OBJECTIVES:

- To enable students to develop their basic communication skills.
- To help students acquire their ability to speak effectively in real life situations.
- To inculcate the habit of reading and to develop their effective reading skills.
- To ensure that students use dictionary to improve their active and passive vocabulary.
- To enable students to improve their lexical, grammatical and communicative competence.

INTENDED OUTCOMES:

Students undergoing this course will be able to

- Use English language for communication: written & spoken.
- Enrich comprehension and acquisition of speaking & writing ability.
- Gain confidence in using English language in real life situations.
- Improve word power: lexical, grammatical and communication competence.

Unit I (9)

**Listening** – Types of listening - Listening to class reading - Video tapes/ Audio tapes. **Speaking** – Introduction on self - Introduction on one’s friend. **Reading** - Reading for comprehension – Reading different kind of passages like descriptive, narrative, objective, conversational and argumentative.

**Writing** – Free writing on any topic –My favorite place, hobbies, dreams, goals, etc - Writing short messages - To fill in different application forms. **Grammar** – Articles - WH questions –Yes/No Question - Subject Verb agreement. **Vocabulary** - Word Formation – Word expansion (Root word) - Prefix and Suffix.

Unit II (10)


Unit III (10)


Unit IV (8)

**Listening** – Responding to questions – Reading in class for complete understanding and for better pronunciation. **Speaking** – Debate- Presentations in seminars. **Reading** – Making inference from the reading passage – Predicting the content of reading passages. **Writing** - Interpreting visual materials (tables, graphs, charts, etc) – Formal and Informal letters. **Grammar** – Sentence pattern – Voice (active and passive voice). **Vocabulary** – One word substitution.
Unit V


Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

Total-45

TEXT BOOK:

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<td>1</td>
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WEBSITES:

- [www.learnerstv.com](http://www.learnerstv.com) – Listening/Speaking/Presentation
- [www.usingenglish.com](http://www.usingenglish.com) – Writing/Grammar
- [www.englishclub.com](http://www.englishclub.com) – Vocabulary Enrichment/Speaking
- [www.ispeakyouspeak.blogspot.com](http://www.ispeakyouspeak.blogspot.com) – Vocabulary Enrichment/Speaking
- [www.teachertube.com](http://www.teachertube.com) – Writing Technically
OBJECTIVES:

- To develop analytical skills for solving different engineering problems.
- To understand the concepts of Matrices, sequences and series.
- To solve problems by applying Differential Calculus and Differential equations.

INTENDED OUTCOMES:

The student will be able to
- apply advanced matrix knowledge to Engineering problems.
- improve their ability in solving geometrical applications of differential calculus problems
- solve engineering problems involving hyperbolic functions, Beta and Gamma functions
- expose the concept of sequences and series

UNIT I MATRICES  (12)

UNIT II DIFFERENTIAL CALCULUS  (12)
Overview of Derivatives - Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes- Evolutes as Envelope of normals – Maxima and Minima of functions of two or more Variables – Method of Lagrangian Multipliers

UNIT III SEQUENCES AND SERIES  (13)

UNIT IV HYPERBOLIC FUNCTIONS, BETA AND GAMMA FUNCTIONS  (12)
Hyperbolic functions: Hyperbolic functions and Inverse Hyperbolic functions – Identities – Real and imaginary parts – solving problems using hyperbolic functions.


UNIT V DIFFERENTIAL EQUATIONS  (11)
Linear Differential equations of second and higher order with constant coefficients - Euler’s form of Differential equations – Method of variation parameters.

Total: 60
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</table>

### WEBSITES:

1. www.efunda.com
2. www.mathcentre.ac.uk
3. www.intmath.com/matrices-determinants
OBJECTIVE:
- To enhance the fundamental knowledge in Physics and its applications relevant to various branches of Engineering and Technology

INTENDED OUTCOME:
- The students will have the knowledge on the basics of physics related to properties of matter, fiber optics, quantum, crystal physics and that knowledge will be used by them in different engineering and technology applications

UNIT I PROPERTIES OF MATTER AND THERMODYNAMICS (9)
Three types of modulus of elasticity – basic definitions, relation connecting the modulii (Derivation), poison ratio- Torsional pendulum- bending of beams- bending moment – basic assumption of moment – uniform and non uniform bending
Concept of entropy- change of entropy in reversible and irreversible processes – refrigeration.

UNIT II LASER AND FIBER OPTICS (9)
Introduction – emission and absorption process- Einstein’s coefficients derivation. Types of LASER - CO2, Semiconductor LASER- Applications of LASER in industry and medicine.
Total internal reflection – modes of propagation of light in optical fibers – numerical aperture and acceptance angle – derivations, types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram)

UNIT III QUANTUM PHYSICS (9)
Introduction to quantum theory – Compton effect- dual nature of matter and radiation – de Broglie wavelength, uncertainty principle – physical significance of wave function, Schrödinger’s wave equation – time dependent and time independent equations – particle in one dimensional box- scanning electron microscope.

UNIT IV CRYSTAL PHYSICS (9)
Lattice – unit cell – Bravais lattice – lattice planes – Miller indices – calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures-crystal defects – point, line and surface defects

UNIT V ULTRASONICS AND NUCLEAR PHYSICS (9)
Production of ultrasonics by piezoelectric method – Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

Total- 45
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### WEBSITES:

- [www.nptel.ac.in](http://www.nptel.ac.in)
- [www.physicsclassroom.com](http://www.physicsclassroom.com)
- [www.oyc.yale.edu](http://www.oyc.yale.edu)
- [www.physics.org](http://www.physics.org)
OBJECTIVES:

- To understand about the water technology.
- To get the information on electrochemical cells, batteries, fuels and combustion.
- To study about the corrosion and protective coatings.
- To gain knowledge on adsorption phenomena.

INTENDED OUTCOME:

- This course will create an impact on the students and make them to realize the modern utility on electrochemical cells, batteries, fuels and combustion process, corrosion and adsorption methods.

UNIT I WATER TECHNOLOGY (9)

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES (9)

UNIT III FUELS AND ROCKET PROPELLANTS (9)

UNIT IV CORROSION SCIENCE (9)
Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings - Paints - Constituents and functions – Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating and Hot dipping.

UNIT V SURFACE CHEMISTRY (9)

Total: 45
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WEBSITES:

5. http://www.chem.qmul.ac.uk/surfaces/sec
OBJECTIVES:

- To impart the basic knowledge about the Electric circuits.
- To understand the working of various Electrical Machines.
- To know about various measuring instruments.
- To understand the basic concepts in semiconductor devices and digital electronics.

INTENDED OUTCOME:

- The students shall develop an intuitive understanding of the circuit analysis, basic concepts of electrical machines, basics of electronics and be able to apply them in practical situation

UNIT I ELECTRIC CIRCUITS


UNIT II ELECTRICAL MACHINES


UNIT III MEASURING INSTRUMENTS

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS


UNIT V DIGITAL ELECTRONICS

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counter – A/D and D/A Conversion (single concepts)

Total: 45
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<td>2</td>
<td>Sedha R.S</td>
<td>Applied Electronics</td>
<td>S. Chand &amp; Co</td>
<td>2006</td>
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<td>3</td>
<td>Premkumar N</td>
<td>Basic Electrical Engineering</td>
<td>Anuradha Publishers</td>
<td>2003</td>
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</table>
ENGINEERING PHYSICS

OBJECTIVE:
- To develop basic laboratory skills and demonstrating the application of physical principles.

INTENDED OUTCOME:
- The students will have the knowledge on Physics practical experiments and that knowledge will be used by them in different engineering and technology applications.

LIST OF EXPERIMENTS – PHYSICS
1. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of Young’s modulus of the material – Non uniform bending or Uniform bending.
5. Spectrometer Dispersive power of a prism.
7. Particle size determination using Diode Laser
10. Determination of thickness of a thin wire – Air wedge method
11. Determination of Band Gap of a semiconductor material.
12. Determination of Specific resistance of a given coil of wire – Carey Foster Bridge

ENGINEERING CHEMISTRY

OBJECTIVE:
- To provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.

INTENDED OUTCOME:
- The students will be outfitted with hands-on knowledge in quantitative chemical analysis of water quality parameters and corrosion measurement.

LIST OF EXPERIMENTS - CHEMISTRY
1. Estimation of alkalinity of Water sample.
2. Estimation of hardness of Water by EDTA
3. Estimation of chloride in Water sample (Argentometric method)
4. Determination of corrosion rate by weight loss method.
5. Conductometric Titration (Simple acid base).
6. Conductometric Titration (Mixture of weak and strong acids).
7. Conduct metric Titration using BaCl₂ vs Na₂SO₄.
8. pH Titration (acid & base).
9. Potentiometric Titration (Fe²⁺ / KMnO₄ or K₂Cr₂O₇).
10. Estimation of Ferric iron by Spectrophotometry.
11. Determination of water of crystallization of a crystalline salt (Copper sulphate).
12. Determination of molecular weight and degree of polymerization using Viscometry.
OBJECTIVE:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

INTENDED OUTCOMES:

- To provide exposure to the students with hands on experience on various basic Engineering practices in Civil and Mechanical Engineering
- To provide exposure to the students with hands on experience on various basic Engineering practices in Electrical and Electronics Engineering.

PART – A (CIVIL & MECHANICAL)

1. WELDING (6)
   i. Preparation of arc welding of butt joints, lap joints and tee joints.

2. BASIC MACHINING (6)
   i. Simple Turning and Taper turning
   ii. Drilling and Tapping

3. SHEET METAL WORK (6)
   i. Model making – Trays, funnels, etc.

4. DEMONSTRATION ON (4)
   i. Smithy operations
   ii. Foundry operations
   iii. Plumbing Works
   iv. Carpentary Works

PART – B (ELECTRICAL & ELECTRONICS)

5. ELECTRICAL ENGINEERING (10)
   i. Study of electrical symbols and electrical equipments.
   ii. Construct the wiring diagram for Stair case wiring and Fluorescent lamp wiring.
   iii. Construct the wiring diagram for Residential house wiring using switches, fuse, indicator, lamp and energy meter.
   iv. Measurement of electrical quantities – voltage, current, power & power factor in R load.
   v. Measurement of energy using single phase energy meter.

6. ELECTRONICS ENGINEERING (13)
   i. Study of Electronic components– Resistor (color coding), capacitors and inductors.
   ii. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
   iii. Study of logic gates AND, OR, NOT, NOR and NAND.
   iv. Study of HWR and FWR.

TOTAL: 45
REFERENCES

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

INTENDED OUTCOMES:

- To introduce the basic concepts and the use of engineering drawing in the design and manufacturing field.
- To develop graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings

UNIT I

INTRODUCTION

(3 + 10)

Introduction to Engineering Drawing, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning– linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

UNIT II

SCALES AND PLANE CURVES

(3 + 10)

SCALES: Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conics – Construction of Ellipse, Parabola and Hyperbola by eccentricity method

UNIT III

FREE HAND SKETCHING

(3 + 12)

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 IV

PROJECTION OF POINTS, LINES AND PLANE SURFACES

(3 + 12)

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Traces–Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT V

PROJECTION OF SOLIDS

(3 + 12)

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

Introduction to Drafting Software/Package (Not for Exam)

(4)

Basic operation of drafting packages, use of various commands for drawing, dimensioning, editing, modifying, saving and printing/plotting the drawings. Introduction to 3D primitives.

TOTAL: 75

TEXT BOOKS


REFERENCES


WEB REFERENCES

5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods
OBJECTIVE:

- To know the value of being a human being and the value of being a useful citizen.

INTENDED OUTCOME:

- Educate the values and meaning of life in the young minds and to transform them as responsible citizens.

UNIT – I:

Human life on Earth - Concept of Human Values - Value Education - Aim of education and value education - Types of values - Components of values – Attitudes – types of attitudes

UNIT – II:

Self Development : Self analysis – Goal Setting - Thought Analysis – Guarding against Anger - Respect to age, experience, maturity, family members, neighbors, co-workers

UNIT – III:


UNIT – IV:

Mind Culture - Modern Challenges of Adolescent - Emotions and behavior - Sex and spirituality - Adolescent Emotions - Meditation

UNIT - V:

Body and Mind Fitness : (a) Physical Exercises (b) Activities: (i) Moralization of Desires (ii) Neutralization of Anger (iii) Eradication of Worries (iv) Benefits of Blessings.

Total: 20

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<tr>
<td>1</td>
<td>Subramanian. R</td>
<td>Professional Ethics</td>
<td>Oxford, New Delhi</td>
<td>2013</td>
</tr>
<tr>
<td>3</td>
<td>Tripathi. A.N</td>
<td>Human Values</td>
<td>New Age International</td>
<td>2009</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To motivate learners to acquire listening & speaking skills in both formal and informal context.
- To focus on question forms & to make them understand the importance of using question tags and also the functional use of transformation of sentences.
- To improve their reading habit and to train them in critical and analytical reading.
- To equip them to write for academic as well as work place context.
- To enable students to face interviews.

INTENDED OUTCOMES:
Students undergoing this course will be able to

- Acquire second language: speaking convincingly, expressing their opinions clearly, negotiating and arguing using appropriate communicative strategies.
- Enhance them reading texts critically and analytically.
- Develop writing effectively, persuasively and producing different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Enrich the ability to face interviews with confidence.

UNIT-1 (10)


UNIT-II (8)


UNIT – III (9)


UNIT-IV (8)

UNIT- V


**Vocabulary** - Collection of Technical Vocabularies with their meanings.

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

**Total-45**

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**WEBSITES:**

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- [www.usingenglish.com](http://www.usingenglish.com) – Writing/ Grammar
- [www.englishclub.com](http://www.englishclub.com) – Vocabulary Enrichment/ Speaking
- [www.ispeakyouspeak.blogspot.com](http://www.ispeakyouspeak.blogspot.com) – Vocabulary Enrichment/ Speaking
- [www.teachertube.com](http://www.teachertube.com) – Writing Technically
OBJECTIVES:

- To understand the concepts and applications of partial differential equations
- To have knowledge in integral calculus and Vector calculus
- To expose to the concept of Analytic function and Complex integration.

INTENDED OUTCOMES:

The student will be able to

- solve problems in Fluid Dynamics, Theory of Elasticity, heat and mass transfer etc.
- find the areas and volumes using multiple integrals
- improve their ability in Vector calculus
- expose to the concept of Analytical function.
- apply Complex integration in their Engineering problems

UNIT- I PARTIAL DIFFERENTIAL EQUATIONS (11)
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange’s linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT-II MULTIPLE INTEGRALS (11)
Double integral – Cartesian coordinates – Polar coordinates – Change of order of integration – Triple integration in Cartesian co-ordinates – Area as double integrals.

UNIT-III VECTOR CALCULUS (13)
Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green’s theorem, Gauss divergence theorem and Stoke’s theorems (Statement Only)- Surfaces : hemisphere and rectangular parallelopipeds.

UNIT-IV ANALYTIC FUNCTIONS (12)
Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms – Sufficient condition for an analytic function (Statement Only) - Properties of analytic functions – Constructions of an analytic function - Conformal mapping: w = z+a, az, 1/z, z² and bilinear transformation.

UNIT-V COMPLEX INTEGRATION (13)
Complex Integration - Cauchy’s integral theorem and integral formula (Statement Only) – Taylor series and Laurent series - Residues – Cauchy’s residue theorem (Statement Only) - Applications of Residue theorem to evaluate real integrals around unit circle and semi circle (excluding poles on the real axis).

Total : 60
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2. [www.mathcentre.ac.uk](http://www.mathcentre.ac.uk)
3. [www.sosmath.com/diffeq/laplace/basic/basic.html](http://www.sosmath.com/diffeq/laplace/basic/basic.html)
4. [www.mathworld.wolfram.com](http://www.mathworld.wolfram.com)
OBJECTIVE:

- To enrich the understanding of various types of materials and their applications in engineering and technology

INTENDED OUTCOME:

- The students will have the knowledge on different types of materials and that knowledge will be used by them in different engineering and technology applications

UNIT I CONDUCTING MATERIALS

UNIT II SEMICONDUCTING MATERIALS

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS

UNIT IV DIELECTRIC MATERIALS

UNIT V ADVANCED MATERIALS

Total- 45
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WEBSITES:

1. www.nptel.ac.in
2. www.physicsclassroom.com
3. www.oyc.yale.edu
4. www.physics.org
OBJECTIVES:

- To give a comprehensive insight into natural resources, ecosystem and biodiversity.
- To educate the ways and means of the environment
- To protect the environment from various types of pollution.
- To impart some fundamental knowledge on human welfare measures.

INTENDED OUTCOME:

- Students will prepare themselves to go ecofriendly and help preserving the nature and environment.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES (9)
Definition, Scope and Importance – Need for public awareness -Forest resources: Use and over-exploitation, deforestation- Water resources-Use and over-utilization of surface and ground water, floods, drought, conflicts over water- Land resources-Land as a resource, land degradation, man induced landslides, soil erosion and desertification –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources- Food resources-World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture- Energy resources-Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources- role of an individual in conservation of natural resources.

