

**NOOURL ISLAM CENTRE FOR HIGHER EDUCATION**

**NOORUL ISLAM UNIVERSITY, KUMARACOIL**

**B.E. AERONAUTICAL ENGINEERING**

**CURRICULUM & SYLLABUS**

**SEMESTER I**

*(Common for All B.E/B.Tech. Programmes Except Marine Engineering)*

<b>Sl. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	EG1101	Technical English – I	3	1	0	4
2.	MA1101	Engineering Mathematics – I	3	1	0	4
3.	PH1101	Engineering Physics – I	3	0	0	3
4.	CH1101	Engineering Chemistry - I	3	0	0	3
5.	ME1101	Engineering Graphics	3	0	0	3
6.	CS1101	Fundamentals of Computing and Programming	3	0	0	3
<b>PRACTICAL</b>						
7.	CS1171	Computer Practice Lab - I	0	1	2	2
8.	ME1171	Computer Aided Drafting and Modeling Lab	0	1	2	2
9.	PH1171	Physics Lab – I	0	0	2	1
10.	CH1171	Chemistry Lab - I	0	0	2	1
<b>TOTAL</b>			<b>18</b>	<b>4</b>	<b>8</b>	<b>26</b>

**\* Those who have admitted from the Academic Year 2013-2014 onwards**

**EG1101**

**TECHNICAL ENGLISH – I**

**3 1 0 4**

**UNIT-I**

**9**

Verb-Tenses -12 Tenses-8 Passive Forms- Word formation with prefixes and suffixes

**UNIT-II**

**9**

Expansion of Compound Nouns – Punctuation - Definitions of Technical Terms - Changing words from one form to another - Imperatives and Instructions - Conditional clauses.

**UNIT-III**

**9**

Interrogatives and Question Tags - Asking Questions - Comprehension – Discourse Markers

**UNIT –IV**

**9**

Concord - Identifying Common Errors - Cause and Effect Expressions – Paragraph Writing – Copy Writing: Slogans and Captions - Writing Instructions - Letter Writing (Formal Letters)

**UNIT –V**

**9**

Creative Writing – Transcoding: Bar Chart, Flow Chart - Pie Chart - Tree Diagram - Tabular Column

**L: 45 + T: 15, TOTAL: 60 PERIODS**

**TEXT BOOK:**

Department of Humanities and Social Sciences, Anna University, English for Engineers and Technologists, Combined Edition (Volumes 1 @ 2), Chennai: Orient Black Swan Pvt.Ltd.,2006 Themes 1-4 (Resources, Energy, Computer, Transport)

**EXTENSIVE READING:**

A.P.J.Abdul Kalam with Arun Tiwari, Wings of Fire: An Autobiography, University Press (India) Pvt.Ltd, 1999, 30 Impression 2007

**NOTE:**

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

**MA1101**

**ENGINEERING MATHEMATICS - I**

**3 1 0 4**

**AIM:**

To impart the fundamental knowledge of Engineering Mathematics to the students in order to achieve a well founded knowledge about the principles of Mathematics.

**OBJECTIVE:**

The course objective is to develop the required skill of the students in the area of

Engineering Mathematics with special emphasis on the characteristic equation of matrices, differential calculus, Beta and Gamma functions and to develop basic knowledge to the students in double and triple integration.

**UNIT I MATRICES**

**9**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of eigen values and eigen vectors(without proof)– Cayley Hamilton theorem (statement only), verification and its applications – Orthogonal and Symmetric matrices and their properties(excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form.

**UNIT II DIFFERENTIAL CALCULUS**

**9**

Curvature – Cartesian co-ordinates and parametric form -Centre and radius of curvature, Circle of curvature – Evolutes.

**UNIT III FUNCTIONS OF SEVERAL VARIABLES**

**9**

Partial derivatives – Total derivatives – Jacobians – Properties – Maxima and minima for functions of two variables–Lagrange Multiplier method- Taylor’s expansion.

**UNIT IV BETA AND GAMMA INTEGRALS**

**9**

Evaluation of improper integrals- Beta and Gamma functions – Properties – Relation between Beta and Gamma functions - Evaluation of integrals using Beta and Gamma functions.

**UNIT V MULTIPLE INTEGRALS**

**9**

Evaluation of double and triple integrals – Area as double integral in cartesian and polar co-ordinates– Change of order of integration- Transformation of Cartesian coordinates into polar coordinates.

