - Government and Corporate Offices, Official Meetings, Educational Institutions, (At the railway junction, malls, post office, bank) etc- every day usage of English

UNIT II ORAL REVIEW, RADIO SHOW & NARRATIVE TECHNIQUES**9**

Oral review of books - Presentation of various radio programs like news, announcements, advertisements, entertainment programs etc. as a team activity. Understanding the basic narrative techniques – Narrating short stories, Narrating real life experiences, Oral interpretation of charts, tables, graphs.

UNIT III RESUME / LETTER WRITING**9**

Preparation of resume- structure – Types of resume – writing the vision statement – Objectives – Types of Letter – Job Application – accepting/declining a Job offer.

UNIT IV PRESENTATION SKILLS & GROUP DISCUSSION**9**

Elements of effective presentation – Structure of a presentation – Speech acts - effective use to presentation tools - Audience analysis – Preparing the PPT slides - Video samples- Importance of GD –in the selection process - Structure of a GD – Moderator – led and other GDs - Strategies in GD – Team work – Body Language-Mock GD-Video samples

UNIT VI INTERVIEW SKILLS

Kinds of interviews—one to one, group interview, telephone interview, online interview, stress interview-
Required Skills– Corporate culture–Mock interviews-Video samples.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- listen and comprehend classroom lectures, short talks and conversations.
- read, interpret and analyze a given text effectively, and use cohesive devices in spoken and written English.
- understand English and converse effectively.
- write flawless sentences, Job application.

TEXT BOOKS:

- Kalpana.V&Co.,“Communication Skills Laboratory Manual”, Vijay Nicole Imprints Pvt. Limited, Chennai.2013
- Rizvi,Ashraf. M.Effective Technical Communication.TataMcGraw-Hill, NewDelhi.2005.

REFERENCE BOOKS:

- Anderson,P.V.“Technical Communication”,Thomson Edition,NewDelhi,2007.
- Kumar Sanjay, PushpLata,“Communication Skills (With CD)”,Oxford University Press, NewDelhi.2011

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CO2	-	-	-	2	3	-	1	2	-	3	3	1	-	-
CO3	-	-	-	-	-	-	-	-	-	3	1	1	-	-
CO4	-	-	-	-	3	1	1	-	2	3	3	1	-	-



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REGULATION 2015

SEMESTER III

Course Code	Course Title	L	T	P	C
MA15301	Transforms and Boundary Value Problems	3	2	0	4
AE15301	Aircraft Materials and Manufacturing Technology	3	0	0	3
AE15302	Basics of Aeronautical Engineering	3	0	0	3
AE15303	Fluid Mechanics and Machinery	3	2	0	4
AE15304	Solid Mechanics	3	0	0	3
AE15305	Thermodynamics and Heat Transfer	3	2	0	4
AE15306	Fluid Mechanics and Machinery Laboratory	0	0	4	2
AE15307	Strength of Materials Laboratory	0	0	4	2
AE15308	Thermodynamics Laboratory	0	0	4	2

SEMESTER IV

Course Code	Course Title	L	T	P	C
MA15404	Numerical Methods	3	2	0	4
AE15401	Aerodynamics I	3	0	0	3
AE15402	Aircraft Propulsion	3	2	0	4
AE15403	Aircraft Structures I	3	2	0	4
AE15404	Aircraft Systems and Instrumentations	3	0	0	3
CH15403	Environmental Science and Engineering	3	0	0	3
AE15405	Aerodynamics Laboratory	0	0	4	2
AE15406	Aircraft Structures Laboratory I	0	0	4	2
AE15407	CAM and Manufacturing Laboratory	0	0	4	2
EN15401	Business English Course Laboratory	0	0	2	1

COURSE OBJECTIVES

To enable the students to

- introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- acquaint the student with Fourier transform techniques used in wide variety of situations.
- familiarize effective application of mathematical tools for the solutions of partial differential equations that model several physical processes.
- apply one dimensional equation of heat conduction and study about wave equation.
- learn and apply Z transform techniques for discrete time systems.

UNIT I FOURIER SERIES**15**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Gibb's Phenomenon – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS**15**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS**15**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**15**

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS**15**

Z-transforms – Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

TOTAL: 75 PERIODS**COURSE OUTCOMES**

At the end of the course, the students will be able to

- comprehend fourier series, their different possible forms and the frequently needed practical harmonic analysis from discrete data.
- describe the concept of a function as a double integral under certain conditions and apply in the fourier transform pair and their properties.