UNIT II ECOSYSTEM (9)
Chemistry and Environment- Environmental segments, Composition and Structure of atmosphere- Concept of an ecosystem- Structure, components and function of an ecosystem Energy flow in the ecosystem – Food chain, Food web and Ecological pyramids, Structure and function of Terrestrial ecosystem (Forest, Desert and Grassland ecosystem) and Aquatic ecosystem (Fresh water and Marine ecosystem)

UNIT III BIODIVERSITY (9)
Introduction to biodiversity, Definition- Genetic diversity, Species diversity and Ecosystem diversity, Biogeographical classification of India, Importance of biodiversity-Value of biodiversity - Hot Spots of biodiversity-Threats to biodiversity - Endangered and Endemic Species of India – Conservation of biodiversity- In-Situ and Ex-Situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION (9)
Definition – causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution and Thermal pollution. Solid waste management-causes, effects and control measures of urban and industrial wastes- Role of an individual in prevention of pollution– Disaster management-earthquake, tsunami, cyclone and landslides.

UNIT V SOCIAL ISSUES AND ENVIRONMENT (9)

Total: 45
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<td>Dr. Ravikrishnan, A</td>
<td>Environmental Science</td>
<td>Sri Krishna Hi tech Publishing Company Private Ltd., Chennai</td>
<td>2012</td>
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<td>2.</td>
<td>Anubha kaushik</td>
<td>Environmental Science</td>
<td>New Age International (P) Ltd., New Delhi.</td>
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</table>

### WEBSITES:

1. [http://people.eku.edu/ritchisong/envscinotes1.html](http://people.eku.edu/ritchisong/envscinotes1.html)
2. [http://nptel.ac.in/courses.php?disciplineId=120](http://nptel.ac.in/courses.php?disciplineId=120)
OBJECTIVES:
- To give students practice in applying their knowledge of mathematics, science, and engineering and to expand this knowledge into the vast area of “rigid body Mechanics”.
- To enhance students’ ability to design by requiring the solution of open ended problems.
- To prepare the students for higher level courses such as courses in Mechanics of Solids, Mechanical Design and Structural Analysis.

INTENDED OUTCOMES:
- To study the principles involved in Engineering Mechanics.
- To understand the Statics of particles and rigid bodies
- To study the principles involved in Friction and kinematics of particles.

UNIT I  STATICS OF PARTICLES (12)
Forces – system of forces - concurrent forces in plane and space- resultant - problems involving the equilibrium of a particle-free body diagram-equilibrium of particle in space.

UNIT II  STATICS OF RIGID BODIES IN TWO DIMENSIONS (12)
Rigid bodies-two dimensional structure-moment of force about an axis-moment of a couple-equivalent system of coplanar forces-Rigid body in equilibrium-problems involving equilibrium of rigid body-types of supports-reactions of beams and frames.

UNIT III  CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA (12)
Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.

UNIT IV  KINEMATICS OF PARTICLES (12)
Introduction-plane, rectilinear motion - time dependent motion-rectangular coordinates-projectile motion.


UNIT V  FRICTION (12)
Laws of friction-coefficient of friction-problems involving dry friction- wedge and ladder friction.

Total: 60
### TEXT BOOKS:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
<th>TITLE OF THE BOOK</th>
<th>PUBLISHER</th>
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</tr>
</thead>
</table>
OBJECTIVES:
- Identify and understand the working of key components of a computer system.
- Identify and understand the various kinds of input-output devices and different types of storage media commonly associated with a computer.
- Understand, analyze and implement software development tools like algorithm, pseudo codes and programming structure.
- Study, analyze and understand logical structure of a computer program, and different constructs to develop a program in ‘C’ language.

INTENDED OUTCOMES:
- Write small programs related to simple/moderate mathematical and logical problems in ‘C’.
- Study, analyze and understand simple data structures and how to use it in C language.
- Identify and understand the working of different operating systems like windows and Linux etc.

UNIT I OVERVIEW OF COMPUTER (8)

UNIT II OVERVIEW OF ‘C’ (8)
Algorithms-Representation of Algorithms-Flowchart- Introduction to programming Languages-What is C- C Character set- Constants, Variables and Keywords-General form of C Program-The First C Program-Data types-Arithmetic Instructions- Type conversions- Relational and Logical Operators-Hierarchy and associativity

UNIT III SELECTION AND ITERATION (9)
Selection Structures- If and nested if - Loops-Definition and types-While loop-for loop- do-while loop- break and continue- Nested loops- Advantages of iteration-Menu driven programs-Switch Case

UNIT IV FUNCTIONS (10)
Functions- Definition-types-Functions without arguments- Functions with Input arguments- Functions with output parameters-local and global variables- advantages of functions- Call by value and Call by reference-Recursion- Function as an argument

UNIT V ARRAYS AND STRINGS (10)
Arrays-definition- Declaring and referencing arrays- Array initialization- Using for loops for accessing arrays-Passing array elements as function arguments-2D Array - Matrix Addition and multiplication-Introduction to Strings- declaration and Initialization--String constant -Strings as Array of Characters

Total : 45
REFERENCES:

OBJECTIVES:

- To familiarize with open source office packages
- To write programs for Understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings and Functions.

INTENDED OUTCOME:

- Study, analyze and understand logical structure of a computer program, and different construct to develop a program in ‘C’ language

LIST OF EXPERIMENTS

1. Working with word Processing, Spreadsheet and presentation software in Linux

2. Programming in Scratch:
   Practicing fundamental concepts of programming like sequence, selection decision statements, working of loops and event driven programming

3. C Programming:
   Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input and Output Formatting, Decision Statements, Switch Case, Control structures, arrays, Strings and function

Total: 45
OBJECTIVES:
- Students will have an ability to apply knowledge of Modeling, science & engineering.
- Students will understand the conventions and assembly concepts and drawing practices.
- Students will be able to convert sketches to engineered drawings.

INTENDED OUTCOME:
- Students will be able to understand the assembly concepts, fits and tolerances and solid modeling and various types of cam profile

UNIT I CONVENTIONS
Importance of sectional views, Code of practice for engineering drawing, drilled and tapped holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves, chamfers, fillet radii and keyways. Conventions to represent standard components-bolts, nuts, washers, screws, cotters, pins, circlips, bearings, gears, springs and flanges.

UNIT II ASSEMBLY CONCEPTS AND DRAWING PRACTICE

UNIT III FITS AND TOLERANCES
Limits, fits and tolerances-need, types, representation of tolerances on drawing, calculation of minimum and maximum clearances and allowances. Geometric tolerance-uses, types of form and position tolerances, symbols, method of indicating geometric tolerances on part drawings. Surface finish symbols- methods of indicating the surface roughness.

UNIT IV SOLID MODELING
Modelling of flange coupling, universal coupling, oldhams coupling, swivel bearing, stuffing box, knuckle joint, C clamp, plummer block, screw jack, simple drill jig.

UNIT V CAM PROFILE
Classifications, displacement diagrams-parabolic, uniform velocity, simple harmonic paths. Layout of plate cam profiles for different types of followers - knife - edged, roller, mushroom, flat type, derivatives of follower motion, pressure angle and undercutting.
TEXT BOOKS:

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<tr>
<td></td>
<td></td>
<td>Seventeenth Edition</td>
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<tr>
<td></td>
<td>Venkata Reddy K</td>
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<tr>
<td>2.</td>
<td>BIS</td>
<td>SP:46-2003</td>
<td>Engineering Drawing Practice for Schools and Colleges, New Delhi</td>
<td>2003</td>
</tr>
</tbody>
</table>
OBJECTIVE:

- To give a basic knowledge on biology to all the students from various academic backgrounds

INTENDED OUTCOMES:

- To understand the basics of biomolecules, human anatomy and physiology
- To have better understanding of advancements in biology

UNIT-I  BASICS OF CELL BIOLOGY  (4)

UNIT-II  BIOMOLECULES  (4)
Carbohydrates-Classification, Qualitative tests for sugars, Lipids-Definition, Classification; Proteins- classification and functions; Nucleic acids-basic structure; Hormones-definition, importance; Vitamins.

UNIT-III  HUMAN ANATOMY AND PHYSIOLOGY  (5)
Levels of Structural organization, the eleven systems of human body, central nervous system- cardiovascular system and immune system.

UNIT-IV  GENETICS AND GENETIC DISORDERS  (4)
History of genetics-Scope and Importance of genetics, Mendel and his work, DNA stores genetic information- gene mutation, disorders due to mutant genes.

UNIT-V  TECHNOLOGICAL ADVANCES IN BIOLOGY  (3)
Biopharmaceuticals, Gene therapy, genetically modified crops, probiotics.

Total: 20
### TEXT BOOK

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</thead>
</table>

### WEBSITE

OBJECTIVES:

- To hone the analytical skills in the minds of Engineers.
- To provide sound foundation in the mathematical fundamentals necessary to formulate, solve and analyze Engineering problems.
- To study the basic principles of different transforms and Partial Differential Equations.

INTENDED OUTCOMES:

- The students will have a lucid idea about Laplace, Fourier and Z-transforms.
- The Learners can equip themselves in the transform techniques.
- Better understanding in problems related to Heat conduction, communication systems, electro optics and electromagnetic theory, using the techniques will be learnt in this course.

UNIT-I  LAPLACE TRANSFORM  (13)

UNIT-II  FOURIER SERIES  (12)

UNIT-III  FOURIER TRANSFORM  (12)

UNIT-IV  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  (12)
Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded).

UNIT-V  Z-TRANSFORM AND DIFFERENCE EQUATIONS  (10)

Total : 60
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</table>

## WEBSITES:

1. [www.sosmath.com](http://www.sosmath.com)
2. [http://mathworld.wolfram.com/FourierSeries.html](http://mathworld.wolfram.com/FourierSeries.html)
3. [www.nptel.ac.in](http://www.nptel.ac.in)
OBJECTIVES:

- To understand nature of aerospace technologies.
- To understand various types of aerospace vehicles, satellites and their applications,

UNIT I  INTRODUCTION TO FLIGHT VEHICLES
Early airplanes, Rockets, Developments in aerodynamics, materials, structures and propulsion over the years. Introduction to Ramjet and Scramjet. Different types of flight vehicles and Classifications, Conventional Control and Powered controls, Basic instruments for flying.

UNIT II  INTRODUCTION TO PRINCIPLES OF FLIGHT

UNIT III  INTRODUCTION TO AIRPLANE STRUCTURES AND ENGINES
General types of construction, Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminum alloy, titanium, stainless steel and composite materials. Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production.

UNIT IV  INTRODUCTION TO ROCKETS AND SPACE
Principles of operation of rocket, types of rockets and typical applications, Exploration into space. Satellite Missions and introduction to orbital dynamics, Different types of satellites and their applications, Spacecraft configurations: structures, Systems and subsystems identifications and functions of each, Spacecraft environment.

UNIT V  INTRODUCTION TO FLIGHT-TESTING
Purpose and Scope of Flight Testing, Types of Wind Tunnels, airport layout and terminologies. Introduction to aerospace industries – Research and Development organizations and Academic institutions in India and worldwide.
**TEXT BOOKS:**

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<thead>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Ben Senson, Jasen Ritter</td>
<td>Aerospace Engineering: From the Ground Up</td>
<td>Cengage Learning, United Kingdom</td>
<td>2011</td>
</tr>
<tr>
<td>2</td>
<td>Rudolph X. Meyer</td>
<td>Elements of Space Technology for Aerospace Engineers</td>
<td>Academic Press, Netherland</td>
<td>1999</td>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>Joseph N. Pelton</td>
<td>The Basics of Satellite Communications</td>
<td>International engineering Consortium, Chicago, USA</td>
<td>2003</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- Apply Mathematical foundations, principles in solving thermodynamics problems.
- Critically analyse the problem, and solve the problems related to heat transfer and propulsion.

UNIT I BASIC CONCEPT AND FIRST LAW
Concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics - concept of temperature and heat, internal energy, specific heat capacities, enthalpy - concept of ideal and real gases. First law of thermodynamics - applications to closed and open systems - steady flow processes with reference to various thermal equipments.

UNIT II SECOND LAW AND ENTROPY
Second law of thermodynamics – kelvin planck and clausius statements of second law. Reversibility and irreversibility - carnot theorems. carnot cycle, reversed carnot cycle, efficiency, COP - thermodynamic temperature scale - clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.

UNIT III THERMODYNAMIC AVAILABILITY AND AIR STANDARD CYCLES

UNIT IV PROPERTIES OF PURE SUBSTANCE AND POWER CYCLE

UNIT V BASICS OF PROPULSION AND HEAT TRANSFER
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.

(Use of standard thermodynamic tables, Mollier diagram and tables are permitted)
### TEXT BOOKS:

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<tbody>
<tr>
<td>1</td>
<td>Rayner Joel</td>
<td>Basic Engineering Thermodynamics</td>
<td>Addison Wesley, New York,</td>
<td>1996</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand the structure and the properties of the fluid.
- To understand and appreciate the complexities involved in solving the fluid flow problems.
- To understand the mathematical techniques already in vogue and apply them to the solutions of practical flow problems.
- To understand the importance of various types of flow in pumps and turbines

UNIT I  INTRODUCTION
Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT - II  FLOW THROUGH CIRCULAR CONDUITS

UNIT - III  CLASSIFICATION OF FLOWS AND DIMENSIONAL ANALYSIS
Classification of Flows: Uniform vs. non-uniform flows, steady vs. unsteady flows, stream function, streak line Dimension and units: Buckingham’s Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT - IV  PUMPS

UNIT - V  TURBINES
TEXT BOOKS:

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</table>

WEB REFERENCE:

www.springer.com › Home ›Materials › Mechanics
www.efunda.com/formulae/fluids/index.cfm
nptel.iitm.ac.in/video.php?subjectId=105101082
www.rgtudiploma.com/M02_4_sy.pdf
www.freebookcentre.net › Physics Books
OBJECTIVES:

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy, potential energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II  BEAMS - LOADS AND STRESSES

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

UNIT III  TORSION

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

UNIT IV  BEAM DEFLECTION


UNIT V  ANALYSIS OF STRESSES IN TWO DIMENSIONS

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr’s circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.
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### WEB REFERENCE:

- www.engineersedge.com
- http://en.wikiversity.org
- www.globalsources.com
- www.clag.org.uk/beam.html
- nptel.iitm.ac.in/courses/IIT.../Strength_of_Materials/index.php

43
OBJECTIVES:
To develop the knowledge in testing the materials for hardness, fatigue, impact, tension and torsion.

LIST OF EXPERIMENTS

1. Tension test on metals-stress strain characteristics, ductility, resilience, toughness.
2. Hardness test on metals using Brinell Hardness tests.
3. Hardness test on metals using Rockwell Hardness tests.
4. Impact test on metals using Charpy impact tests.
5. Impact test on metals using Izod impact tests.
6. Shear test on metals-direct shear strength, single shear, double shear.
7. Tension Tests on helical springs.
8. Compression Tests on helical springs.
9. Torsion test on beams-torque and angle of twist characteristics, shear stress, modulus of rigidity.
10. Block Compression Test.
OBJECTIVES:
To Study the flow measurement and the performance of fluid machinery

LIST OF EXPERIMENTS

1) Determination of the Coefficient of discharge of given Orifice meter.
2) Determination of the Coefficient of discharge of given Venturi meter.
3) Calculation of the rate of flow using Rota meter.
4) Determination of friction factor for a given set of pipes.
5) Conducting experiments and drawing the characteristic curves of centrifugal pump
6) Conducting experiments and drawing the characteristic curves of submersible pump
7) Conducting experiments and drawing the characteristic curves of reciprocating pump.
8) Conducting experiments and drawing the characteristic curves of Gear pump.
9) Conducting experiments and drawing the characteristic curves of Pelton wheel.
10) Conducting experiments and drawing the characteristics curves of Francis turbine.
11) Flow visualization by Hele-shaw apparatus
OBJECTIVES:
To introduce the concept of design of basic structural components and to draft both manually and using modeling package.

LIST OF EXERCISES
1. Design of riveted joints (Lap joint).
2. Design of riveted joints (Butt joint with single and double straps).
3. Design of welded joints.
4. Layout of typical wing structure.
5. Layout of typical fuselage structure.
6. Introduction to 3D Modelling.
7. Computer aided modeling of typical aircraft wing.
9. Computer aided modeling of landing gear
10. Three view diagram of a typical aircraft
11. Layout of control systems

LIST OF EQUIPMENT
(For a batch of 30 students)

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Equipments</th>
<th>Quantity</th>
<th>Experiments No.</th>
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<tbody>
<tr>
<td>1.</td>
<td>Drawing Boards, Drafting machines</td>
<td>30</td>
<td>1 to 5</td>
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<td>2.</td>
<td>Computer</td>
<td>30</td>
<td>1 to 11</td>
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<td>3.</td>
<td>Solid Works</td>
<td>30 licenses</td>
<td>1 to 11</td>
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<tr>
<td>4.</td>
<td>CATIA</td>
<td>30 licenses</td>
<td>1 to 11</td>
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OBJECTIVES:

- To assist students to understand the role of thinking in all forms of communication.
- To help students with neutral accent.
- To guide students to read and comprehend articles from newspapers and magazines.
- To equip students with oral and appropriate written communication skills.
- To assist students with employability and job search skills.

INTENDED OUTCOMES:

Students undergoing this course will be able to

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Listen to/ view and comprehend different spoken discourses/ excerpts in different accents.
- Take national and international examination and enhance the performance at Placement Interviews.

UNIT - I ESSENTIALS OF COMMUNICATION

Communication: Definition-Process-Scope-Types- Barriers- Dyadic Communication exercises.