**L: 45 + T: 15, TOTAL: 60 PERIODS**

**TEXT BOOK:**

Grewal B.S., “Higher Engineering Mathematics”- 40<sup>th</sup> Edition , Khanna Publishers, Delhi 2007.

**REFERENCES:**

- 1 Veerarajan T, “ Engineering Mathematics (for first year)”, Tata McGraw- Hill Publishing Company Ltd.,New Delhi , 2007
- 2 Erwin Kreyszig, “ Advanced Engineering Mathematics”, 7<sup>th</sup> Edition, Wiley India, 2007.
- 3 P.Kandasamy , K.Thilagavathy , K.Gunavathy” Engineering Mathematics” Vol,1 S.Chand & Company Ltd.2002
4. B.V. Ramana,”Higher Engineering Mathematics” Tata McGraw- Hill, Publishing Company Ltd.,New Delhi, 2006

**AIM:**

To provide a sound knowledge on the principles of Physics and its practical applications in various areas of Engineering and Technology.

**OBJECTIVE:**

At the end of the course students would be exposed to

- The mechanical properties of matter and its engineering applications
- Application of ultrasonics in Industry and Medical field
- The important properties of light and their application
- Application of laser and fiber optics in communication and technology
- The fundamentals of heat- energy conversion and its application.

**UNIT I Properties of matter****9**

Elasticity – Poisson’s ratio – Stress-strain diagram – factors affecting elasticity – bending of beams – cantilever – bending moment – theory and experiment of Young’s modulus determination – Uniform and non-uniform bending – I shaped girders – twisting couple – hollow cylinder – shaft – torsion pendulum – determination of rigidity modulus

**UNIT - II Ultrasonics****9**

Introduction-production of ultrasonic waves- magnetostriction effect- magnetostriction generator-piezoelectric effect-piezoelectric generator-detection of ultrasonic waves-properties - velocity measurement - acoustic grating-industrial applications-drilling, welding, soldering and cleaning- SONAR- non destructive testing pulse echo system-medical applications-sonograms.

**UNIT –II Optics****9**

Interference: air wedge- theory and experiment-testing of flat surfaces- Michelson’s Interferometer-types of fringes- applications (determination of wavelength and thickness of thin transparent medium).

Polarization: Introduction- double refraction, quarter and half wave plates- production of plane, circularly and elliptically polarized light-detection of plane, circularly & elliptically polarized light.

Photoelasticity- Stress-optic law- photoelastic bench

**UNIT- IV Lasers & Fiber Optics****9**

Introduction- principle of spontaneous emission and stimulated emission, Einsteins A and B coefficients-derivation- population inversion, pumping, types of lasers- Nd-YAG, CO<sub>2</sub>- applications.

Principle and propagation of light in optical fibre- numerical aperture and acceptance angle- types of optical fibres (material, refractive index, mode)- double crucible technique of fibre drawing, fibre optic communication system (Block diagram)-fibreoptic sensors.

**UNIT – V Heat and Thermodynamics****9**

Thermal conductivity- Forbe's and Lee's disc methods-radial flow of heat- thermal conductivity of rubber and glass-thermal insulation in buildings - Laws of thermodynamics- Carnot's cycle as heat engine – efficiency, Otto engine & Diesel engine (qualitative).

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. R.K. Gaur and S.L.Gupta, 'Engineering Physics' Dhanpat Rai publications, New Delhi.
2. Marikani A, 'Engineering Physics' PHI learning pvt ltd, III Edition, New Delhi.
3. Palanisamy.P.K., 'Engineering Physics' Scitech publications, Chennai.
4. M.N. Avadhanulu and PG Kshirsagar. ' A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi.

**REFERENCES:**

1. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint.
2. Brijlal and Subrahmanyam 'Heat and Thermodynamics' S. Chand , Limited.
3. Ajoy Ghatak, ' Optics' Tata McGraw Hill Publications, New Delhi.
4. Brijlal and Subrahmanyam 'Properties of Matter' S. Chand , Limited.

**CH1101****ENGINEERING CHEMISTRY-I****3 0 0 3****AIM**

To have a thorough knowledge of the basics of chemistry particularly engineering oriented topics to engineering students.

**OBJECTIVES**

To make the students conversant with the principles of the following topics: (i) Water Technology, (ii) Engineering Materials and Polymers,(iii) Surface Chemistry and Nanomaterials,(iv) Analytical Techniques and (v) Chemical Kinetics

**UNIT I****WATER TECHNOLOGY****9**

Water as a universal solvent – hard and soft water – reasons for hardness – disadvantages of hard water in washing and industrial purposes - estimation of hardness by EDTA method, problems; boiler feed water – characteristics- softening methods - external conditioning – demineralization (ion exchange) process, desalination by reverse osmosis method- internal conditioning (phosphate, calgon and carbonate conditioning methods); stages in domestic water treatment – disinfection by chlorination, ozone and UV treatments.