- solve certain boundary value problems and apply the methods and results in engineering applications.
- employ partial differential equations to solve one dimensional wave and heat equations.
- demonstrate the knowledge of differential equations gained and solve them using Z transforms.

TEXT BOOKS

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

REFERENCES

1. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Engineers", SPIE Optical Engineering press, Washington USA (1999).
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
4. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

WEB LINKS

1. <http://172.16.100.200/NPTEL/displayweb.html?type1=111103021%2F35.pdf>
2. <http://172.16.100.200/NPTEL/displayweb.html?type1=111104031%2Flectures.pdf%23page%3D101>.

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	1	-	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	-	-	-	-	-	-	-	1	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	1	3	2



COURSE OBJECTIVES

To enable the students to

- study about the various Metal Casting and Welding process followed in industries
- introduce the various metallic and non-metallic engineering materials used in aircraft applications and their test methods.
- understand the effect of corrosion in the aircraft materials and its prevention methods.
- learn the heat treatment process of ferrous and non-ferrous materials.
- know the basic concepts of Composite materials and its applications.

UNIT I CASTING**8**

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO₂ moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT II WELDING**8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

UNIT III MACHINING**10**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

UNIT IV AIRCRAFT METAL ALLOYS AND SUPERALLOYS**10**

Aluminum alloys, Magnesium alloys, Titanium alloys, Plain carbon and Low carbon Steels, Corrosion and Heat resistant steels, Maraging steels, Copper alloys, Producibility and Surface treatments for each of the above – Super alloys, Nickel based super alloys, Cobalt based super alloys, and Iron based super alloys, manufacturing processes associated with super alloys, Heat treatment and surface treatment of super alloys.

UNIT V AIRCRAFT COMPOSITE MATERIALS AND NON METALLIC**9**

Composite materials – GFRP, CFRP, MMC, GLARE – Classification and properties of wood, plywood and applications – Ablation process-ablative materials- super conducting materials matrix materials- their applications – Purpose of Doping – Adhesives – Aircraft paints – Rubber and Rubber materials.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- know about different manufacturing process and applications in industry for component production
- analyze the properties of different aircraft materials.
- compare the properties of various alloys for aerospace application.
- conduct the heat treatment and surface treatment process for various alloys.
- identify the suitable materials for different parts of the aircraft.

TEXT BOOKS

1. Krishnadas Nair C G, 'Handbook of Aircraft Materials', First Edition, Interline Publishers, Bangalore, 1993.
2. Hajra Choudhury, "Elements of Workshop Technology", Vol. I, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2010.
3. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.

REFERENCES

1. George Francis Titterton, 'Aircraft Material and Processes', Fifth Edition, Sterling Book House, Mumbai, 1998.
2. Horst Buhl (Ed.), 'Advanced Aerospace Materials', Springer-Verlag, 1992.
3. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", Fourth Edition, Pearson Education, Inc. 2007.
4. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
5. Hajra Choudhury, "Elements of Workshop Technology", Vol. II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2010.

WEB LINKS

1. <http://www.nptelvideos.in/2012/12/advanced-materials-and-processes.html>
2. <http://nptel.ac.in/courses/112107144/>

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	-	2	3	3	2	-	3	-	-	-	-	2	3	3
CO2	-	2	2	3	3	-	2	-	-	-	-	2	3	2
CO3	-	2	3	3	2	-	2	-	-	-	-	2	2	3
CO4	-	3	2	2	3	-	3	-	-	-	-	2	2	2
CO5	-	3	3	2	3	-	3	-	-	-	-	2	3	2



COURSE OBJECTIVES

To enable the students to

- study about the basic fluid properties and flow characteristics
- apply the conservation laws to flow through pipes and hydraulic machines
- know the importance of dimensional analysis.
- study about the various types of pumps and its applications.
- understand the importance of various types of flow in turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 14

Units and dimensions-Properties of fluids. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 14

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram-commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 15

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS 16

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

UNIT V TURBINES 16

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL: 75 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- apply mathematical knowledge to predict the properties and characteristics of a fluid.
- identify about the concepts involved in Dimensional Analysis
- perform the flow analysis in Circular pipes

- analyze the performance of pumps and its industrial applications.
- execute the performance calculations of Turbines.

TEXT BOOKS

1. Nodi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2009.
2. White F, Fluid 'Mechanics', 5th Edition, Tata McGraw-Hill, , New Delhi, 2011.

REFERENCES

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2010
3. Philip J. Pritchard, 'Fox and McDonald's Introduction to Fluid Mechanics', Eighth Edition, Wiley, 2011.
4. Yunus A. Cengel and John M. Cimbala, 'Fluid Mechanics: Fundamentals and Applications', Third Edition, McGraw-Hill, 2013.
5. R. K. Bansal, 'Fluid Mechanics', Laxmi Publications (P) Ltd, 2008.