UNIT - II SPEECH PROCESS


UNIT - III ORAL COMMUNICATION

Distinguishing between Formal and Informal speech – Defining and Describing objects and people –Self Introduction – Extempore talk on a given topic - Asking questions politely, disagreeing politely in formal contexts – Speaking to a group - Giving oral presentations – Group discussion – Debates- Types of Interview.

UNIT - IV WRITTEN COMMUNICATION

Formal Reports - Project Proposals - Book reviews - Official Correspondence - Proof Reading & Editing.

UNIT – V ENGLISH FOR COMPETITIVE EXAMINATION

TEXT BOOK:

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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Anderson, Paul V</td>
<td>Technical Communication</td>
<td>Thomson and Wadsworth Publishers, USA.</td>
<td>2007</td>
</tr>
</tbody>
</table>

WEBSITES:

- www.learning-development.hr.toolbox.com – Unit-III- Oral Communication
- www.englishclub.com - Writing/ Grammar – Unit-IV
- www.ispeakyouspeak.blogspot.com - Vocabulary Enrichment/ Speaking – Unit-II
- www.teachertube.com - Writing Technically – Unit- V
OBJECTIVES:
To understand the behavior of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime.

UNIT - I REVIEW OF FLUID MECHANICS AND ELEMENTARY FLOW

UNIT - II TWO DIMENSIONAL FLOWS
Circulation and Vorticity, Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows. D’Alembert’s Paradox, Magnus effect, Kutta Joukowski’s theorem

UNIT - III CONFORMAL TRANSFORMATION

UNIT - IV AIRFOIL AND WING THEORY
Thin aerofoil theory and its applications. Vortex filament, Horse shoe vortex, Biot and Savart law, Prandtl’s classical lifting line theory, Limitations of Prandtl’s lifting line theory.

UNIT - V INTRODUCTION TO BOUNDARY LAYER THEORY
Newton’s law of viscosity, Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, energy thickness, boundary layer equations for a steady, two dimensional incompressible flow, boundary layer growth over a flat plate, Navier Strokes Equation, Blasius solution, basics of turbulent flow.
### TEXT BOOKS:

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### WEB REFERENCE:

- [www.beknowledge.com/.../review-of-basic-fluid-mechanics-concepts](http://www.beknowledge.com/.../review-of-basic-fluid-mechanics-concepts)
- [www.nasa.gov/audience/forstudents/.../what-is-aerodynamics-k4.html](http://www.nasa.gov/audience/forstudents/.../what-is-aerodynamics-k4.html)
- [www.ims.nus.edu.sg/Programs/wbfst/files/siva1.pdf](http://www.ims.nus.edu.sg/Programs/wbfst/files/siva1.pdf)
- [www.dynamicflight.com/aerodynamics/](http://www.dynamicflight.com/aerodynamics/)
- [www.scientistsandfriends.com/aerodynamics.html](http://www.scientistsandfriends.com/aerodynamics.html)
OBJECTIVES:
To understand the basic concepts of control system.

UNIT - I  INTRODUCTION
Historical review - Simple pneumatic, hydraulic and thermal systems, Series and parallel systems, Analogies - Mechanical and electrical components, Development of flight control systems.

UNIT - II  OPEN AND CLOSED LOOP SYSTEMS
Feedback control systems – Block diagram representation of control systems, Reduction of block diagrams, Output to input ratios, Signal flow graph.

UNIT - III  CHARACTERISTIC EQUATION AND FUNCTIONS
Laplace transformation, Response of systems to different inputs viz., Step input, impulse, ramp, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

UNIT - IV  CONCEPT OF STABILITY
Necessary and sufficient conditions, Routh – Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.

UNIT - V  SAMPLED DATA SYSTEMS
Introduction to digital control system, Digital Controllers and Digital PID Controllers.
### TEXT BOOKS:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
<th>TITLE OF THE BOOK</th>
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<tbody>
<tr>
<td>1.</td>
<td>Ogato</td>
<td>Modern Control Engineering</td>
<td>Prentice – Hall of India Pvt. Ltd. New Delhi.</td>
<td>2010</td>
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</table>

### WEB REFERENCE:

- [www.site.uottawa.ca/~rhabash/elg4152ln01.pdf](http://www.site.uottawa.ca/~rhabash/elg4152ln01.pdf)
- [www.gaugamela.net/control-ch1.pdf](http://www.gaugamela.net/control-ch1.pdf)
- [www.theorem.net/control.html](http://www.theorem.net/control.html)
OBJECTIVES:
To study the various materials used in the Aircraft applications and the different manufacturing processes involved in manufacturing of aerospace components.

UNIT - I AIRCRAFT MATERIALS, ALUMINIUM ALLOYS AND COMPOSITES

UNIT - II AIRCRAFT SUPERALLOYS, POLYMERIC MATERIALS, CERAMICS AND GLASS
General introduction to super alloys-Nickel based super alloys-Cobalt based super alloys and iron based super alloys-Heat treatment and surface treatment of super alloys- ceramics and applications- adhesives and sealants and their applications in aircraft-Aircraft fabrics and their applications

UNIT - III CASTING

UNIT - IV WELDING

UNIT - V METAL FORMING AND MACHINING PROCESSES
**TEXT BOOKS:**

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<tbody>
<tr>
<td></td>
<td>S.C.Keshu</td>
<td>Aircraft Production Technique</td>
<td>Interline publishing house Bangalore</td>
<td>1993</td>
</tr>
</tbody>
</table>

**WEB REFERENCE:**

www.protech-ie.com/
www.productiontechnology.co.uk/
itl.nist.gov/div898/handbook/ppc/ppc.htm
en.wikipedia.org/wiki/Welding
electrochem.cwru.edu/encycl/art-p04-metalpowder.htm
OBJECTIVES:
To study different types of beams and columns subjected to various types of loading and support conditions with particular emphasis on aircraft structural components.

UNIT - I  STATICALLY DETERMINATE STRUCTURES
Introduction to Beams, Columns, Truss and Frames - Analysis of plane truss – Method of joints – 3 D Truss - Plane frames

UNIT - II  STATICALLY INDETERMINATE STRUCTURES

UNIT - III  ENERGY METHODS
Strain Energy due to axial, bending and Torsional loads - Castigliano's theorem - Maxwell's Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.

UNIT - IV  COLUMNS
Columns with various end conditions – Euler's Column curve – Rankine's formula - Column with initial curvature - Eccentric loading – South well plot – Beam column.

UNIT - V  FAILURE THEORY
Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.
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</thead>
</table>
OBJECTIVES:
To understand the principles of operation and design of aircraft power plants.

UNIT - I  FUNDAMENTALS OF GAS TURBINE ENGINES

UNIT - II  SUBSONIC AND SUPersonic INLETS FOR JET ENGINES

UNIT - III  COMBUSTION CHAMBERS

UNIT - IV NOZZLES

UNIT - V  COMPRESSORS
Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of pre whirl, rotation stall and surge – Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.
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<th>YEAR OF PUBLICATION</th>
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</thead>
</table>

### WEB REFERENCE:

- www.free-ed.net/free-ed/aviation/avengines01.asp
- www.users.zetnet.co.uk/gas/combust.htm
- www.pilotfriend.com/training/flight.../jet_engine_components.htm
- www.grc.nasa.gov/WWW/k-12/airplane/nozzle.html
- www.engineeringtoolbox.com/air-compressor-types-d_441.html
OBJECTIVES:
To study experimentally the load deflection characteristics structural materials under different types of loads.

LIST OF EXPERIMENTS
1. Determination of Young’s modulus of steel using mechanical extensometers.
4. Stress Strain curve for various engineering materials.
5. Deflection of beams with various end conditions.
8. South – well’s plot.
10. Three point bending test.

LIST OF EQUIPMENT
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Equipment</th>
<th>Quantity</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 kN Universal Testing Machine</td>
<td>1</td>
<td>1,2,10</td>
</tr>
<tr>
<td>2</td>
<td>Beams with weight hangers and dial gauges</td>
<td>6</td>
<td>3,4,5,6,7</td>
</tr>
<tr>
<td>3</td>
<td>Column set up with dial gauges</td>
<td>2</td>
<td>8,9</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To introduce the scientific computing, covering some important aspects of solving algebraic equations, IVP, BVP.
- To implement the methods using the spreadsheet in Excel

INTENDED OUTCOMES:

- To develop analytical skills for solving different engineering problems.
- To understand the concepts of Matrices, sequences and series.
- To solve problems by applying Differential Calculus and Differential equations.

LIST OF EXPERIMENTS

1. Finding solution of Transcendental equation
   i) Newton – Raphson Method
   ii) Bisection method
   iii) Iterative method by reducing the equation to the form \( x = f(x) \)

2. Finding the dominant eigenvalue and eigenvector by power method

3. Numerical integration
   i) Gauss 2 point and 3 point formulae
   ii) Trapezoidal method
   iii) Simpson’s 1/3 rule

4. Solution of initial value problems governed by ODE
   i) Runge - Kutta 4th order method
   ii) Modified Euler’s method
   iii) Milne’s method
   iv) Adam – Bashforth method

5. Solution of BVP governed by PDE
   i) Laplace Equation
   ii) One – dimensional heat equation
      a) Explicit method : Bender – Schmidt’s method
      b) Implicit method : Crank - Nicolson’s method
   iii) One dimensional wave equation
       Implicit method

REFERENCES:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Author(s) Name</th>
<th>Title of the book</th>
<th>Publisher</th>
<th>Year of Publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Curtis F. Gerald and Patrick O. Wheatley</td>
<td>Applied Numerical Analysis</td>
<td>Pearson Education, South Asia</td>
<td>2009</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To study experimentally the basic aerodynamics on different bodies at low speeds.

LIST OF EXPERIMENTS

1. Calibration of wind tunnel.
2. Pressure distribution over smooth cylinder.
3. Pressure distribution over rough cylinder.
4. Pressure distribution over symmetric airfoils.
5. Pressure distribution over cambered airfoils.
6. Force measurement on symmetric airfoil using wind tunnel balance.
7. Force measurement on cambered airfoil using wind tunnel balance.
8. Force measurement on Stepped airfoil using wind tunnel balance.
9. Flow over a flat plate at different angles of incidence.
10. Flow visualization studies in low speed flows over cylinders.
11. Flow visualization studies in low speed flows over airfoil with different angle of incidence.

LIST OF EQUIPMENT
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Items</th>
<th>Quantity</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Wind Tunnel test section size around 300 x 300 mm with test section flow speed of 70 m/s.</td>
<td>1 No.</td>
<td>1-10</td>
</tr>
<tr>
<td>2.</td>
<td>Wings of various airfoil sections (Symmetrical &amp; cambered airfoils)</td>
<td>2 Nos. each</td>
<td>4,5,6,7,10</td>
</tr>
<tr>
<td>3.</td>
<td>Angle of incidence changing mechanism</td>
<td>1 No.</td>
<td>1-10</td>
</tr>
<tr>
<td>4.</td>
<td>Multiple Manometer stands with 20 – 30 manometer tubes</td>
<td>4 Nos.</td>
<td>2,3,4,5</td>
</tr>
<tr>
<td>5.</td>
<td>U-Tube Manometer</td>
<td>1 No.</td>
<td>2,3,4,5</td>
</tr>
<tr>
<td>6.</td>
<td>Static Pressure Probes</td>
<td>4 Nos.</td>
<td>2,3,4,5</td>
</tr>
<tr>
<td>7.</td>
<td>Total Pressure Probes</td>
<td>4 Nos.</td>
<td>2,3,4,5</td>
</tr>
<tr>
<td>8.</td>
<td>Pitot-Static Tubes</td>
<td>4 Nos.</td>
<td>2,3,4,5,6,7</td>
</tr>
<tr>
<td>9.</td>
<td>Wooden Models of Three Dimensional bodies (eg. Cylinder etc..)</td>
<td>2 Nos. each</td>
<td>2-7,10</td>
</tr>
<tr>
<td>10.</td>
<td>Wind Tunnel balances (3 or 5 or 6 components)</td>
<td>1 No.</td>
<td>6,7</td>
</tr>
<tr>
<td>11.</td>
<td>Pressure Transducers with digital display</td>
<td>1 No.</td>
<td>2,3,4,5</td>
</tr>
<tr>
<td>12.</td>
<td>Hele-Shaw apparatus</td>
<td>1</td>
<td>11</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To help students comprehend the role of listening skills in effective communication.
- To familiarize students with verbal and non-verbal communication.
- To expose students to neutral accent.
- To develop emotional intelligence skills in them for enhancing their self-esteem.
- To assist them in setting goals and developing positive attitude.
- To enable students to acquire decision making skills, problem solving skills and assertive skills.

INTENDED OUTCOMES:

Students undergoing this course will be able to

- Equip students of engineering and technology with effective speaking, writing and listening and reading skills in English.
- Develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- Equip students of engineering and technology with group discussion and other recruitment exercises.
- Use both verbal and non-verbal skills cohesively and develop confidence in participating in seminars, conferences, technical and extracurricular activities for lifelong learning.

UNIT - I  THE ART OF LISTENING

The art of listening - The importance of listening - The difference between listening and hearing - Barriers to listening - Remedies for listening problems - Listening through English.

UNIT - II  VERBAL AND NON-VERBAL COMMUNICATION

Non-verbal communication - Eye contact - Facial expressions - Posture - Gestures - Body language - Etiquette.

Verbal communication - Importance of voice modulation - Accent - Diction - Functional Grammar - Sentence construction - Effective vocabulary - Idioms - Phrases - Jargons - How to get others to listen to.

UNIT - III  INTRAPERSONAL AND INTERPERSONAL SKILLS

Intrapersonal skills - Self-analysis - Thought process - Understanding one’s potential and limitations - Developing problem solving skills - Ability to self-reflect - Self-control - Improving self-esteem.

Interpersonal skills - Confidence building - Resolving conflicts - Negotiation - Handling difficult people - Valuing diversity - Adaptability and Flexibility – Inter Cultural Communication.

UNIT - IV  GOAL SETTING AND POSITIVE ATTITUDE

Difference between goals and dreams - SMART goal setting - 3 Ds of goal setting - Determination, Discipline and Direction - Developing the right attitude - Motivation - Intrinsic and Extrinsic motivation - Dealing with change - Dedication - Taking responsibilities - Decision making.

UNIT - V  MANAGERIAL SKILLS

Analytical skills - Team Building - Leadership skills - Planning/organizing - Ability to work independently - Professional ethics - Preparing résumé - Writing covering letter - Communicating via e-mail.
**TEXT BOOK:**

<table>
<thead>
<tr>
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<th>YEAR OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gopalaswamy Ramesh &amp; Mahadevan Ramesh</td>
<td>The Ace of Soft Skills</td>
<td>Pearson Publication, Chennai</td>
<td>2014</td>
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</table>

**WEBSITES:**

- [www.englishclub.com](http://www.englishclub.com) – Art of Listening- Unit-I
- [http://tribehr.com/social-hr-software/talent-management/skills-tracking](http://tribehr.com/social-hr-software/talent-management/skills-tracking) - Unit-V
- [www.ispeakyouspeak.blogspot.com](http://www.ispeakyouspeak.blogspot.com) – Unit-II
- [https://alison.com/subjects/6/Personal-Development-Soft-Skills](https://alison.com/subjects/6/Personal-Development-Soft-Skills) - Unit-III, IV,& V
- [www.learning-development.hr.toolbox.com](http://www.learning-development.hr.toolbox.com) – Unit-V
OBJECTIVES:
To study the behavior of various aircraft structural components under different types of loads.

UNIT - I UNSYMMETRICAL BENDING
Introduction to Aero elasticity - Theory of Simple Bending – Bending moments – Bending stresses in beams of unsymmetrical sections – Bending of symmetric sections with skew loads - Determination of Principal Axes.

UNIT - II SHEARFLOW IN OPEN SECTIONS
Thin walled beams, Concept of shear flow, shear centre, Elastic axis – With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT - III SHEARFLOW IN CLOSED SECTIONS

UNIT - IV BUCKLING OF PLATES
Introduction to theory of plates & shells. Rectangular sheets under compression, Local buckling stress of thin walled sections, Crippling stresses by Needham’s and Gerard’s methods, Thin walled column strength. Sheet stiffener panels. Effective width, interrivet and sheet wrinkling failures.

UNIT - V STRESS ANALYSIS IN WING AND FUSELAGE
Loads on an aircraft – the V-n diagram – shear force and bending moment distribution over the aircraft wing and fuselage – shear flow in thin-webbed beams with parallel and non-parallel flanges – complete tension field beams – semi-tension field beam theory.
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</thead>
</table>
OBJECTIVES:
To understand the behavior of airflow both internal and external incompressible flow regime with particular emphasis on supersonic flows.

UNIT - I  ONE DIMENSIONAL COMPRESSIBLE FLOW
Introduction to compressible flow equations, Compressibility, velocity of sound, Adiabatic steady state flow equations, Flow through converging, diverging passages, Performance under various backpressures, Area mach number relation

UNIT - II  NORMAL, OBLIQUE SHOCKS AND EXPANSION WAVES

UNIT - III  DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS
Method of characteristics, design of supersonic nozzle contours, Small perturbation potential theory, solutions for supersonic flows, Mach waves and Mach angles, Prandtl-Glauert affine transformation relations for subsonic flows, Linearised two dimensional supersonic flow theory, Lift, drag pitching moment and center of pressure of supersonic profiles.

UNIT - IV  AIRFOIL IN HIGH SPEED FLOWS
Lower and upper critical Mach numbers, Lift and drag divergence, shock induced separation, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule, Tip effects.

UNIT - V  EXPERIMENTAL TECHNIQUES FOR HIGH SPEED FLOWS
Blow down, indraft and induction tunnel layouts and their design features, Transonic, supersonic and hypersonic tunnels and their peculiarities, Helium and gun tunnels, Shock tubes, Optical methods of flow visualization.
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<tbody>
<tr>
<td>1.</td>
<td>Rathakrishnan,E.</td>
<td>Gas Dynamics</td>
<td>Prentice Hall of India, New Delhi</td>
<td>2013</td>
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WEB REFERENCE:

- www.me.memphis.edu/menews/OneD_Flow.pdf
- www.iaa.ncku.edu.tw/~cywen/course/gas%20dynamics/Ch4.ppt
- www.does.org/masterli/e50.htm
- www.adl.gatech.edu/classes/dci/aerodesn/dci03aero.html
- www.lockheedmartin.com/data/assets/13617.pdf
INTENDED OUT COMES
To describe the principle and working of aircraft systems and instruments.

UNIT - I    AIRCRAFT SYSTEMS
Hydraulic systems - Study of typical workable system - components - Hydraulic system controllers -
Modes of operation - Pneumatic systems - Advantages - Working principles - Typical Air pressure
system – Brake system - Typical Pneumatic power system - Components, Landing Gear systems -
Classification – Shock absorbers - Retractive mechanism.

UNIT - II    AIRPLANE CONTROL SYSTEMS
Conventional Systems – Power assisted and fully powered flight controls – Poweractuated systems
– Engine control systems – Push pull rod system – operating principles – Modern control systems –
Digital fly by wire systems – Auto pilot system, Active Control Technology.

UNIT - III    ENGINE SYSTEMS AND AUXILLIARY SYSTEMS
Fuel systems – Components - Multi-engine fuel systems, lubricating systems - Starting and Ignition
systems –Basic Air cycle systems -Oxygen systems - Fire protection systems, Deicing and anti-icing
systems.

UNIT - IV    INTRODUCTION TO AVIONICS
Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon
systems – typical avionics subsystems, design, technologies – Introduction to digital computer and

UNIT – V    AVIONICS SYSTEMS
Control and display technologies -CRT, LED, LCD, EL and plasma panel- Civil cockpit and
military cockpit: MFDS, HUD, MFK, HOTAS- Communication Systems - Navigation systems
ADF, DME, VOR, LORAN, OMEGA, ILS, MLS - Air Data Systems.
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<td></td>
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<td>Subsystems Integration</td>
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<td></td>
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<td></td>
<td>Delhi</td>
<td></td>
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</tbody>
</table>

WEB REFERENCE:

www.aircraftinstruments.com/
dcb.larc.nasa.gov/Introduction/Controls
www.mtu-online.com/mtuonsiteenergy/products/gas-engine-systems
academicearth.org/courses/aircraft-systems-engineering
www.efunda.com
OBJECTIVES:
To study in detail about gas turbines, ramjet, fundamentals of rocket propulsion and chemical rockets.

UNIT - I AIRCRAFT GAS TURBINES

UNIT - II RAMJET PROPULSION:

UNIT - III FUNDAMENTALS OF ROCKET PROPULSION

UNIT - IV CHEMICAL ROCKETS

UNIT - V ADVANCED PROPULSION TECHNIQUES
Electric rocket propulsion– types of electric propulsion techniques - Ion propulsion – Nuclear rocket – comparison of performance of these propulsion systems with chemical rocket propulsion systems – future applications of electric propulsion systems - Solar sail.
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**WEB REFERENCE:**

www.aircraftenginedesign.com/
www.aticourses.com/rockets.htm
www.grc.nasa.gov/
exploration.grc.nasa.gov/education/rocket/rktth1.html
www.scribd.com
15BTASSE_  DEPARTMENT ELECTIVE – I  3003100
OBJECTIVES:
To study in detail about the aerodynamic behavior of various bodies in supersonic regime.

List of Experiments
1. Calibration of Supersonic Wind Tunnel.
2. Pressure measurements over a Double Wedge model.
3. Pressure measurements over a Cone model.
4. Pressure measurements over a Sphere Cylinder model.
5. Unsteady Pressure Measurements in Supersonic Wind Tunnel.
7. Study of supersonic flow over a cone by flow visualization.
8. Study of supersonic flow over a cylinder by flow visualization.
9. Study of supersonic flow over a diamond shape airfoil with half wedge angle of 80 by flow visualization.
10. Study of supersonic flow over a diamond shape airfoil with half wedge angle of 350 by flow visualization.
OBJECTIVES:
To understand the basic concepts and carry out experiments in Aerospace Propulsion

LISTOFEXPERIMENTS
1. Study of an aircraft piston engine (includes study of assembly subsystems, various components, their functions and operating principles)
2. Study of an aircraft jet engine (includes study of parts, various components, their functions and operating principles)
3. Performance of 2d diffuser a) StableFlow b) Separatedflow
5. Determination of heat of combustion of aviation fuel
6. Combustion performance studies in a duct (duct burner)
7. Construction of Free jet velocity profiles at various locations.
8. Construction of Wall Jet velocity profiles at various locations.

LISTOF EQUIPMENT
(For a batch of 30 students)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Equipment</th>
<th>Quantity</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Piston Engine</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Jet Engine</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>2DDiffuser</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Propeller Test Rig</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Bomb Calorimeter</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Duct Burner</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>FreeJet and Wall Jet Test Setup</td>
<td>2</td>
<td>7,8</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To experimentally study the unsymmetrical bending of beams, find the location of shear centre, obtain the stresses in circular discs and beams using photo elastic techniques, calibration of photo-elastic materials and study on vibration of beams.

LIST OF EXPERIMENTS
1. Determination of Unsymmetrical bending of different materials using bend test set up.
2. Determination of Shear centre location for open sections
3. Determination of Shear centre location for closed sections
4. Experiment on Constant strength beam
5. Finding out flexibility matrix for cantilever beam
6. Testing of Beam with combined loading
7. Calibration of Photo-elastic materials
8. Determination of Stresses in circular discs and beams using photoelastic techniques
9. Measurement of Vibrations of beams
10. Wagner beam - Tension field beam experiments.

LIST OF EQUIPMENT
(For a batch of 30 students)

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Name of the Equipment</th>
<th>Qty</th>
<th>Experiments Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beam Test set –up</td>
<td>2</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>2</td>
<td>Unsymmetrical sections like ‘Z’ sections</td>
<td>2</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>3</td>
<td>Channel section and angle section</td>
<td>2</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>4</td>
<td>Dial gauges</td>
<td>12</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>5</td>
<td>Weights 1 Kg</td>
<td>10</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>6</td>
<td>Weights 2 Kg</td>
<td>10</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>7</td>
<td>Beam Test Set– up</td>
<td>2</td>
<td>3, 4</td>
</tr>
<tr>
<td>8</td>
<td>Strain indicator and strain gauges</td>
<td>One set</td>
<td>4, 5, 6</td>
</tr>
<tr>
<td>9</td>
<td>Photo–elastic apparatus</td>
<td>1</td>
<td>7, 8</td>
</tr>
<tr>
<td>10</td>
<td>Amplifier</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>Exciter</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>12</td>
<td>Pick– up</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>13</td>
<td>Oscilloscope</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>14</td>
<td>Wagner beam</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>Hydraulic Jack</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>
Students will undergo industrial training for four weeks during the vacation at the end of IV semester and a report with the training completion certificate from the industry will be subsequently submitted to the department within a week after completion. Viva – Voce exam will be conducted at the end of V semester and 100 marks will be awarded.
OBJECTIVES:

- To equip the students with effective technical presentation
- To understand the barriers and bridges to communication
- To improve the public speaking capabilities, body language and posture

During the seminar session each student is expected to prepare and present a topic on engineering/technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.
OBJECTIVES:

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION

UNIT II ONE-DIMENSIONAL PROBLEMS

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION
**TEXT BOOKS:**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Author(s) Name</th>
<th>Title of the book</th>
<th>Publisher</th>
<th>Year of Publication</th>
</tr>
</thead>
</table>

**REFERENCES:**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Author(s) Name</th>
<th>Title of the book</th>
<th>Publisher</th>
<th>Year of Publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Logan, D.L</td>
<td>A first course in Finite Element Method</td>
<td>Thomson Asia Pvt. Ltd</td>
<td>2002</td>
</tr>
<tr>
<td>3</td>
<td>Chandrupatla &amp; Belagundu</td>
<td>Introduction to Finite Elements in Engineering</td>
<td>Prentice Hall College Div</td>
<td>1990</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To introduce the concepts of heat transfer to enable the students to design components subjected to thermal loading.

UNIT - I HEAT CONDUCTION

UNIT - II CONVECTIVE HEAT TRANSFER

UNIT - III RADIATIVE HEAT TRANSFER

UNIT - IV HEATEXCHANGERS

UNIT - V HEATTRANSFER PROBLEMS IN AEROSPACE ENGINEERING
### TEXT BOOKS:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
<th>TITLE OF THE BOOK</th>
<th>PUBLISHER</th>
<th>YEAR OF PUBLICATION</th>
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### REFERENCE BOOKS:

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<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
<th>TITLE OF THE BOOK</th>
<th>PUBLISHER</th>
<th>YEAR OF PUBLICATION</th>
</tr>
</thead>
</table>

### WEB REFERENCE:
- [www.jhu.edu/virtlab/conduct/conduct.htm](http://www.jhu.edu/virtlab/conduct/conduct.htm)
- [web.mit.edu/lienhard/www/ahtt.html](http://web.mit.edu/lienhard/www/ahtt.html)
- [www.personal.psu.edu/cxc11/AERSP560.pdf](http://www.personal.psu.edu/cxc11/AERSP560.pdf)
OBJECTIVES:
To study the basic concepts of orbital Mechanics with particular emphasis on interplanetary trajectories

UNIT I  BASIC CONCEPTS

UNIT II  THE GENERAL N-BODY PROBLEM

UNIT III  SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS

UNIT IV  INTERPLANETARY TRAJECTORIES
Two Dimensional Interplanetary Trajectories – Fast Interplanetary Trajectories – Three Dimensional Interplanetary Trajectories – Three Dimensional Interplanetary Trajectories – Launch if Interplanetary Spacecraft – Trajectory about the Target Planet.

UNIT V  BALLISTIC MISSILE TRAJECTORIES AND MATERIALS
### TEXT BOOKS:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
<th>TITLE OF THE BOOK</th>
<th>PUBLISHER</th>
<th>YEAR OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Jason Hall</td>
<td>Advances in Spacecraft Technologies</td>
<td>InTech, Croatia</td>
<td>2011</td>
</tr>
</tbody>
</table>

### REFERENCE BOOKS:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
<th>TITLE OF THE BOOK</th>
<th>PUBLISHER</th>
<th>YEAR OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Van de Kamp, P</td>
<td>Elements of Astromechanics</td>
<td>Pitman, Newjersey</td>
<td>1979</td>
</tr>
</tbody>
</table>

### WEB REFERENCE:

- [www.space.com/topics/military-space/](http://www.space.com/topics/military-space/)
- [www.nasa.gov/directorates/spacetech/small_spacecraft](http://www.nasa.gov/directorates/spacetech/small_spacecraft)
- [www.nasa.gov/.../Small_Spacecraft_Technology_State_of_the_Art_201](http://www.nasa.gov/.../Small_Spacecraft_Technology_State_of_the_Art_201)
- [www.nasa.gov/directorates/spacetech/...spacecraft/smallsat_overview.htm.](http://www.nasa.gov/directorates/spacetech/...spacecraft/smallsat_overview.htm.)
OBJECTIVES:

- Ability to analyse the performance of aircraft under various Flight conditions such as take off, cruise, landing, climbing, gliding, turning and other maneuvers
- Ability to analyse the static and dynamic response of aircraft for both voluntary and involuntary changes in flight conditions

UNIT I CRUISING FLIGHT PERFORMANCE
Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle – Different types of drag –estimation of parasite drag co-efficient by proper area method- Drag polar of vehicles from low speed to high speeds - Variation of thrust, power with velocity and altitudes for air breathing engines . Performance of airplane in level flight - Power available and power required curves. Maximum speed in level flight - Conditions for minimum drag and power required

UNIT II MANOEUVERING FLIGHT PERFORMANCE
Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle ofclimb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turnradius). Bank angle and load factor – limitations on turn - V-n diagram and load factor.

UNIT III STATIC LONGITUDINAL STABILITY
Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixedstability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence ofCG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient -Stick free neutral points-Symmetric maneuvers - Stick force gradients - Stick force per ‘g’-Aerodynamic balancing.

UNIT IV LATERAL AND DIRECTIONAL STABILITY
Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects- Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements – Oneengine inoperative condition - Rudder lock.

UNIT V DYNAMIC STABILITY
Introduction to dynamic longitudinal stability: - Modes of stability, effect of freeing the stick – Briefdescription of lateral and directional. dynamic stability - Spiral, divergence, Dutch roll, auto rotationand spin.
### TEXT BOOKS:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
<th>TITLE OF THE BOOK</th>
<th>PUBLISHER</th>
<th>YEAR OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>airplanes, second edition</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### REFERENCE BOOKS:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
<th>TITLE OF THE BOOK</th>
<th>PUBLISHER</th>
<th>YEAR OF PUBLICATION</th>
</tr>
</thead>
</table>

### WEB REFERENCE:
- [nptel.ac.in/courses/101106042](https://nptel.ac.in/courses/101106042)
- [https://www.classle.net/category/subject-area/flight-dynamics-ii](https://www.classle.net/category/subject-area/flight-dynamics-ii)
- [www.myopencourses.com › Courses › Aerospace Engineering](http://www.myopencourses.com › Courses › Aerospace Engineering)
- [www.myopencourses.com › Courses › Aerospace Engineering](http://www.myopencourses.com › Courses › Aerospace Engineering)
15BTAS6E_  Department Elective – II  3 0 0 3 100

15BTAS6E_  Department Elective – III  3 0 0 3 100
OBJECTIVES:

- To introduce and develop the basic concept of aircraft design.
- Each student is assigned with the design of an Airplane (or Helicopter or any other flight vehicle), for given preliminary specifications. The following are the assignments to be carried out:

EXPERIMENTS

1. Comparative configuration study of different types of airplanes.
2. Comparative study on specification and performance details of aircraft.
3. Preliminary weight estimations, selection of main parameters.
5. Estimation of various Drag
6. V-n diagram for the design study
7. Gust and maneuverability envelopes
8. Critical loading performance and final V-n graph calculation
9. Load estimation of wings and estimation of fuselage

LIST OF EQUIPMENTS
(For a batch of 30 students)

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Items</th>
<th>Quantity</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Drawing Board</td>
<td>30</td>
<td>4 and 5</td>
</tr>
<tr>
<td>2.</td>
<td>Drawing Instrument</td>
<td>20</td>
<td>4 and 5</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To enhance the basic knowledge in applied thermodynamics

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 the viscosity coefficient of a given liquid
6. COP test on a vapour compression refrigeration test rig
7. COP test on a vapour compression air-conditioning test rig

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Details of Equipments</th>
<th>Qty Req.</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>4 stroke twin cylinder diesel engine</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Cut section model of 4 stroke diesel engine and cut section model of 2 stroke petrol engine</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Parallel and counter flow heat exchanger test rig</td>
<td>1</td>
<td>3,4</td>
</tr>
<tr>
<td>4.</td>
<td>Bomb Calorimeter</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>Vapour compression refrigeration test rig</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>6.</td>
<td>Vapour compression air-conditioning test rig</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>7.</td>
<td>Conductive heat transfer set up</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>8.</td>
<td>Composite wall</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>
The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.

The item chosen may be small machine elements or small components used in aeronautical applications.(Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.

The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.
OBJECTIVES:
To study the basic concepts of orbital Mechanics with particular emphasis on interplanetary trajectories.

UNIT - I BASIC CONCEPTS

UNIT - II THE GENERAL N-BODY PROBLEM

UNIT - III SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS

UNIT - IV INTERPLANETARY TRAJECTORIES
Two Dimensional Interplanetary Trajectories – Fast Interplanetary Trajectories – Three Dimensional Interplanetary Trajectories – Launch of Interplanetary Spacecraft – Trajectory about the Target Planet.

UNIT - V BALLISTIC MISSILE TRAJECTORIES AND MATERIALS
TEXT BOOK:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Author(s)</th>
<th>Title of the Book</th>
<th>Publisher</th>
<th>Year of Publication</th>
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REFERENCES BOOKS:

<table>
<thead>
<tr>
<th>S.NO.</th>
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<th>Publisher</th>
<th>Year of Publication</th>
</tr>
</thead>
</table>

WEB REFERENCES:

www.sccs.swarthmore.edu/users/08/ajb/.../N-body_problem.html
www.math.uvic.ca/faculty/diacu/Sphere15-releq.pdf
www.philsrockets.org.uk/interplanetary.pdf
www.princeton.edu/sgs/publications/sgs/archive/15_2_Forden.pdf
see.msfc.nasa.gov/
OBJECTIVES:
To study the basic concepts of hypersonic flows and their effects on flight vehicles

UNIT I FUNDAMENTALS OF HYPERSONIC AERODYNAMICS
Introduction to hypersonic aerodynamics, differences between hypersonic aerodynamics and supersonic aerodynamics, concept of thin shock layers, hypersonic flight paths, hypersonic Similarity parameters, shock wave and expansion wave relations of inviscid hypersonic flows.