WEB LINKS

1. <http://www.nptelvideos.in/2012/11/fluid-mechanics.html>
2. <http://nptel.ac.in/courses/112105182/#>

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	1	2	3	2	-	-	-	-	-	-	2	3	2
CO2	1	3	2	2	3	-	-	-	-	-	-	2	3	2
CO3	2	2	3	3	2	3	-	-	-	-	-	2	2	2
CO4	3	2	2	2	2	2	-	-	-	-	2	2	3	2
CO5	3	1	3	2	3	3	-	-	-	-	3	2	3	2



TEXT BOOKS

1. Stephen Timoshenko, James M. Gere "Mechanics of materials" Van No strand Reinhold Co., 1972.
2. Stephen Timoshenko and D. H. Young, Elements of strength Materials, Vol. I and Vol. II, T. Van No Strand Co-Inc Princeton- N.J. 1990.

REFERENCES

1. Dym C L and I. H. Shames, 'Solid Mechanics', 2013.
2. Nash William, 'Strength of Materials', TMH, 2010.
3. Rajput R.K "Strength of Materials" S.Chand and Company Ltd, 2012
4. S. Timoshenko, 'Strength of Materials', Vol. II, CBS Publishers, 2002.
5. Srinath L.S., 'Advanced Mechanics of Solids', Tata McGraw-Hill Publishing Co., New Delhi, 2003.

WEB LINKS

1. <http://www.nptelvideos.in/2012/11/mechanics-of-solids.html>
2. <http://web.mit.edu/emech/dontindex-build/>

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	3	2	-	-	-	-	-	-	3	2	3	2
CO2	2	3	1	2	-	-	-	-	-	-	2	2	3	2
CO3	2	3	2	3	-	-	-	-	-	-	3	2	2	2
CO4	2	3	2	3	-	-	-	-	-	-	2	2	3	2
CO5	3	2	2	2	-	-	-	-	-	-	2	2	3	2



COURSE OBJECTIVES

To enable the students to

- understand the principles and basics of thermodynamics.
- study about the various Air cycles and its applications.
- provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Properties of pure substances.
- infer the concept of Air-conditioning and its concepts
- enlighten the basic concepts of heat transfer and propulsion cycles.

UNIT I BASIC THERMODYNAMICS 15

Systems – Zeroth Law, First Law – Heat and work transfer in flow and non-flow processes – Difference in heat capacities, Ratio of specific heats – Second law, Kelvin Planck statement – Clausius statement – Concept of entropy – Entropy change in non-flow processes – T-S equations for entropy change – Numerical Problems.

UNIT II AIR CYCLES 15

Air standard cycle approximations – Otto, Diesel Cycles – P-V and T-S diagrams –Description – Efficiency, Mean Effective Pressure – Comparison of Otto, Diesel cycles for same compression ratio and heat input – Dual cycles – P-V and T-S diagrams – Brayton cycle for open and closed systems – Efficiency of gas turbine cycle – Numerical problems.

UNIT III THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW 15

Application of continuity, momentum and energy equations- Rankine cycle - Isentropic flow of ideal gases through nozzles - Simple jet propulsion system - Thrust rocket motor – Specific impulse.

UNIT IV AIR CONDITIONING 15

Principles of refrigeration, Air conditioning – Vapour compression – Vapour absorption types –Air cycle machine – Humidity control – Coefficient of performance – Properties of refrigerants

UNIT V BASICS OF PROPULSION AND HEAT TRANSFER 15

Classification of jet engines - simple jet propulsion system – thrust equation – specific impulse – ideal and non-ideal cycle analysis - conduction in parallel, radial and composite wall – basics of convective and radiation heat transfer.

TOTAL: 75 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- apply thermodynamic laws to solve the complex engineering problems.

- explain the principles of continuity, momentum and energy equation to solve the problems in simple jet propulsion systems.
- determine the efficiency and net work of the otto, diesel, and brayton cycles, and to make connections between these cycles and aircraft propulsion systems.
- calculate the design parameters for various air conditioning components.
- apply the basic concepts of heat transfer to solve the various engineering problems

TEXT BOOKS

1. Nag P K, 'Engineering Thermodynamics', Fifth Edition, Tata McGraw-Hill, 2013.
2. Rathakrishnan, E, 'Fundamentals of Engineering Thermodynamics', Prentice Hall, 2005.