UNIT II SIMPLE SOLUTION METHODS FOR HYPERSONIC INVISCID FLOWS
Local surface inclination methods, Newtonian theory, modified Newtonian law, tangent wedge and tangent cone methods, shock expansion methods, approximate theory-thin shock layer theory.

UNIT III VISCOUS HYPERSONIC FLOW THEORY
Boundary layer equation for hypersonic flow-hypersonic boundary layers, self-similar and non self-similar boundary layers, solution methods for non-self-similar boundary layers aerodynamic heating.

UNIT IV VISCOUS INTERACTIONS IN HYPERSONIC FLOWS
Introduction to the concept of viscous interaction in hypersonic flows, strong and weak viscous interactions, hypersonic viscous interaction similarity parameter, introduction to shock wave boundary layer interactions.

UNIT V INTRODUCTION TO HIGH TEMPERATURE EFFECTS
Nature of high temperature flows, chemical effects in air-real and perfect gases- Gibb’s free energy and entropy-chemically reacting mixtures-recombination and dissociation.
TEXT BOOK:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Author(s)</th>
<th>Title of the Book</th>
<th>Publisher</th>
<th>Year of Publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Wallace D. Hayes, Ronald F. Probstein, Ronald R. Probstein</td>
<td>Hypersonic Inviscid Flow</td>
<td>Courier Corporation, Massachusetts, United States.</td>
<td>2004</td>
</tr>
</tbody>
</table>

REFERENCES BOOKS:

<table>
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<tr>
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<th>Author(s)</th>
<th>Title of the Book</th>
<th>Publisher</th>
<th>Year of Publication</th>
</tr>
</thead>
</table>

WEB REFERENCES:

http://nptel.ac.in/courses/101103003/
https://www.grc.nasa.gov/www/BGH/
www.myopencourses.com › Courses › Aerospace Engineering
<table>
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<td>15BT__OE__</td>
<td>Open Elective-I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>100</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To train the students “ON HAND” experience in maintenance of various air frame systems in aircraft and rectification of common snags.

LIST OF EXPERIMENTS
1. Aircraft “Jacking Up” procedure
2. Aircraft “Levelling” procedure
3. Control System “Rigging check” procedure
4. Aircraft “Symmetry Check” procedure
5. “Flow test” to assess of filter element clogging
6. “Pressure Test” To assess hydraulic External/Internal Leakage
7. “Functional Test” to adjust operating pressure
8. “Pressure Test” procedure on fuel system components
9. “Brake Torque Load Test” on wheel brake units
10. Maintenance and rectification of snags in hydraulic and fuel systems.

LIST OF EQUIPMENTS
(For a batch of 30 students)

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Items</th>
<th>Quantity</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Serviceable aircraft with all above systems</td>
<td>1</td>
<td>1,2,3,4,5,6,7,8,9,10</td>
</tr>
<tr>
<td>2.</td>
<td>Hydraulic Jacks (Screw Jack)</td>
<td>5</td>
<td>1,2,4,8</td>
</tr>
<tr>
<td>3.</td>
<td>Trestle adjustable</td>
<td>5</td>
<td>1,2,4,8</td>
</tr>
<tr>
<td>4.</td>
<td>Spirit Level</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>5.</td>
<td>Levelling Boards</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>6.</td>
<td>Cable Tensiometer</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>7.</td>
<td>Adjustable Spirit Level</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>8.</td>
<td>Plumb Bob</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To teach and train the students in the lab about the design and analysis of Aircraft components

LIST OF EXPERIMENTS
1. Scaling, rotation, translation, editing, dimensioning – Typical CAD command structure.
2. Wire frame modeling – surface modeling
3. Solid Modeling
4. Advanced modeling
5. Flow Simulation over a Symmetrical Airfoil Using CFD
6. Flow Simulation over a Cambered Airfoil Using CFD
7. Flow Simulation over a Turbine Blade Using CFD
8. Flow Simulation over a compressor Blade Using CFD
9. Stress Analysis of a Turbine Blade
10. Stress Analysis of any Aircraft Component

LIST OF EQUIPMENT
(For a batch of 30 students)

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Name of the Equipment</th>
<th>Quantity</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Computer nodes</td>
<td>30</td>
<td>1 to 10</td>
</tr>
<tr>
<td>2</td>
<td>Pro-E-Wildfire, AutoCAD, CATIA, SOLIDWORKS</td>
<td>30 licenses</td>
<td>1 to 10</td>
</tr>
<tr>
<td>3</td>
<td>ANSYS with Fluent, NASTRAN, CFX</td>
<td>30 licenses</td>
<td>1 to 10</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To give training on riveting, patchwork, welding and to introduce the knowledge of the maintenance and repair of Aircraft Engines.

1. Patch repair welding using TIG.
2. Patch repair welding using MIG.
3. Exercise on pipe bending and flaring.
4. Exercise on Riveted joints & repair work.
5. Patch repair welding using Arc Welding.
7. Disintegration and reassembly of a aircraft piston engine
8. Engine (Piston Engine)- cleaning, visual inspection, NDT checks.
10. Engine starting procedure.

LIST OF EQUIPMENT
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Equipment</th>
<th>Quantity</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TIG Weld Plant</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>MIG Weld Plant</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Pipe bending machine</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Bench Vices</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Drilling Machine</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Riveting Gun</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Arc welding setup</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Piston Engines</td>
<td>2</td>
<td>6,7,8,9</td>
</tr>
<tr>
<td>9</td>
<td>Aircraft with serviceable stand</td>
<td>1</td>
<td>6,7,8,9,10</td>
</tr>
<tr>
<td>10</td>
<td>Precision instruments(Vernier Caliper, Micrometer, Cylinder bore gauge, depth gauge, Bevel Protector and DTI)</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>NDT Equipments(Defectoscope,Dye penetrating method, Hot oil Chalk Method )</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

UNIT I INTRODUCTION
Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES

UNIT III STATISTICAL PROCESS CONTROL (SPC)
The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS

UNIT V QUALITY SYSTEMS
### TEXT BOOK:

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
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<th>PUBLISHER</th>
<th>YEAR OF PUBLICATION</th>
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</table>

### WEB REFERENCES:

- [asq.org/learn-about.../total-quality-management/.../overview.html](asq.org/learn-about.../total-quality-management/.../overview.html)
- [managementhelp.org/quality/total-quality-management.html](managementhelp.org/quality/total-quality-management.html)
- [www.statisticalprocesscontrol.org/](www.statisticalprocesscontrol.org/)
- [www.ifm.eng.cam.ac.uk/dstools/represent/tqm.html](www.ifm.eng.cam.ac.uk/dstools/represent/tqm.html)
- [www.qseprocess.com/](www.qseprocess.com/)
OBJECTIVES:

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Twenty four periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

The continuous assessment shall be made as prescribed in the regulations.
OBJECTIVES:
To understand the fabrication, analysis and design of composite materials & structures.

UNIT - I  STRESS STRAIN RELATION

UNIT - II  METHODS OF ANALYSIS

UNIT - III  LAMINATED PLATES
Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.

UNIT - IV  SANDWICH CONSTRUCTIONS
Basic design concepts of sandwich construction -Materials used for sandwich construction - Failure modes of sandwich panels.

UNIT - V  FABRICATION PROCESS
## TEXT BOOKS

<table>
<thead>
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</thead>
</table>
OBJECTIVES:
To study the maintenance aspect of airframe systems and rectification of snags

UNIT -  I  WELDING IN AIRCRAFT STRUCTURAL COMPONENTS
Types of Welding and Joints - Equipments used in welding shop and their maintenance – Ensuring quality welds – Welding jigs and fixtures – Soldering and brazing.


UNIT - II  PLASTICS AND COMPOSITES IN AIRCRAFT
Review of types of plastics used in airplanes – Maintenance and repair of plastic components – Repair of cracks, holes etc., various repair schemes – Scopes.

Inspection and Repair of composite components – Special precautions – Autoclaves.

UNIT - III  AIRCRAFT JACKING, ASSEMBLY AND RIGGING

UNIT - IV  REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM
Trouble shooting and maintenance practices – Service and inspection. – Inspection and maintenance of landing gear systems. – Inspection and maintenance of air-conditioning and pressurization system, water and waste system. Installation and maintenance of Instruments – handling – Testing – Inspection. Inspection and maintenance of auxiliary systems – Fire protection systems – Ice protection system – Rain removal system – Position and warning system – Auxiliary Power Units (APUs)
UNIT - V  SAFETY PRACTICES


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</table>

WEB REFERENCES:


[www.manningmetal.com/repair__maintenance.htm](http://www.manningmetal.com/repair__maintenance.htm)

[www.aviation-database.com/Aerospace_plastics.htm](http://www.aviation-database.com/Aerospace_plastics.htm)


OBJECTIVES:
- Estimate and predict the flow patterns, pressure distribution, and wind loading around bodies
- An understanding of the importance of wind loading in engineering
- An appreciation of the structural response to dynamic wind loading

UNIT - I  THE ATMOSPHERE
Atmospheric Circulation – Stability of atmospheres – definitions & implications – Effects of friction – Atmospheric motion – Local winds, Building codes, Terrains different types

UNIT - II  ATMOSPHERIC BOUNDARY LAYER
Governing Equations – Mean velocity profiles, Power law, logarithmic law wind speeds, Atmospheric turbulence profiles – Spectral density function – Length scale of turbulence, Roughness parameters simulation techniques in wind tunnels

UNIT - III  BLUFF BODY AERODYNAMICS
Governing Equations – Boundary layers and separations – Wake and Vortex formation two dimensional – Strouhal Numbers, Reynolds numbers– Separation and Reattachments Oscillatory Flow patterns Vortex shedding flow switching– Time varying forces to wind velocity in turbulent flow – Structures in three dimensional

UNIT - IV WIND LOADING

UNIT - V  AEROELASTIC PHENOMENA
Vortex shedding and lock in phenomena in turbulent flows, across wind galloping wake galloping - Torsional divergence, along wind galloping of circular cables, cross wind galloping of circular cables, Wind loads & their effects on tall structures – Launch vehicles
**TEXTBOOKS:**

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<tr>
<td>3.</td>
<td>Tom Lawson</td>
<td>Building Aerodynamics</td>
<td>Imperial College Press London</td>
<td>2001</td>
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**REFERENCES BOOKS:**

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<tr>
<td>1.</td>
<td>N J Cook</td>
<td>Design Guides to wind loading of buildings structures Part I &amp; II</td>
<td>Butterworths London</td>
<td>1985</td>
</tr>
<tr>
<td>2.</td>
<td>NA</td>
<td>Part III Wind loads</td>
<td>Indian Standards for Building codes</td>
<td>1987</td>
</tr>
</tbody>
</table>

**WEB REFERENCES:**

www.multi-science.co.uk/windeng.htm
en.wikipedia.org/wiki/Wind_engineering
www.journals.elsevier.com/journal-of-wind-engineering-and-industrial-a..
www.sciencedirect.com/science/journal/01676105
www.ansys.com/Industries/Construction/Wind+Engineering
OBJECTIVES:

- More effective decision-making at a general management level and enhanced leadership skills, giving you increased confidence and managerial impact
- Develop a keen understanding of how to ‘manage for value’ in the civil aviation context

UNIT-I AIRLINE INDUSTRY
Structure of Airline Industry (Domestic & International)-Growth and Regulation-Deregulation-Major and National Carriers-Regional Carriers-Economic characteristics of the Airlines

UNIT-II AIRLINE MANAGEMENT AND ORGANIZATION

UNIT-III FLEET PLANNING AND ROUTE EVALUATION

UNIT-IV AIRLINE SCHEDULING

UNIT-V AIRLINE PRICING, DEMAND AND OUTPUT
Airline pricing and demand-Determinants of demand-changes in demand-Elasticity of demand-determinants of elasticity; Types of passenger fares-Pricing process-Airline costs-Pricing and output determination
## TEXTBOOKS:

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<tbody>
<tr>
<td>2</td>
<td>Charles Banfe</td>
<td>The Airline business</td>
<td>Routledge</td>
<td>2005</td>
</tr>
</tbody>
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## REFERENCES BOOKS:

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## WEB REFERENCES:

- https://www.ashgate.com/.../Modeling_Applications_in_the_Airline_Ind.
- www.iata.org › Home › Training › Subject Areas
- www.aci.aero › ... › Course Categories › Economics
- ocw.mit.edu › Courses › Aeronautics and Astronautics
- ocw.mit.edu › ... › Aeronautics and Astronautics › Airline Management
OBJECTIVES:
- Introduce methods of optimization to engineering students, including linear Programming, network flow algorithms, integer programming, interior point methods, quadratic Programming, nonlinear programming, and heuristic methods.

UNIT-I INTRODUCTION TO OPTIMIZATION
Statement of an Optimization Problem-Classification of Optimization Problems-Local and Global Optima

UNIT-II CLASSICAL OPTIMIZATION TECHNIQUES

UNIT-III LINEAR PROGRAMMING
Applications of Linear Programming-Standard form of a Linear Programming Problem-Solution by graphical method- Simplex Method; Two phase and Big M methods-Revised simplex method-Duality in Linear Programming

UNIT-IV TRANSPORTATION AND ASSIGNMENT PROBLEMS
Transportation Problem- North west corner method-Vogel’s approximation method- MOD method- Assignment problems

UNIT-V NON-LINEAR PROGRAMMING-UNCONSTRAINED OPTIMIZATION TECHNIQUES
Classification of Unconstrained Minimization-Powell’s M-Steepest Dscent Method- Conjugate Gradient Method- Marquardt Method,Davidon-Fletcher-Powell Method, Broyden-Fletcher-Goldfarb-Shanno Method
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</thead>
</table>

## WEB REFERENCES:

- en.wikipedia.org/wiki/Engineering_optimization
- link.springer.com/journal/11081
- www.springer.com › Home › Mathematics
- www.researchgate.net/journal/0305-215X_Engineering_Optimization
OBJECTIVES:
To study the concepts of estimation of the endurance and failure mechanism of components.

UNIT - I  FATIGUE OF STRUCTURES

UNIT - II  STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR
Low cycle and high cycle fatigue - Coffin - Manson’s relation - Transition life - cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques -Cumulative damage - Miner’s theory - Other theories.

UNIT - III  PHYSICAL ASPECTS OF FATIGUE
Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces.

UNIT - IV  FRACTURE MECHANICS

UNIT - V  FATIGUE DESIGN ANDTESTING
Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.
**TEXTBOOKS:**

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</thead>
</table>

**WEB REFERENCES:**

onlinelibrary.wiley.com › Materials Science › Failure Fracture
www.engineersedge.com
www.nlr.nl/id~4823/lang~en.pdf
www.statisticalengineering.com/fatigue_fracture.html
ocw.mit.edu/courses/materials-science-and...mechanics.../frac.pdf
OBJECTIVES:
To study the flow of dynamic fluids by computational methods

UNIT - I  FUNDAMENTAL CONCEPTS

UNIT - II DISCRETIZATION
Boundary layer Equations and methods of solution - Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation -- Stability properties of explicit and implicit methods - Conservative upwind discretization for Hyperbolic systems - Further advantages of upwind differencing.

UNIT - III  FINITE ELEMENT TECHNIQUES
Finite Element Techniques in Computational Fluid Dynamics; introduction - Strong and Weak Formulations of a Boundary Value Problem - Strong formulation - Weighted Residual Formulation - Galerkin Formulation - Weak Formulation - Variational Formulation - Piecewise defined shape functions - Implementation of the FEM - The Solution Procedure.

UNIT - IV  FINITE VOLUME TECHNIQUES

UNIT - V  FLOW FIELD ANALYSIS
**TEXTBOOKS:**

<table>
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**WEB REFERENCES:**

- www.cfd-online.com
- audilab.bmed.mcgill.ca/AudiLab/teach/fem/fem.html
- www.cmi.univ-mrs.fr/~herbin/PUBLI/bookevol.pdf
- mathworld.wolfram.com
OBJECTIVES:

- To understand the Concepts of modeling of 2D and 3D geometrical elements, concepts of computer graphics and theory of analysis.

UNIT I - INTRODUCTION


UNIT II - GRAPHIC CONCEPTS (2D and 3D)


UNIT III - SOFTWARE PACKAGES AND RECENT TECHNOLOGY

All about popular commercial solid modeling packages — their salient features- technical comparison- modules and Tools available- brief outline of Data exchange standards. Brief outline of feature technology - classification of features- design by features- applications of features- its advantages- and limitations

UNIT IV - FEM FUNDAMENTALS

Introduction to finite element method - principle- Steps involved in FEA – node- element and their types- shape function- constraints, forces and nodal displacements- stiffness matrix- solution techniques. Analysis of spring element. Simple problems involving stepped bars subjected to axial loading and simple structural members for triangular element

UNIT V - ANALYSIS

FEA in a CAD Environment Stages of FEA in a CAD environment - Preprocessor- solver and post processor. Preprocessing - FEA modeling - geometry generation- node generation- element
generation- boundary constraints- load constraints- mesh generation and refining. Solving - performing the actual analysis. Post processing - Types of O/P available for interpretation of results.

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<tbody>
<tr>
<td>1.</td>
<td>Ibrahim Zoid</td>
<td>CAD / CAM — Theory and Practice</td>
<td>TMH, Helsinki.</td>
<td>2010</td>
</tr>
<tr>
<td>3.</td>
<td>Chairs McMahon and Jimmie Browne</td>
<td>CAD/CAM</td>
<td>Addision Wesly, Newyork,</td>
<td>2000</td>
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**WEB REFERENCES:**

- en.wikipedia.org/wiki/Computer-aided_design
- www.iitk.ac.in/infocell/flier/cad1.pdf
- www.journals.elsevier.com/computer-aided-design/
- www.ptc.com/cad
OBJECTIVES:

- The students will be able to describe the transfer functions for automatic control systems; open-loop and closed-loop systems and describe the various time domain and frequency domain tools for analysis and design of linear control systems.

UNIT I - INTRODUCTION TO AUTOMATIC CONTROL SYSTEMS

Historical review, Examples of control systems: simple pneumatic, hydraulic and thermal systems, series and parallel systems, analogies, mechanical and electrical components.

UNIT II - OPEN AND CLOSED LOOP SYSTEMS

Closed loop control versus open loop control, Feedback control systems, Block diagram representation of control systems, reduction of block diagrams, Output to input ratios.

UNIT III - TRANSIENT AND STEADY-STATE RESPONSE ANALYSIS

Laplace transformation, Response of systems to different inputs viz. Step, impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

UNIT IV - STABILITY ANALYSIS

Stability definitions, characteristic equation, location of roots in the s-plane for stability, Routh-Hurwitz criteria of stability, Root locus and Bode techniques, concept and construction, frequency response.

UNIT V - SAMPLED DATA CONTROL SYSTEMS

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<tr>
<td>1.</td>
<td>Benjamin, C Kuo</td>
<td>Automatic Control System</td>
<td>Prentice Hall of India Private Ltd, New Delhi</td>
<td>1993</td>
</tr>
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</table>

### WEB REFERENCES:
- en.wikipedia.org/wiki/Automatic_control
- www2.nuu.edu.tw/~emo/e.../Automatic%20Control.pdf
- www.amazon.in/Automatic-Control-Systems-Farid.../dp/0470048964
- www.wiley.com › ... › Control Systems Technology
OBJECTIVES:

- The course is meant to give the students an introduction and an enhancement of their knowledge of fluid mechanics applied in the area of vehicle engineering.
- Different methodologies for the evaluation of the aerodynamic forces will be introduced.

UNIT - I LAUNCH VEHICLE CONFIGURATIONS AND DRAG ESTIMATION
Types of Rockets and missiles- various configurations-components-forces on the vehicle during atmospheric flight-nose cone design and drag estimation.

UNIT - II AERODYNAMICS OF SLENDER AND BLUNT BODIES
Aerodynamics of slender and blunt bodies, wing-body interference effects-Asymmetric flow separation and vortex shedding-unsteady flow characteristics of launch vehicles- determination of aero elastic effects, Slender Bodies of Revolution, non circular shapes, lifting surfaces, low Aspect Ratio characteristics, wing-body-tail interference, prediction of overall characteristics of body dominated configurations and lifting surface dominated configurations, high angle of attack aerodynamics.

UNIT - III HYPERSONIC AERODYNAMICS
Introduction to hypersonic aerodynamics, concept of thin shock layers-hypersonic flight paths-hypersonic similarity parameters-shock wave and expansion wave relations of in viscid hypersonic flows, Shock wave -boundary layer interactions, aerodynamic heating.

UNIT - IV AERODYNAMIC ASPECTS OF LAUNCHING PHASE

UNIT - V AERODYNAMIC LAUNCHING PROBLEMS
Introduction, Safety of parent Aircraft, Launch Boundaries-Launch-Aircraft Trajectory, Parent Aircraft Performance, Ground Launch.
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<tr>
<td>2.</td>
<td>Anderson, J.D.,</td>
<td>Hypersonic and High Temperature Gas</td>
<td>AIAA Education Series,</td>
<td>2006</td>
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<td></td>
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<td>Dynamics</td>
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### WEB REFERENCES:

- ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110002881.pdf
- https://www.edx.org/course/flight-vehicle-aerodynamics-mitx-16-110x
- www.icas.org/ICAS_ARCHIVE/ICAS2000/PAPERS/ICA0322.PDF
- www.icas.org/ICAS_ARCHIVE/ICAS2002/PAPERS/264.PDF
OBJECTIVES:

- Ability to design satellite communication systems using both a creative and systematic approach applying concepts and principles developed to solve a particular engineering need.
- Ability to analyse modulation and coding schemes in satellite communication systems using principles and techniques developed throughout the course.

UNIT - I INTRODUCTION TO SATELLITE SYSTEMS

Common satellite applications and mission- Typical spacecraft orbits- Definitions of spin the three axis stabilization- Space environment- Launch vehicles-Satellite system and their functions (structure, thermal, mechanisms, power, propulsion, guidance and control, bus electronics).

UNIT - II ORBITAL MECHANICS

Fundamental of flight dynamics – Time and coordinate systems-Orbit determination and prediction-Orbital maneuvers-GPS Systems and application for satellite/Orbit determination-Ground station network requirements

UNIT - III SATELLITE STRUCTURES AND THERMAL CONTROL

Satellite mechanical and structural configuration: satellite configuration choices, launch loads, separation induced loads, deployment requirements-Design and analysis of satellite structures-Structural materials and fabrication-The need of thermal control-Heat transfer mechanism: internal to the spacecraft and external heat load variations –Thermal control systems, active and passive methods.

UNIT - IV SPACECRAFT CONTROL

Control requirements: attitude control and station keeping functions type of control maneuvers-Stabilization schemes: spin stabilization, gravity gradient methods, 3 axis stabilization-Commonly used control systems: mass expulsion systems, Momentum exchange Systems, gyro and magnetic torquer-sensors star and sun sensor, earth sensor, magnetometers and inertial sensors

UNIT - V POWER SYSTEM AND BUS ELECTRONICS

Solar panels: Silicon and Ga-As cells, power generation capacity, efficiency-Space battery systems-battery types, characteristics and efficiency parameters-Power electronics. Telemetry and tele command systems. Tm&Tc functions, communication bands, their characteristics and applications-Coding systems –Onboard computer –Ground checkout systems.
### TEXTBOOKS:

<table>
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<tr>
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<th>Title of the Book</th>
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<tbody>
<tr>
<td>2.</td>
<td>Andrew F. Inglis, Arch C. Luther</td>
<td>Satellite Technology</td>
<td>FocalPress, Massachusetts</td>
<td>1997</td>
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<tr>
<td>3.</td>
<td>Hughes, P.C.</td>
<td>Space craft altitude Dynamics</td>
<td>Wiley</td>
<td>1986</td>
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<tr>
<td>4.</td>
<td>Franceis J.Hale</td>
<td>Introduction to space flight</td>
<td>Prentice Hall</td>
<td>1994</td>
</tr>
</tbody>
</table>

### WEB REFERENCES:

- en.wikipedia.org/wiki/Communications_satellite
- en.wikipedia.org/wiki/Satellite
- https://www.esoa.net/Satellite-technology-.htm
- www.radio-electronics.com/info/satellite/
OBJECTIVES:
An understanding and experience of design of an aerospace system, mission, or vehicle and Identifying Engineering Problems

UNIT-I REQUIREMENTS OF FLIGHT VEHICLE:
Type, role, mission. Payload, performance and other requirements. Study of comparable aircraft - principal design and constructional and performance. Data collection and statistical analysis.

UNIT-II CONCEPTUAL SKETCH AND FIRST ESTIMATE OF WEIGHT
Conceptual sketch of candidate design - alternative configurations. First estimate of take off weight. Airfoil and wing geometry selection. Estimate of thrust to weight ratio and wing loading.

UNIT-III FUSELAGE AND CONTROL SURFACES
Sizing of Fuselage and control surfaces and drawing of the configuration. Weight balance

UNIT-IV PERFORMANCE AND STABILITY ESTIMATE

UNIT-VFLIGHT CONTROL SYSTEM
Flight control system, Landing Gear and subsystem, Propulsion and Fuel system integration, Air pressurization and air conditioning system, Electrical & Avionic system
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## WEB REFERENCES:

- highered.mheducation.com/.../6eCh10FlightVehicleStructuresAndMateri
- https://www.cranfield.ac.uk/courses/.../aerospace-vehicle-design.html
- en.wikipedia.org/wiki/Flying_car_(aircraft)
OBJECTIVES:

- Develop a conceptual design of a spacecraft, following methods used in government and industry
- Apply numerical integration and differentiation in aerospace applications

UNIT I INTRODUCTION
Design Philosophy of aircraft systems- Principles of design - Configuration design - Arriving design specification for detailed design

UNIT II DESIGN METHODOLOGIES
Emphasis on design procedures for the design of wings, fuselage, landing gear, pressure vessels including manoeuvring loads. Design of Aircraft parts and landing gears using engineering design methods/codes and standards to arrive at design for detailed analysis.

UNIT III FUSELAGE DESIGN

UNIT IV MODELLING AND SIMULATION OF WING SURFACES
Estimation of wing loading, wing idealization, mesh generation, element formulation, consistent load vectors, solutions and stress distribution.

UNIT V ANALYSIS OF LANDING GEAR
Evaluation of reaction loads on the members of the landing gear and analysis of landing gear system, oleo strut, torquelinke.
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# WEB REFERENCES:

- [https://www.cranfield.ac.uk/courses/.../aerospace-vehicle-design.html](https://www.cranfield.ac.uk/courses/.../aerospace-vehicle-design.html)
- [ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20060018286.pdf](ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20060018286.pdf)
- [en.wikipedia.org/wiki/Aerospace_engineering](en.wikipedia.org/wiki/Aerospace_engineering)
- [www.ae.gatech.edu/~lsankar/AE1350/Lecture.2.ppt](www.ae.gatech.edu/~lsankar/AE1350/Lecture.2.ppt)
OBJECTIVES:

- Ability to demonstrate a systematic understanding of relevant international and national regulations and explain their effects on airport business, planning, design, operations and safety management decisions.

UNIT-I AIRPORTS AND AIRPORT SYSTEMS

Introduction-Airport Management on an international level- Rules that govern airport management-
Airport ownership and organization-Airport organization chart-Airport manager and public relations

UNIT-II THE AIRFIELD

Components of an airport-The airfield-Navigation aids (NAVAIDS) located on airfields-Air traffic
Control and surveillance facilities located on the airfield-Weather reporting facilities located on
airfields-security infrastructure on airfields

UNIT-III AIRSPACE AND AIR TRAFFIC CONTROL

Air traffic control management and operating infrastructure-Basics of air traffic control-Current and
future enhancementsto air traffic control

UNIT-IV AIRPORT TERMINALS AND GROUND ACCESS

Historical development of airport terminals-Components of airport terminal-Airport ground access
Pavement management-Aircraft rescue and fire fighting (ARFF)-Snow and ice control-Safety
inspection programs-Bird and wildlife hazard management

UNIT-V AIRPORT SECURITY

Transportation Security Administration-Security at commercial service airports-Security at general
aviation airports
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<td>2.</td>
<td>Rigas Doganis</td>
<td>The Airport Business</td>
<td>Routledge</td>
<td>2005</td>
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www.tdot.state.tn.us/aeronautics/handbook/airportmanagementguide.pdf  
www.aviation.unsw.edu.au/.../AVIA5007_CourseOutline_2012web.pdf  
en.wikipedia.org/wiki/Total_Airport_Management_Systems  
alagappauniversity.ac.in/files/question.../M.B.A.(A%20&%20AM).pdf  
www.unige.ch/formcont/aviation/aviation.pdf  
www.studymode.com › Home › Literature › Periodicals
OBJECTIVES:
To familiarize the learner with non-aeronautical uses of aerodynamics such as road vehicle, building aerodynamics and problems of flow induced vibrations

UNIT I ATMOSPHERIC BOUNDARY LAYER
Atmospheric circulation-Local winds-Terrain types-Mean velocity profiles-Power law and logarithm law- wind speeds-Turbulence profiles-Roughness parameters-simulation techniques in wind tunnels

UNIT II BLUFF BODY AERODYNAMICS
Boundary layers and separation-Two dimensional wake and vortex formation-Strouhal and Reynolds numbers-Separation and reattachments-Power requirements and drag coefficients of automobiles-Effects of cut back angle-aerodynamics of trains.

UNIT III WIND ENERGY COLLECTORS
Horizontal and vertical axis machines-energy density of different rotors-Power coefficient- Betz coefficient by momentum theory.

UNIT IV BUILDING AERODYNAMICS
Pressure distribution on low rise buildings-wind forces on buildings-Environmental winds in city blocks-special problems of tall buildings-building codes-ventilation and architectural aerodynamics

UNIT V FLOW INDUCED VIBRATIONS
Vortex shedding, lock & effects of Reynolds number on wake formation in turbulent flows - across wind galloping-wake galloping-along wind galloping of circular cables-oscillation of tall structures and launch vehicles under wind loads-stall flutter.
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<tr>
<td>3.</td>
<td>Peter Sachs</td>
<td>Wind Forces in Engineering</td>
<td>Pergamon Press</td>
<td>2013</td>
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## WEB REFERENCES:

- [www.windows2universe.org/earth/Atmosphere/boundary_layer.html](http://www.windows2universe.org/earth/Atmosphere/boundary_layer.html)
- [serve.me.nus.edu.sg/fluid/index_files/bluffbodyaerodynamics.html](http://serve.me.nus.edu.sg/fluid/index_files/bluffbodyaerodynamics.html)
- [www.ifh.kit.edu/english/112.php](http://www.ifh.kit.edu/english/112.php)
OBJECTIVES:
To know the
- Concepts in combustion
- To make combustion calculations
- To know supersonic combustion

UNIT I-FUNDAMENTAL CONCEPTS IN COMBUSTION
Thermo-chemical equations - Heat of reaction first order, second order and third order reactions — premixed flames - Diffusion flames

UNIT II-CHEMICAL KINETICS AND FLAMES

UNIT III-COMBUSTION IN GAS TURBINE ENGINES

UNIT IV-COMBUSTION IN ROCKETS

UNIT V-SUPERSONIC COMBUSTION
Introduction - Supersonic combustion controlled by mixing, diffusion and heat convection - Analysis of reaction and mixing processes - Supersonic burning with detonation shocks.
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**WEB REFERENCES:**

- en.wikipedia.org/wiki/Combustion_Engineering
- articles.courant.com › Collections
- www.asbestos.com › Asbestos Exposure › Asbestos Manufacturers
- windsorhistoricalsociety.org/fa_combustion.html
OBJECTIVES:

- To analyze cryogenic systems
- To calculate the efficiency of cryogenic systems
- To know cryogenic applications in aerospace engineering

UNIT I - INTRODUCTION

Historical Background - Introduction to cryogenic propellants – Liquid hydrogen, liquid helium, liquid nitrogen and liquid oxygen and their properties

UNIT II - PRODUCTION OF LOW TEMPERATURE

Theory behind the production of low temperature - Expansion engine heat exchangers - Cascade process Joule Thompson Effect - Magnetic effect - Ortho and H2 - Helium4 and Helium 3

UNIT III - EFFICIENCY OF CRYOGENIC SYSTEMS

Types of losses and efficiency of cycles - specific amount of cooling - The fraction liquified - Cooling coefficient of performance - Thermodynamic efficiency – The energy balance Method

UNIT IV - CYCLES OF CRYOGENIC PLANTS


UNIT V - CRYOGENIC IN AEROSPACE APPLICATIONS

Cryogenic liquids in Rocket launching and space simulation Storage of cryogenic liquids - Effect of cryogenic liquids on properties of aerospace materials – Cryogenic loading problems - Zero gravity problems associated with cryogenic propellants - Phenomenon of tank collapse - Elimination of Geysering effect in missiles
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**WEB REFERENCES:**

- [en.wikipedia.org/wiki/Cryogenics](en.wikipedia.org/wiki/Cryogenics)
- [www.journals.elsevier.com/cryogenics](www.journals.elsevier.com/cryogenics)
- [cryogenics.nist.gov/AboutCryogenics/about%20cryogenics.htm](cryogenics.nist.gov/AboutCryogenics/about%20cryogenics.htm)
- [www.cryogenic.co.uk/](www.cryogenic.co.uk/)
OBJECTIVES:
To study the various Maintenance Processes followed on an Aircraft.

UNIT - I AIRCRAFT MAINTENANCE PRACTICES
General knowledge of procedure of jacking, leveling and mooring of aircraft. Knowledge of maintenance and handling of ground equipment such as engine starting trolley, hydraulic trolley and air condition trolley used in the maintenance of aircraft. Knowledge of safety and fire precautions to be observed during maintenance, refueling and defueling of aircraft. Knowledge of aircraft fire extinguishers. Maintenance safety

UNIT - II WORKSHOP PRACTICES
Uses of Hand tools in aircraft maintenance, precision measuring instruments. Knowledge and terminology, of aircraft bolts, nuts, rivets, screws, and locking devices. Knowledge of various types of gears and bearings, their use and common defects. Knowledge of various types of threads, drills, taps, reamers.