REFERENCES

1. Gordon J. Van Wylen and Richard E. Sonntag, 'Fundamentals of Classical Thermodynamics', Sixth Edition, Wiley Publication, 2003.
2. Yunus A. Çengel and Michael A. Boles, 'Thermodynamics an Engineering Approach', Seventh Edition, Tata McGraw-Hill, 2010.
3. Oates, G.C., 'Aero Thermodynamics of Aircraft Engine Components', AIAA Education Series, New York, 1985.
4. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill, 1995.
5. Prasanna Kumar: Thermodynamics "Engineering Thermodynamics" Pearson Education, 2013

WEB LINKS

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/Basic_Thermodynamics/ui/TOC.htm
2. <http://nptel.ac.in/courses/112105123/1>

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	3	2	-	-	-	-	-	-	2	3	2
CO2	2	3	1	3	3	-	-	-	-	-	-	2	3	2
CO3	-	3	2	2	2	2	3	-	-	-	-	2	2	2
CO4	-	2	2	3	2	3	2	-	-	-	-	2	3	2
CO5	2	3	2	3	3	2	2	-	-	-	-	-	-	-



COURSE OBJECTIVES

To enable the students to

- study and experiment the flow measurement and the performance of the various fluid machinery
- familiarize the basic flow on the turbines
- impart the knowledge of pumps
- learn about the viscosity

LIST OF EXPERIMENTS

1. Calibration of venturimeter
2. Pressure measurement with pitot static tube
3. Determination of pipe flow losses
4. Verification of Bernoulli's theorem
5. Flow visualization by Heleshaw apparatus
6. Performance test on centrifugal pumps
7. Performance test on reciprocating pumps
8. Performance test on piston wheel turbine
9. Performance test on Francis turbine
10. Determination of Viscosity of a Fluid

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- use the measurement equipments for flow measurement
- perform the flow visualization of various apparatus
- analyze the performance thrust on different fluid machinery pumps
- analyze the problems in turbine

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	2	3	-	-	-	-	-	-	2	3	2
CO2	1	3	3	2	2	-	-	-	-	-	-	2	3	2
CO3	3	2	2	3	3	2	-	-	-	-	-	2	2	
CO4	3	2	3	3	2	2	-	-	-	-	3	2		



COURSE OBJECTIVES

To enable the students to

- impart the knowledge in testing the materials for hardness, fatigue, impact, tension and torsion.
- familiarize the hardness of materials
- impart the knowledge of strength of materials
- learn about the Fatigue

LIST OF EXPERIMENTS

1. Determine the BHN using Brinell Hardness Test
2. Determine the RHN using Rockwell Hardness test
3. Determine the Tension of various Materials using Tension test
4. Determine the Torsion of Various Materials using Torsion test
5. Determine the Impact Strength value by using Izod Impact test
6. Determine the Impact Strength value by using Charpy Impact test
7. Perform the Reverse plate bending Fatigue test
8. Perform the Rotating Beam Fatigue test
9. Testing of springs
10. Perform the Block Compression Test for various Materials

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- perform different destructive testing
- gain knowledge of torsion, Fatigue and Tension
- characterize materials by its strength values
- perform compression test of various materials and springs

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	1	-	-	-	-	-	-	-	2	3	2
CO2	2	3	3	2	-	-	-	-	-	-	-	2	3	2
CO3	2	3	2	3	-	-	-	-	-	-	-	2	2	2
CO4	2	3	2	3	-	-	-	-	-	-	-	2		



COURSE OBJECTIVES

To enable the students to

- enhance and experiment the basic knowledge in applied thermodynamics and engines
- familiarize the flow of heat exchanger
- impart the knowledge of air-condition
- learn about the thermal conductivity

LIST OF EXPERIMENTS

1. Performance test on a 4-stroke engine
2. Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
3. Determination of effectiveness of a parallel flow heat exchanger
4. Determination of effectiveness of a counter flow heat exchanger
5. Determination of heating value of a fuel
6. COP test on a vapour compression refrigeration test rig
7. COP test on a vapour compression air-conditioning test rig
8. Determination of specific heat of solid
9. Determination of Thermal Conductivity of solid.
10. Determination of Thermal Resistance of a Composite wall.

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- perform test on diesel/petrol engine
- explain the characteristics of the diesel/petrol engine
- determine the properties of the fuels.
- calculate performance coefficients of vapour compression systems

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	-	3	-	2	3	2	-	-	2	2	-	2	3	2
CO2	2	3	2	3	-	3	-	-	1	-	2	2	3	2
CO3	2	3	-	3	-	2	3	-	3	-	3	2	2	2
CO4	3	-	1	-	2	2	2	-	2	-	3	2	3	2



COURSE OBJECTIVES

To enable the students to

- introduce the concepts of mass, momentum and energy conservation relating to aerodynamics.
- make the student to understand the concept of vorticity, irrotationality, theory of airfoils and wing sections.
- study the Conformal Transformation process.
- introduce the basics of airfoil wing theory and its applications.
- learn the Boundary layer theory and its problems.

UNIT I INTRODUCTION TO AERODYNAMICS 9

Aerodynamic forces and moments – Pressure distribution on an airfoil – Types of drag – Continuity, momentum and energy equations – Incompressible-inviscid flow – Irrotational flow – Circulation and Vorticity – Euler's equation – **Bernoulli's Equation** – Pitot tube: Measurement of airspeed, Pressure Coefficient.

UNIT II TWO DIMENSIONAL FLOWS 9

Elementary flows – Uniform, Source, Sink, Doublet and vortex flow, Combination of a uniform flow with a source and sink, Non lifting flow over a circular cylinder, Lifting flow over a cylinder, Kutta Joukowski theorem and Generation of lift, D'Alembert Paradox, **Magnus effect**-Numerical Problems

UNIT III CONFORMAL TRANSFORMATION 8

Joukowski transformation and its application to fluid flow problems, Joukowski, and Karman-Trefftz Profiles-Numerical Problems.

UNIT IV AIRFOIL AND WING THEORY 10

Airfoil Nomenclature – Airfoil characteristics, NACA airfoils and Modern airfoils – Kutta condition – Thin airfoil theory and its applications – Aerodynamic Center – Horse shoe vortex, Vortex filament – Biot and Savart law – Downwash and induced drag – Helmholtz theorems, Lifting line theory and its limitations.

UNIT V INTRODUCTION TO BOUNDARY LAYER THEORY 9

Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, energy thickness, shape parameter, boundary layer equations for a steady, two dimensional incompressible flow, boundary layer growth over a flat plate, critical reynolds number, blasius solution, basics of turbulent flow.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- apply airfoil theory to predict airfoil performance and behavior of airflow over bodies
- analyze and optimize the aircraft wing performance.
- perform the dimensional analysis in two dimensions
- analyze the Problems of incompressible flow for airfoils
- gain Knowledge about boundary layer theory

TEXT BOOKS

1. Anderson, J.D., 'Fundamentals of Aerodynamics', Fifth Edition, McGraw-Hill Book Co., New York, 2012.
2. Houghton E L, P. W. Carpenter, Steven H. Collicott, and Daniel T. Valentine, 'Aerodynamics for Engineering Students', Sixth Edition, Butterworth-Heinemann, 2012.
3. Clancy, L.J., 'Aerodynamics', Pitman, 1986.

REFERENCES

1. Kuethe A M and C-Y Chow, 'Foundations of Aerodynamics: Bases of Aerodynamic Design', Fifth Edition, Wiley, 1997.
2. Theodore A. Talay, 'NASA's Flight Aerodynamics Introduction', NASA, 2013.
3. Alan Pope, 'Basic Wing and Airfoil Theory', Dover Publications, 2009.
4. John J. Bertin and Russell M. Cummings, 'Aerodynamics for Engineers', Sixth Edition, Pearson, 2013.
5. Ira H. Abbott and Albert E. Von Doenhoff, 'Theory of Wing Sections', Dover Publications Inc., 1960.

WEB LINKS

1. <http://nptel.ac.in/courses/101105059/>
2. <http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005/lecture-notes/>

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	3	2	-	-	-	-	-	-	2	3	2
CO2	2	3	1	3	2	-	2	-	-	-	-	2	3	2
CO3	2	3	2	2	3	2	-	-	-	-	-	2	2	2
CO4	-	2	2	3	2	2	-	-	-	-	-	2	3	
CO5	2	3	2	3	3	3	2	-	-	-	-	2		



COURSE OBJECTIVES

To enable the students to

- introduce basic concepts and salient features of engine components of jet propelled engines which are operated in atmosphere to students.
- familiarize with jet propulsion components and its methods.
- understand the performance and types of combustion chambers and nozzles.
- study about the details of compressor of Jet propulsion and hypersonic propulsion
- infer about the working of Turbines and its applications

UNIT I FUNDAMENTALS OF AIR BREATHING ENGINES 15

Classification of gas turbines – open cycle and closed cycle turbines, efficiencies - illustration of working of gas turbine engine – the thrust equation – factors affecting thrust – effect of pressure, velocity and temperature changes of air entering compressor – methods of thrust augmentation – characteristics of turboprop, turbofan and turbojet – performance characteristics.