UNIT - III AIRCRAFT HARDWARE, MATERIALS, SYSTEM PROCESSES

UNIT - IV INSPECTION
Purpose – type – inspection interval & inspection schedule. Special inspection. FAR Air worthiness directive Type certificate data sheet, service bulletin

UNIT - V AIRCRAFT ENGINE, ELECTRICAL AND INSTRUMENT
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<td>General Handbook</td>
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<td>5.</td>
<td>Titterton</td>
<td>Aircraft Materials and Processes</td>
<td>Shroff Publishers Mumbai</td>
<td>2007</td>
</tr>
</tbody>
</table>

### WEB REFERENCE:
- www.classle.net/faq/10378
OBJECTIVES::

- To know about the various Measurements and Instrumentation techniques in the Field of engineering.

UNIT I INTRODUCTION


UNIT II TRANSUDER ELEMENTS, INDICATING AND RECORDING ELEMENTS

Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive Self Generating and Non-Self Generating Types, Electromagnetic, Electrodynamical, Eddy Current, Variable Inductance, Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators, Differentiating and Integrating Elements, Filters, Classification of Filters, Digital Voltmeters (DVMs), Cathode Ray Oscilloscopes (CROs), Galvanometric Recorders, Magnetic Tape recorders, Data Acquisition Systems, Data Display and Storage.

UNIT III MOTION, FORCE AND TORQUE MEASUREMENT


UNIT IV PRESSURE AND FLOW MEASUREMENT


UNIT V TEMPERATURE MEASUREMENT

Introduction, Measurement of Temperature, Non-Electrical Methods – Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods –

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OBJECTIVES:
To study the basic concepts of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.

UNIT I PISTON ENGINES
Carburetion and Fuel injection systems for small and large engines - Ignition system components - spark plug detail - Engine operating conditions at various altitudes – Engine power measurements – Classification of engine lubricants and fuels – Induction, Exhaust and cooling system - Maintenance and inspection check to be carried out. Inspection and maintenance and troubleshooting - Inspection of all engine components - Daily and routine checks - Overhaul procedures - Compression testing of cylinders - Special inspection schedules - Engine fuel, control and exhaust systems - Engine mount and super charger - Checks and inspection procedures.

UNIT II PROPELLERS
Propeller theory - operation, construction assembly and installation - Pitch change mechanism-Propeller axially system- Damage and repair criteria - General Inspection procedures - Checks on constant speed propellers - Pitch setting, Propeller Balancing, Blade cuffs, Governor/Propeller operating conditions – Damage and repair criteria.

UNIT III JET ENGINES
Types of jet engines – Fundamental principles – Bearings and seals - Inlets - compressors- turbines-exhaust section – classification and types of lubrication and fuels- Materials used - Details of control, starting around running and operating procedures – Inspection and Maintenance- permissible limits of damage and repair criteria of engine components- internal inspection of engines- compressor washing- field balancing of compressor fans- Component maintenance procedures - Systems maintenance procedures - use of instruments for online maintenance - Special inspection procedures-Foreign Object Damage - Blade damage .

UNIT IV TESTING AND INSPECTION

UNIT V OVERHAULING
Engine Overhaul - Overhaul procedures - Inspections and cleaning of components - Repairs schedules for overhaul - Balancing of Gas turbine components. Trouble Shooting: Procedures for trouble shooting - Condition monitoring of the engine on ground and at altitude - engine health monitoring and corrective methods.
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<td>1.</td>
<td>Turbomeca</td>
<td>Gas Turbine Engines</td>
<td>The English Book Store, New Delhi.</td>
<td>1993</td>
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<td></td>
<td>Whitney</td>
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</table>

## WEB REFERENCES:

- www.sbtdc.org/pdf/aircraft.pdf
- www.ueet.nasa.gov/StudentSite/engines.html
- www.opm.gov/fedclass/fws8602.pdf
OBJECTIVES:

- To provide extensive treatment of the operating principles and limitations of pressure and temperature measurements.
- To cover both operating and application procedures of hot wire anemometer.
- To describe flow visualization techniques and to highlight in depth discussion of analog methods.

UNIT I BASIC MEASUREMENTS IN FLUID MECHANICS

UNIT II WIND TUNNEL MEASUREMENTS

UNIT III FLOW VISUALIZATION AND ANALOGUE METHODS
Visualization techniques – Smoke tunnel – Hele-Shaw apparatus - Interferometer – Fringe-Displacement method – Schlieren system – Shadowgraph - Hydraulic analogy – Hydraulic jumps – Electrolytic tank

UNIT IV PRESSURE, VELOCITY AND TEMPERATURE MEASUREMENTS
Pitot-Static tube characteristics - Velocity measurements - Hot-wire anemometry – Constant current and Constant temperature Hot-Wire anemometer – Pressure measurement techniques - Pressure transducers – Temperature measurements.

UNIT V SPECIAL FLOWS AND UNCERTAINTY ANALYSIS
Experiments on Taylor-Proudman theorem and Ekman layer – Measurements in boundary layers - Data acquisition and processing – Signal conditioning – Uncertainty analysis – Estimation of measurement errors – External estimate of the error – Internal estimate of the error – Uncertainty calculation - Uses of uncertainty analysis
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<td>2.</td>
<td>R. Goldstein</td>
<td>Fluid Mechanics Measurements</td>
<td>Taylor And Francis</td>
<td>1996</td>
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**WEB REFERENCES:**

- [www.uio.no/studier/emner/matnat/math/MEK9600/](http://www.uio.no/studier/emner/matnat/math/MEK9600/)
- [www.springer.com › Home › Materials › Mechanics](http://www.springer.com › Home › Materials › Mechanics)
OBJECTIVES:
To introduce basic concepts of design and trajectory estimation of rocket and missiles

UNIT - I  ROCKETS SYSTEM

UNIT - II  AERODYNAMICS OF ROCKETS AND MISSILES

UNIT - III  ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD
One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields – description of Vertical, Inclined and Gravity Turn Trajectories – Determination of range and Altitude Simple Approximations to Burnout Velocity.

UNIT - IV  STAGING AND CONTROL OF ROCKETS AND MISSILES

UNIT - V  MATERIALS FOR ROCKETS AND MISSILES
Selection of Materials – Special Requirements of Materials to Perform under Adverse Conditions.
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## WEB REFERENCES:

- www.n55.dk/manuals/n55rocketsystem/n55rocketsystem.html
- www.rasaero.com/
- www.relativitycalculator.com/rocket_equations.html
OBJECTIVES:

- Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations.
- After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling.

UNIT I OVERVIEW OF MANAGEMENT

UNIT II PLANNING AND ORGANISING

UNIT - III DIRECTING AND CONTROLLING

UNIT - IV ENTREPRENEURSHIP AND MOTIVATION

UNIT - V TYPES OF ENTERPRISES, OWNERSHIP STRUCTURE AND PROJECTS
Small scale, medium scale and large scale enterprises, role of small enterprises in economic development; proprietorship, partnership, Ltd. companies and co-operatives: their formation, capital structure and source of finance. Identification and selection of projects; project report: contents and formulation, concept of project evaluation, methods of project evaluation: internal rate of return method and net present value method.
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### WEB REFERENCES:

- [www.montegodata.co.uk/Leading/planning.html](http://www.montegodata.co.uk/Leading/planning.html)
- [www.managementstudyguide.com/directing_function.html](http://www.managementstudyguide.com/directing_function.html)
OBJECTIVES:
The course presents the elements of solid modeling, creation of parts of increasing complexity and the assembly of parts to form a final design, along with mechanism simulation. The operation and programming of CNC machines is covered.

UNIT – I INTRODUCTION
Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.

UNIT – II COMPUTER GRAPHICS
Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – III GEOMETRIC MODELING
Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

UNIT – IV DRAFTING AND MODELING SYSTEMS
Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling, constraint based modeling.

UNIT – V NUMERICAL CONTROL
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<td>1</td>
<td>Ibrahim Zeid</td>
<td>CAD / CAM Theory and Practice</td>
<td>TMH, New Delhi.</td>
<td>2002</td>
</tr>
<tr>
<td>2</td>
<td>Radhakrishnan and subramanian</td>
<td>CAD / CAM / CIM</td>
<td>New Age Publications, New Delhi</td>
<td>2010</td>
</tr>
</tbody>
</table>

WEB REFERENCES:

en.wikipedia.org/wiki/Computer-aided_technologies

www.autodesk.com/solutions/cad-cam


www.planmeca.com/CADCAM/

www.dloac.org/symposium
OBJECTIVES:
To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working.

UNIT - I MECHANISMS

UNIT - II GEARs
Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque.

UNIT - III CAMS
Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

UNIT - IV BALANCING
Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method

UNIT - V VIBRATION
**TEXT BOOKS:**

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>AUTHOR(S)</th>
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</table>

**WEB Reference:**

- [www.camnetics.com/books.htm](http://www.camnetics.com/books.htm)
- [www.britannica.com/EBchecked/topic/90418/cam](http://www.britannica.com/EBchecked/topic/90418/cam)
- [www.freestudy.co.uk/dynamics/balancing.pdf](http://www.freestudy.co.uk/dynamics/balancing.pdf)
- [www.designworldonline.com](http://www.designworldonline.com)
OBJECTIVES:

- To Understand the basic difference between incompressible and compressible flow
- To study the phenomenon of shock waves and its effect on flow
- To gain basic knowledge about jet propulsion and Rocket Propulsion

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS

Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves and Mach cone –Effect of Mach number on compressibility - Isentropic flow through variable area ducts - Nozzle and Diffusers –Use of Gas tables.

UNIT II FLOW THROUGH DUCTS

Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow)
Variation of flow properties - Use of tables and charts - Generalised gas dynamics.

UNIT III NORMAL AND OBLIQUE SHOCKS

Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl – Meyer relations - Use of table and charts – Applications.

UNIT IV JET PROPULSION

Theory of jet propulsion - Thrust equation - Thrust power and propulsive efficiency - Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines – Aircraft combustors.

UNIT V SPACE PROPULSION

Types of rocket engines - Propellants - Ignition and combustion - Theory of rocket propulsion – Performance study - Staging - Terminal and characteristic velocity - Applications - Space flights.
TEXTBOOKS:

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WEB REFERENCES:

www.adl.gatech.edu/classes/gasdyn/gasdyn01.html
navier.stanford.edu/thermosciences/htgl.html
web.mit.edu/aeroastro/labs/spl/
www.aerospaceguide.net/spacepropulsion/index.html
OBJECTIVES:
Provides an in-depth understanding of aeroelastic behavior for aerospace systems. Explores aeroelastic phenomena, structural dynamics and fluid-structure-control interaction; also examines practical issues such as ground and flight tests.

UNIT I VIBRATIONS

UNIT II AEROELASTICITY PHENOMENA:
Vibration of beams due to coupling between bending and torsion - The aero-elastic triangle of forces - Stability versus response problems – Aeroelasticity in Aircraft Design – Vortex induced vibration.

UNIT III DIVERGENCE OF A LIFTING SURFACE:

UNIT IV STEADY STATE AEROELASTIC PROBLEMS:
Loss and reversal of aileron control – Critical aileron reversal speed – Aileron efficiency – Semirigid theory and successive approximations – Lift distributions – Rigid and elastic wings.

UNIT V FLUTTER PHENOMENON:
TEXTBOOKS:

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WEB REFERENCES:

- www.nptel.iitm.ac.in/courses/101104005/
- www3.imperial.ac.uk/aeroelastics
- researchtech.larc.nasa.gov/branches/aero_elas.html
- www.infography.com/content/554054344796.html
- www.researchgate.net/.../225978416_Aeroelastic_problems_of_civil
**OBJECTIVES:**
To bring awareness on experimental method of finding the response of the structure to different types of load.

**UNIT - I MEASUREMENTS**
Principles of measurements, Accuracy, Sensitivity and range of measurements.

**UNIT - II EXTENSOMETERS**
Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

**UNIT - III ELECTRICAL RESISTANCE STRAIN GAUGES**
Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheat stone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

**UNIT - IV PHOTO ELASTICITY**
Two dimensional photo elasticity, Concept of light–photo elastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

**UNIT - V NON-DESTRUCTIVETESTING**
**TEXTBOOKS:**

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**WEB REFERENCES:**

- nptel.iitm.ac.in/courses/112106068
- courses.washington.edu/me354a/photoelas.pdf
- www.ndt.net/ndtaz/ndtaz.php
- www.ndt.net/
OBJECTIVES:
The purpose of this course is to give an overview of various Propellant Technologies that are employed in Aerospace Vehicles.

UNIT – I LIQUID FUELS
Properties and tests for petroleum products - Motor gasoline - Aviation gasoline - Aviation turbine fuels – Requirements of aviation fuels of kerosene type and high flash point type - Requirements for fuel oils.

UNIT – II SOLID PROPELLANTS

UNIT – III LIQUID PROPELLANTS

UNIT – IV CRYOGENIC PROPELLANTS

UNIT – V PROPELLANT TESTING
Laboratory testing - Arc Image Furnace - Ignitability studies - Differential Thermal Analysis - Thermo-gravimetric analysis - Particle size measurement Micro-merograph - Strand burner tests impulse bomb - Performance estimation.
### TEXTBOOKS:

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### WEB REFERENCES:

OBJECTIVES:
To introduce the fundamentals of boundary layer theory. To make the student understand the importance of viscosity and boundary layer in fluid flow. To introduce the theory behind laminar and turbulent boundary layers.

UNIT I FUNDAMENTAL EQUATIONS OF VICOUS FLOW
Fundamental equations of viscous flow, Conservation of mass, Conservation of Momentum-Navier-Stokes equations, Energy equation, Mathematical character of basic equations, Dimensional parameters in viscous flow, Non dimensional sing the basic equations and boundary conditions, vorticity considerations, creeping flow, boundary layer flow

UNIT II SOLUTIONS OF VICOUS FLOW EQUATIONS
Solutions of viscous flow equations, Couette flows, Hagen-Poiseuille flow, Flow between rotating concentric cylinders, Combined Couette-Poiseuille Flow between parallel plates, Creeping motion, Stokes solution for an immersed sphere, Development of boundary layer, Displacement thickness, momentum and energy thickness.

UNIT III LAMINAR BOUNDARY LAYER EQUATIONS
Laminar boundary layer equations, Flat plate Integral analysis of Karman – Integral analysis of energy equation – Laminar boundary layer equations – boundary layer over a curved body-Flow separation- similarity solutions, Blasius solution for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature profiles for constant plate temperature – Reynold’s analogy, Integral equation of Boundary layer – Pohlhausen method – Thermal boundary layer calculations

UNIT IV TURBULENT BOUNDARY LAYER
Turbulence-physical and mathematical description, Two-dimensional turbulent boundary layer equations — Velocity profiles – The law of the wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent boundary layer on a flat plate – Boundary layers with pressure gradient, Eddy Viscosity, mixing length , Turbulence modeling

UNIT V COMPRESSIBLE BOUNDARY LAYERS
Compressible boundary layer equations, Recovery factor, similarity solutions, laminar supersonic Cone rule, shock-boundary layer interaction
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### WEB REFERENCES:

1. nptel.iitm.ac.in/video.php?subjectId=105101082
2. www.fluid.mech.ntua.gr/laer/fluidsec.html
3. nptel.iitm.ac.in/courses/Webcourse-contents/.../Course_home-9.html
4. www.desktop.aero/appliedaero/blayers/lambl.html
5. www.efm.leeds.ac.uk/CIVE/CIVE1400/.../laminar_turbulent.htm
OBJECTIVES:

- To study concepts and techniques of linear and nonlinear control system analysis and synthesis in state space framework.
- It will have preferential bias towards aerospace applications, especially towards aircrafts and missiles.
- However, the theory as well as many demonstrative examples studied in this course will be generic.

UNIT I INTRODUCTION

UNIT II NON LINEAR SYSTEMS

UNIT III CONTROL SYSTEM DESIGN
Pole Placement Control Design.- Pole Placement Observer Design - Static Optimization - Optimal Control Formulation; Linear Quadratic Regulator (LQR) Design - Application of Linear Control Theory to Autopilot Design of Aircrafts and Missiles- Gain Scheduling and Dynamic Inversion Design.

UNIT IV STABILITY ANALYSIS & LYAPUNOV THEORY

UNIT V NONLINEAR CONTROL DESIGN
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WEB REFERENCES:

nptel.ac.in/courses/101108047/8
www.learnerstv.com/Free-engineering-Video-lectures-ltv543-Page1.htm
www.studycircle.com/.../advanced-control-system-design-aerospace-veh
www.slideshare.net/nyinyikyaw/basic-aircraft-control-system-7376945
OBJECTIVES:

- Ability to apply knowledge of math., science, and engineering. This will be accomplished by applying these disciplines to solve problems regarding space flight.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished through problems from orbital mechanics such as finding characteristics of desired transfer trajectories and the corresponding specific impulses.