UNIT II INLETS FOR JET ENGINES 15

Internal flow and Stall in subsonic inlets – relation between minimum area ratio and external deceleration ratio – diffuser performance – supersonic inlets – starting problem on supersonic inlets – shock swallowing by area variation – **Numerical problems.**

UNIT III COMBUSTION CHAMBERS AND NOZZLES 15

Classification of combustion chambers – combustion chamber performance – effect of operating variables on performance – flame stabilization real flow in nozzles and nozzle efficiency – losses in nozzles – equilibrium flow and frozen flow in nozzles- two phase flow in nozzles – ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces – thrust reversal- Numerical Problems

UNIT IV COMPRESSORS FOR JET ENGINES 15

Principle of operation of centrifugal compressor and axial flow compressor– Work done and pressure rise – velocity diagrams – degree of reaction – free vortex and constant reaction designs of axial flow compressor – performance characteristics of centrifugal and axial flow compressors

UNIT V TURBINES FOR JET ENGINES 15

Impulse and reaction blading of gas turbines – velocity triangles and power output – elementary theory – vortex theory – choice of blade profile, pitch and chord – estimation of stage performance – limiting factors in gasturbine design- overall turbine performance – methods of blade cooling – matching of turbine and compressor – **numerical problems.**

TOTAL: 75 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- identify the engine components of jet propelled engines
- analyze thermodynamics of an aircraft jet engine
- estimate the best possible engine performance
- assess the internal mechanisms of gas turbine engine components
- evaluate the operating characteristics of compressors and Turbines

TEXT BOOKS

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 2009.
2. James Award, "Aerospace Propulsion System", wiley,2010

REFERENCES

1. Cohen, H. Rogers, G.F.C. and Saravana muttoo, H.I.H. "Gas Turbine Theory", Longman, 2006.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, NewYork, 1985.
3. Rolls Royce, "Jet Engine", 5th Edition, Rolls Royce Technical Publications, 2015.
4. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 2010.
5. V. Ganesan, 'Gas Turbines', Third Edition, Tata McGraw-Hill, 2010.

WEB LINKS

1. <http://nptel.ac.in/courses/101101001/>
2. <http://www.nptelvideos.in/2012/11/jet-aircraft-propulsion.html>

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1 1	PSO1 2
CO1	2	3	2	3	2	2	3	-	-	-	2	2	3	2
CO2	-	3	1	2	2	1	-	-	-	-	3	2	3	2
CO3	-	3	2	2	3	3	-	-	-	-	3	3	2	2
CO4	-	2	2	3	2	3	2	-	2	-	3	2	3	2
CO5	-	3	2	3	3	3	2	-	2	-	2	2	3	2



COURSE OBJECTIVES

To enable the students to

- provide the students an understanding on the linear static analysis of determinate structures
- infer about the indeterminate aircraft structural components.
- learn about various energy methods and its applications
- study about the column and loading Functions
- offer the design process using different failure theories.

UNIT I STATICALLY DETERMINATE STRUCTURES 15

Analysis of plane truss – Method of joints – 3D Truss – Matrix Displacement method for Trusses – Simple beams, stiffened shear webs – Idealized beams: Torsional and shear loading – Numerical Problems.

UNIT II STATICALLY INDETERMINATE STRUCTURES 15

Composite beam – Clapeyron's Three Moment Equation – Moment Distribution Method – Numerical Problems.

UNIT III ENERGY METHODS 15

Strain Energy due to axial, bending and torsional loads – Castigliano's theorem for displacements and moments – Maxwell's reciprocal theorem, Unit load method – Application to beams, trusses, frames, rings, etc. – Numerical Problems.

UNIT IV COLUMNS 15

Columns with various end conditions – Euler's Column curve – Rankine's formula – Column with initial curvature – Eccentric loading – South well plot – Beam column – Numerical Problems.

UNIT V FAILURE THEORIES 15

Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum strain energy theory – Application to aircraft structural problems – Numerical Problems.

TOTAL: 75 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- differentiate statically determinate and indeterminate structures.
- calculate the response of statically indeterminate structures under various loading conditions.
- apply the reaction forces of structures using strain energy concept.
- create a structure to carry the given load.
- examine the structural failures using failure theories.

TEXT BOOKS

1. Donaldson, B.K., "Analysis of Aircraft Structures – An Introduction", McGraw-Hill, 2012.
2. Bruhn.E.F."Analysis and design of flight vehicle structures" Tri set of offset company, USA,1973.
3. Timoshenko, S., 'Strength of Materials', Vol. II, CBS Publishers,2004.

REFERENCES

1. Howard D. Curtis, 'Fundamentals of Aircraft Structural Analysis', McGraw Hill Higher Education Group, 1996.
2. Megson, T.H.G., 'Aircraft Structures for Engineering Students', Fifth Edition (Rev.), Butterworth-
3. Heinemann, 2012.. Bansal R.K, 'Strength of Materials', Laxmi Publications, New Delhi, 2012.
4. S. S. Bhavikatti, 'Strength of Materials', Third Edition, Vikas Publishing House Pvt. Ltd, 2009.
5. Peery, D.J., and Azar, J.J., 'Aircraft Structures', Second Edition, McGraw-Hill, 1993.

WEB LINKS

1. <http://www.nptelvideos.in/2012/11/structural-analysis-ii.html>
2. <http://www.nptel.ac.in/courses/112107146/34>

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	3	3	-	3	-	-	-	3	2	3	2
CO2	2	3	2	3	2	-	2	-	-	-	3	3	3	2
CO3	2	3	2	2	3	-	3	-	-	-	3	2	2	2
CO4	3	2	2	3	2	-	3	-	-	-	2	2	3	2
CO5	2	3	2	1	3	3	2	-	-	-	3	2	3	2



COURSE OBJECTIVES

To enable the students to

- impart the knowledge of hydraulic and pneumatic systems components.
- study the Engines and its various control systems
- gain knowledge of advance control systems and its applications
- learn about the types of instruments and its operation including navigational instruments
- understand about the cockpit layout of a aircraft

UNIT I CONVENTIONAL AIRCRAFT SYSTEMS 9

Conventional flight control system – Hydraulic and Pneumatic systems – Electrical Power generation and distribution system – Environmental control system – De-icing and anti-icing systems – Landing gear system – Aircraft fuel systems.

UNIT II CONVENTIONAL ENGINE CONTROL SYSTEMS 9

Fuel systems of Piston engine and Jet engine – Main engine components and functions of jet engines – Engine lubrication systems – Accessory gear box and accessories driven – Engine starting system – Main and After burner fuel control systems – Thrust reversing and Thrust vector control.

UNIT III ADVANCED TECHNOLOGY SYSTEMS 9

Autopilot system – Advanced flight control systems – Flight Management System – Communication and Navigation systems – Radar and weapon control systems – Full Authority Digital Engine Control (FADEC) system.

UNIT IV AIRCRAFT INSTRUMENTS 9

Flight instruments, Navigation and Communication instruments, Gyroscope, Accelerometers, Airspeed indicator, Mach meter, Electronic horizontal situation indicator, Horizontal situation indicator, Multi Function Display, Attitude director indicator, Primary Flight Display, Engine instruments and display – Operation and principles, Flight Data Recorder (FDR), Cockpit Voice Recorder (CVR).

UNIT IV COCKPIT LAYOUT 9

Ergonomic layout – Controls and Indications – Display systems – Self test and Built-In Test Equipment (BITE) – Cockpit air-conditioning and pressurization – Challenges posed by cockpit to the designer – Failure warning system.

THEORY: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

- compare the features of various flight control systems.
- describe the principle and working of different aircraft systems.
- analyze the performance of various aircraft engine systems.
- acquire and interpret data from various aircraft instruments.
- identify the various cockpit controls.

TEXT BOOKS

1. Pallett E H J, 'Aircraft Instruments – Principles and Applications', Second Edition, Longman House, 1981.
2. Pallett E H J and S. Coyle, 'Automatic Flight Control', Fourth Edition, Blackwell Science Ltd, 1993.
3. Irwin Treager, 'Aircraft Gas Turbine Engine Technology', Third Edition, McGraw- Hill, 2013.

REFERENCES

1. James Powell, 'Aircraft Radio Systems', Shroff Publishers, 2006.
2. Ian Moir and Allan Seabridge, 'Aircraft Systems – Mechanical, electrical and avionics subsystems integration', Second Edition, Professional Engineering Publishing Limited, 2001.
3. Ian Moir, Allan Seabridge and Malcolm Jukes, 'Civil Avionics Systems', Second Edition, Wiley, 2013.
4. "General Hand Book of Airframe and Powerplant Mechanics", U.S.Dept. of Transportation, Federal Aviation Administration, English Book Store, New Delhi, 1995.
5. Mike Tooly and David Wyatt, 'Aircraft Communications and Navigation Systems: Principles, Maintenance and Operation', Butterworth-Heinemann's Series, 2007.