UNIT 1 INTRODUCTION
Dynamics of point masses kinematics- time derivatives-relative motion – the two body problem-
equations of motion in inertial frame, relative motion- angular momentum, circular, elliptical, parabolic, hyperbolic trajectories Lagrangian coefficients-three body problem

UNIT II ORBITAL ELEMENTS
Orbits Vs trajectories, universal variables, orbits as function of time, orbits in three dimensions – Gibbs method,Lambert Problem, sidereal time- top centric coordinate system- gauss method

UNIT III MANEUVERS
Hofmann transfer-bi-elliptic Hofmann-non Hoffman-plane range-relative motion –rendezvous motion-interplanetary trajectories – gyroscopic instruments-mechanisms- types -operation

UNIT IV RIGID BODY DYNAMICS
Kinematics-equations of motion, rotational motion-moment of inertia-Euler’s equation-kinetic energy-Euler’s angles-yaw, pitch and roll angles, dual spin the spinning top problem

UNIT V ATTITUDE DYNAMICS
Torque free motion - stability -dual spin-rotation damper-coning maneuver -attitude control thrusters-gyroscopic attitude control-gravity-gradient stabilization- rocket vehicle dynamics-thrust equation-rocket performance- staging-optimal staging
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**WEB REFERENCES**

en.wikipedia.org/wiki/Orbital_mechanics

www.braeunig.us/space/orbmech.htm

https://www.agi.com/.../at_051303_0830_orbital_mechanics_viasbirs.pd..

www2.jpl.nasa.gov/basics/bsf3-4.php

physics.info/orbital-mechanics-l
OBJECTIVES:
The objective of this course is to introduce the students the essential knowledge and skills they need to be able to do conceptual and preliminary design of various flight control systems. The course begins with some introductory definitions and classifications followed by aerodynamic considerations in control system design.

UNIT I INTRODUCTION TO CONTROL SYSTEM DESIGN & FCS

UNIT II AERODYNAMIC CONSIDERATIONS OF FLIGHT CONTROL SYSTEMS
Static and Dynamic Stability - Stability and Maneuverability - Static Margin - Variations of the Center of Pressure - Hinge Moment - Aeroelastic Effects - Control System Performance - Canard Control - Wing Control - Tail Control - Fin Configuration Effects - Side Jet Control-Thrust - Vector Control - Variation of Mass and CG

UNIT III SENSORS & ACTUATORS

UNIT IV CONTROLLER DESIGN

UNIT V AIRCRAFT CONTROL SYSTEM DESIGN
Longitudinal Control-Lateral Control- Attitude Control Systems -Flight Path Control Systems-Active Control Systems -Thrust Vector Control - Classifications and Applications -
Mathematical Modeling - Control Architectures - Controller Design - Miscellaneous Topics - Sensitivity Analysis - Man in the Loop considerations - Parameter Optimization

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**WEB REFERENCES**

en.wikipedia.org/wiki/Aircraft_flight_control_system
www.diva-portal.org/smash/get/diva2:224078/fulltext01
www.slideshare.net/nyinyikyaw/basic-aircraft-control-system-7376945
OBJECTIVES:
To introduce the aerodynamic behavior of turbomachinery devices and their components in Gas turbine engines

UNIT I INTRODUCTION TO TURBOMACHINERIES
General fluid dynamics governing equations, Classification of turbomachinery thermodynamic analysis - efficiency – dimensional analysis, Elementary Airfoil theory, Euler’s Turbomachinery equations

UNIT II AXIAL FLOW COMPRESSORS AND FANS

UNIT III AXIAL FLOW TURBINES
Introduction, Turbine stage, Turbine Blade 2-D (cascade) analysis Work Done, Degree of Reaction, Losses and Efficiency, Flow Passage, Subsonic - transonic and supersonic turbines, Multi-staging of Turbine, Exit flow conditions, Turbine Cooling, Turbine Blade design – Turbine Profiles : Airfoil Data and Profile construction.

UNIT IV CENTRIFUGAL COMPRESSORS
Introduction, Elements of centrifugal compressor/ fan, Inlet Duct Impeller, Slip factor, Concept of Rothalpy, Modified work done, Incidence and lag angles, Diffuser, Centrifugal Compressor Characteristics, Surging, Chocking, Rotating stall, Design

UNIT V MODULE V RADIAL TURBINE
Introduction, Thermodynamics and Aerodynamics of Radial turbines, Radial Turbine Characteristics, Losses and efficiency, Design of radial turbines
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<tr>
<td>2</td>
<td>Ganesan V</td>
<td>Gas Turbines</td>
<td>McGraw Hill, Newdelhi.</td>
<td>2010</td>
</tr>
</tbody>
</table>

**WEB REFERENCES**

- [www.nptelvideos.in/2012/11/turbomachinery-aerodynamics.html](http://www.nptelvideos.in/2012/11/turbomachinery-aerodynamics.html)
- [www.cdeep.iitb.ac.in/NPTEL2/](http://www.cdeep.iitb.ac.in/NPTEL2/)
- [www.omprakashsingh.com/events.html](http://www.omprakashsingh.com/events.html)
OBJECTIVES:
To introduce the basic concepts of measurement of forces and moments on models during the wind tunnel testing.

UNIT - I PRINCIPLES OF MODEL TESTING
Dimensional Homogeneity-Methods of Dimensional Analysis - Buckingham Theorem – Non-Dimensional Numbers –Scale Effect –Similarity laws-Types of Similarities– Geometric Kinematic and Dynamic similarities.

UNIT - II WIND TUNNELS
Classification and types – Special problems of Testing in Subsonic, Transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.

UNIT - III CALIBRATION OF WIND TUNNELS

UNIT - IV WIND TUNNEL MEASUREMENTS

UNIT - V FLOW VISUALIZATION
**TEXT BOOK:**

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**WEB REFERENCES:**

- naca.central.cranfield.ac.uk/reports/arc/rm/3319.pdf
- wright.nasa.gov/tested.htm
- www.tryengineering.org/lessons/windtunnels.pdf
- www.nasa.gov/centers/dryden/pdf/87754main_H-513.pdf
- www.waset.org/journals/waset/v55/v55-104.pdf
- www.uwal.org/uwalinfo/techguide/flowvis.htm
VALUE ADDED COURSES

15BTAS_51          PROFESSIONAL ETHICS          1 1 0 1 100

OBJECTIVES::

- To create an awareness on Engineering Ethics.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of others.

UNIT I ENGINEERING ETHICS
Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas –
moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of
Professional Roles - theories about right action - Self-interest - customs and religion - uses of
ethical theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a
balanced outlook on law - the challenger case study
SAFETY, RESPONSIBILITIES AND RIGHTS : Safety and risk - assessment of safety and risk
- risk benefit analysis and reducing risk - the three mile island and chernobyl case studies.
Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts
of interest - occupational crime - professional rights - employee rights - Intellectual Property
Rights (IPR) - discrimination.

UNIT III GLOBAL ISSUES
Multinational corporations - Environmental ethics - computer ethics - weapons development -
engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral
leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers(India),
Indian Institute of Materials Management, Institution of electronics and telecommunication
engineers(IETE),India, etc.

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<tr>
<td>2.</td>
<td>Govindarajan M, Natarajan S, Senthil Kumar V.S</td>
<td>Engineering Ethics</td>
<td>Prentice Hall of India, New Delhi</td>
<td>2004</td>
</tr>
</tbody>
</table>
OBJECTIVES::

- Monitor and evaluate a typical pump system.
- Specify and install the correct pump for the application.
- Develop a preventive maintenance plan for a pump system.
- Perform maintenance on a pump system.

UNIT I SINGLE PHASE INDUCTION MOTOR

UNIT II THREE PHASE INDUCTION MOTOR

UNIT III PUMPS
Pumps: definition and classifications - Centrifugal pump: classifications, working principle, velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: classification, working principle, indicator diagram, work saved by air vessels and performance curves - cavitations in pumps - rotary pumps: working principles of gear and vane pumps

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<td>Nagrath, I. J</td>
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<tr>
<td>2</td>
<td>Bimbhra, P. S</td>
<td>Electrical Machinery</td>
<td>Khanna Publishers, New Delhi</td>
<td>2003</td>
</tr>
</tbody>
</table>
OBJECTIVES::

- To study the procedure of the air traffic control.

UNIT - I  BASIC CONCEPTS
Objectives of ATS - Parts of ATC service – Scope and Provision of ATCs – VFR & IFR operations – Classification of ATS air spaces – Varies kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS – Division of responsibility of control.

UNIT - II  AIR TRAFFIC SERVICES
Area control service, assignment of cruising levels minimum flight altitude ATS routes and significant points – RNAV and RNP – Vertical, lateral and longitudinal separations based on time / distance –ATC clearances – Flight plans – position report

UNIT - III  FLIGHT INFORMATION ALERTING SERVICES, COORDINATION, EMERGENCY PROCEDURES AND RULES OF THE AIR

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<td>2.</td>
<td>John G. Wensveen</td>
<td>Air Transportation</td>
<td>Ashgate Publishers, Farnham, United Kingdom.</td>
<td>2011</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To understand the various safety measures to be taken in industrial environments.

UNIT-1 SAFETY MANAGEMENT

UNIT- II SAFETY IN MANUFACTURING
Safety in metal working- Machine guarding -Safety in welding and gas cutting -Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

UNIT- III ELECTRICAL SAFETY
### TEXT BOOKS:

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<tr>
<td>1.</td>
<td>Fordham Cooper W</td>
<td>Electrical Safety Engineering</td>
<td>Butterworths, London</td>
<td>1986</td>
</tr>
</tbody>
</table>
OBJECTIVES:

• To introduce the basic concepts of Nanoscience relevant to the field of engineering.
• To provide an exposure about the importance of various synthesis method.
• To enrich the knowledge of students in various characterisation techniques

UNIT I  INTRODUCTION& CLASSIFICATION OF NANOMATERIALS
Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic, transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

UNIT II PRODUCTION OF NANOPARTICLES
Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

UNIT III CARBON BASED NANOMATERIALS AND NANOPHOTONICS
### TEXT BOOKS:

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<tr>
<td>2.</td>
<td>A. Nabok</td>
<td>Organic and Inorganic Nanostructures</td>
<td>Artech House, Norwood.</td>
<td>2005</td>
</tr>
</tbody>
</table>
OPEN ELECTIVES
(COURSES OFFERED TO OTHER DEPARTMENTS)

15BTASOE01 INTRODUCTION TO SPACE TECHNOLOGY 3 0 0 3 100

OBJECTIVES:

- To develop a basic knowledge about satellite orbits, satellite dynamics and orbital elements.
- To learn the different cases of satellite orbit transfer, orbit perturbations.
- Basic of rocket flight dynamics, and ballistic missile trajectories.

UNIT I - ORBITAL MECHANICS

Fundamentals of orbital dynamics, two body problem, circular and escape velocities, motion in circular, elliptical, parabolic and hyperbolic orbits, different space missions, applications, types of satellite orbits, two body problem, equation of motion, orbit equation.

UNIT II - ORBITS IN THREE DIMENSIONS

Different coordinate frames, coordinate transformation, Orbital elements, relations between position and time, Effects of the earth’s oblateness, Orbit perturbation due to third body, orbit decay and life time.

UNIT III - ORBITAL MANEUVER

Impulsive maneuvers, Hohmann transfer, one tangent burn transfer, bi-elliptic Hohmann transfer, Phasing maneuvers, Plane change maneuvers.

UNIT IV - ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD

Multistage Rocket systems- rocket performance, restricted staging in field-free space, One dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields - Description of vertical, inclined and gravity turn trajectories.

UNIT V - BALLISTIC MISSILE TRAJECTORIES

Free-flight range equation, flight-path angle equation, maximum range trajectory, time of free-Flight, effect of earth rotation, effect of launching errors on range.
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**WEB REFERENCES:**

http://nptel.ac.in/courses/101106046/
ocw.tudelft.nl/.../aerospace.../introduction...aerospace.
www.space.com/
www.nasa.gov/directorates/spacetech/home
www.spacefoundation.org
OBJECTIVES:
To provide in-depth knowledge on various techniques of non-destructive testing.

UNIT I : INTRODUCTION
Properties of Materials – Characteristics of Ferrous, Non-ferrous and Alloys. Destructive testing and Non-destructive testing – Classification – Uses and applications. Codes, Standards and Specifications (ASME, ASTM, AWS etc.).

UNIT II PENETRANT TESTING AND MAGNETIC PARTICLE INSPECTION
Introduction to Penetrant Testing – Liquid Penetrants and Dye Penetrants - An Illustration of Penetrant Testing, Advantages of Penetrant Testing, Disadvantages of Penetrant Testing. Introduction to Magnetic Particle Inspection - An Illustration of Magnetic Particle Inspection, Advantages of Magnetic Particle Crack Detection, Disadvantages of Magnetic Particle Crack Detection

UNIT III ULTRASONIC FLAW DETECTION AND RADIOGRAPHY INSPECTION

UNIT IV EDDY CURRENT AND ELECTRO-MAGNETIC METHODS

UNIT V NON-DESTRUCTIVE INSPECTION (NDI) AND ITS APPLICATIONS
Inspection of Raw Products, Inspection For In-Service Damage, Power Plant Inspection, Storage Tank Inspection, Aircraft Inspection, Jet Engine Inspection, Pressure Vessel Inspection, Bridge Inspection, Pipeline Inspection.
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### WEB REFERENCE:

https://www.asnt.org/MinorSiteSections/AboutASNT/Intro-to-NDT

https://www.asnt.org/

www.bindt.org/

www.ndt.net/

OBJECTIVES:
- Ability to design UAV system
- Ability to identify different hardware for UAV

UNIT I INTRODUCTION TO UAV
History of UAV – classification – Introduction to Unmanned Aircraft Systems--models and prototypes – System Composition-applications

UNIT II THE DESIGN OF UAV SYSTEMS

UNIT III AVIONICS HARDWARE
Autopilot – AGL-pressure sensors-servos-accelerometer–gyros-actuators- power supply-processor, integration, installation, configuration, and testing

UNIT IV COMMUNICATION PAYLOADS AND CONTROLS
Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range –modems-memory system-simulation-ground test-analysis-trouble shooting

UNIT V THE DEVELOPMENT OF UAV SYSTEMS
Waypoints navigation-ground control software- System Ground Testing- System In-flight Testing- Future Prospects and Challenges-Case Studies – Mini and Micro UAVs.
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<tr>
<td>1.</td>
<td>Reg Austin</td>
<td>Unmanned Aircraft Systems UAV design, development and deployment</td>
<td>John Wiley &amp; Sons New York</td>
<td>2010</td>
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WEB REFERENCE:

www.draganfly.com/.../introduction-to-unmanned-aerial-vehicles-uavs/
rahauav.com/Library/.../Unmanned-Air-Systems
http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-83x
spaceflight.nasa.gov/shuttle/reference/shutref/orbiter/.../plcomm.html
www.theuav.com/
OBJECTIVES:
To study the procedure of the formation of aerodrome, its design and the concepts of air transportation.

UNIT - I  INTRODUCTION
Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft, airport: airline management and organization – levels of management, functions of management, Principles of organization planning the organization – chart, staff departments & line departments.

UNIT - II  AIRLINE ECONOMICS
Forecasting – Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. – Passenger fare and tariffs – Influence of geographical, economic & political factors on routes and route selection.

UNIT - III  PRINCIPLES OF AIRLINES SCHEDULING
Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipments and types of schedule – hub & spoke scheduling, advantages / disadvantages & preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT - IV  AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION

UNIT - V  VISUAL AIDS FOR NAVIGATION, VISUAL AIDS FOR DENOTING OBSTACLES EMERGENCY AND OTHER SERVICES
Visual aids for navigation Wind direction indicator – Landing direction indicator – Location and characteristics of signal area – Markings, general requirements – Various markings – Lights, general requirements – Aerodrome beacon, identification beacon – Simple approach lighting system and various lighting systems – VASI & PAPI - Visual aids for denoting obstacles; object to be marked and lighter – Emergency and other services.
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<td>2.</td>
<td>Fedric J.H</td>
<td>Aircraft Management</td>
<td>English Book house New Delhi</td>
<td>2000</td>
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### WEB REFERENCE:

- www.grc.nasa.gov/WWW/k-12/airplane/
- www.history.navy.mil/branches/car-toc.html
- www.britannica.com/EBchecked/topic/.../Aircraft-configurations
- www.brown.edu/Departments/EEB/EML/.../principles_flight.html
OBJECTIVES:
To introduce the basic concepts of various avionics systems of aircraft.

UNIT I INTRODUCTION TO AVIONICS

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

UNIT II DIGITAL AVIONICS ARCHITECTURE


UNIT III FLIGHT DECKS AND COCKPITS

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT IV INTRODUCTION TO NAVIGATION SYSTEMS


UNIT V AIR DATA SYSTEMS AND AUTO PILOT

Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.
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<td>1.</td>
<td>Albert Helfrick.D</td>
<td>Principles of Avionics</td>
<td>Avionics Communications Inc</td>
<td>2004</td>
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# WEB REFERENCES:

- [www.ntps.edu/courses/116-introduction-to-avionics-systems-course](http://www.ntps.edu/courses/116-introduction-to-avionics-systems-course)
- [www.ece.ucsb.edu/courses/ECE152/152A_Su11Shynk/Lec1.pdf](http://www.ece.ucsb.edu/courses/ECE152/152A_Su11Shynk/Lec1.pdf)
- [www.pbase.com/bruceleibowitz/cockpit](http://www.pbase.com/bruceleibowitz/cockpit)
- [www.cranfield.ac.uk/soe/shortcourses/.../avionics-introduction.html](http://www.cranfield.ac.uk/soe/shortcourses/.../avionics-introduction.html)