WEB LINKS

1. <http://www.niuniv.com/NIUWeb/qbank/EVEN%20SEM/BE%20Aero/AE211.pdf>
2. http://www.faa.gov/regulations_policies/handbooks_manuals/aircraft/amt_airframe_handbook/media/ama_ch10.pdf

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	3	2	-	3	-	-	-	-	-	2	3	2
CO2	2	2	2	2	-	2	-	-	-	-	-	2	3	2
CO3	3	1	2	2	3	2	-	-	-	-	-	2	2	2
CO4	2	2	3	2	2	2	-	-	-	-	-	2	3	2
CO5	2	2	2	2	3	3	-	-	-	-	-	2	3	2



COURSE OBJECTIVES

To enable the students to

- familiarize the students in basic aerodynamics and use of wind tunnels.
- familiarize the calibration of wind tunnel
- impart the knowledge of wind tunnel balance
- learn about the different airfoil lift and drag

LIST OF EXPERIMENTS

1. Flow visualization in water flow channel
2. Flow visualization in smoke tunnel
3. Plot of RPM Vs test section velocity in a subsonic wind tunnel.
4. Pressure distribution over circular cylinder.
5. Pressure distribution over airfoil and estimation of CL and CD.
6. Force measurement using wind tunnel balance.
7. Determination of lift for the given airfoil section
8. Pressure distribution over a smooth circular cylinder.
9. Pressure distribution over a rough circular cylinder.
10. Pressure distribution over a symmetric aerofoil.
11. Pressure distribution over a cambered aerofoil.
12. Flow visualization studies in subsonic flows
13. Surface and Flow Pattern Visualization

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

- use the fundamental aerodynamic principle in aircraft application.
- operate the wind tunnel for various models
- gain knowledge of Lift, Drag and Pressure Relation
- analyze the Pressure distribution around various models

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	-	-	3	-	-	-	2	2	-	2	3	
CO2	-	3	2	-	2	3	3	-	2	-	2	2		
CO3	-	-	-	3	3	3	3	-	3	3	-	2		
CO4	1	3	-	-	2	-	-	-	-	3	-	2	3	2



COURSE OBJECTIVES

To enable the students to

- experiment the load deflection characteristics of structural materials under different types of loads.
- familiarize with reciprocal theorem
- acquaint with mechanical properties of thin cylinder internal pressure
- practically understand the principle of superposition

LIST OF EXPERIMENTS

1. Determination of Young's modulus of steel using mechanical extensometers.
2. Determination of Young's modulus of aluminum using electrical extensometers
3. Determination of fracture strength and fracture pattern of ductile and brittle materials
4. Determination of forces in statically indeterminate force system.
5. Deflection of beams with various end conditions.
6. Verification of Maxwell's Reciprocal theorem & principle of superposition
7. Column – Testing
8. South – well's plot.
9. Testing of Riveted Joints.
10. Determination of membrane stresses in a thin cylinder under internal pressure.

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

- know the strength of rivet and thin cylinder
- find the properties of different materials
- gain Knowledge of stress variation in the deflected materials
- understand the different between column beam

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	-	2	-	-	-	2	-	2	-	3	2
CO2	2	3	2	-	3	-	3	-	3	-	3	-	3	2
CO3	2	3	3	-	2	-	-	-	3	-	3	-	2	2
CO4	2	3	3	-	2	-	3	-	2	-	3			



COURSE OBJECTIVES

To enable the students to

- develop skill to use software to create 2D and 3D models.
- train the students about the different types of operation by using CNC.
- teach the student to design the layout of control system and engine components
- design the different welding joints by using software.

LIST OF EXPERIMENTS

1. Design and modeling of rectangular plate with hole.
2. Design and modeling of spar components.
3. Design and modeling of aerofoil sections.
4. Design and modeling of cut section for wings.
5. Design and modeling of machine component.
6. Design and modeling of bulk head.
7. Design and analysis of a truss.
8. Design and analysis of beam distributed load.
9. Facing and Turning (Taper, Step) operations in CNC.
10. Drilling operations in CNC.

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

- design and model difficult aero component
- perform structural analysis using available software packages
- understand the concept of CNC machine design
- know the designing importance of the model for CNC machine

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	-	3	-	-	-	-	-	-	2	3	3
CO2	1	2	2	-	1	-	-	-	-	-	-	2	3	2
CO3	1	2	2	-	3	-	-	-	-	-	-	2	2	3
CO4	1	2	2	1	3	-	-	-	-	-	-	2	2	3