## **UNIT-II ENGINEERING MATERIALS AND POLYMERS 9**

Abrasives – Natural & synthetic – Moh's scale, diamond, carborundum – Refractories – classification and properties – Cement – Manufacture. Lubricants- Types – properties of lubricants – oiliness, fire & flash points, pour & cloud point (definition only) – solid lubricants – Graphite and MoS<sub>2</sub>.

Polymer and polymerization (definition only)- examples for natural & synthetic polymers, Preparation, properties and uses of Kevlar, Nomex, Rubber – natural and synthetic – neoprene, butyl rubber- vulcanization of rubber, Introduction to Conducting polymers and Liquid crystal polymers.

## **UNIT III SURFACE CHEMISTRY AND NANOMATERIALS 9**

Adsorption – classification- adsorption of gases on solids- adsorption isotherms- Freundlich and Langmuir adsorption isotherms- adsorption of solutes from solution- application of adsorption-catalysis and pollution control-Nanomaterials – introduction – carbon nanotubes (CNT) and their applications.

## **UNIT IV ANALYTICAL TECHNIQUES 9**

Importance of spectroscopic techniques- Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. Thermal Analysis- TGA and DTA- principles- thermogram of calcium oxalate monohydrate.

## **UNIT-V CHEMICAL KINETICS 9**

Introduction – rate, rate constant, order & molecularity of reactions –First order reaction – Derivation of rate constant – Second order reactions – rate constant (no derivation, equation and problem only) - activation energy – concept-Arrhenius equation-derivation- steady state approximation.

**TOTAL: 45 PERIODS**

### **TEXT BOOKS:**

1. P.C. Jain and Monica Jain, Engineering Chemistry Dhanpat Rai Pub, Co., New Delhi (2002)
2. S.S. Dara, A text book of engineering chemistry S. Chand & C. Ltd., New Delhi (2006)
3. B. Sivasankar Engineering Chemistry Tate McGraw- Hill Pub. Co. Ltd, New Delhi (2008)

### **REFERENCES:**

1. B. K. Sharma Engineering Chemistry Krishna Prakasan Media (P) Ltd., Meerut (2001)
2. R. Gopalan, D. Venkappayya, Sulochana Nagarajan, Engineering Chemistry Vikas Pub, Co., New Delhi (2006)
3. Principles of physical chemistry by Samuel Glasstone, Van Nostrand pub.comp, Newyork.
4. Principles of physical chemistry by Puri & Sharma, Vikas pub.comp, 2008

**OBJECTIVE**

- To know the fundamental principles of geometrical drawing
- To visualize the various machine components

**Unit I - Introduction****9**

Introduction to Engineering Drawing, Drawing Standard, ISI code of practice, Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

**Unit II - Orthographic Projection (Points, Lines & Planes)****9**

Principles of orthographic projection-projection of points, straight lines, traces and projection of planes inclined to both planes Orthographic projection of simple engineering components-missing view exercises.

**Unit III - Orthographic Projection (Solids)****9**

Projection of solids – Inclined to one plane - Sections and Sectional Views of Right Angular Solids covering - Prism, Cylinder, Pyramid, Cone – Auxiliary Views

**Unit IV - Pictorial Projections****9**

Principles of pictorial views, isometric view of simple solids. Free hand sketching of orthographic views from pictorial views. Free hand sketching of isometric views from given two or three views.

**Unit V - Development Of Surfaces & Perspective Projection****9**

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Perspective Projection of Planes and Solids

**L: 45 + T: 15, TOTAL: 60 PERIODS****TEXT BOOKS:**

1. Venugopal K and Prabhu Raja V, “Engineering Graphics”, New Age International Publishers, 2007.
2. . Luzadder W J, “Fundamentals of Engineering Drawing”, Prentice Hall Book Co., New York, 1998
3. Bhat, N.D.& M. Panchal , *Engineering Drawing*, Charotar Publishing House,2008

**REFERENCES:**

1. Kumar M S, “Engineering Graphics”, Ninth Edition, DD Publications, Chennai, 2007.
2. Bureau of Indian Standards, “Engineering Drawing Practices for Schools and Colleges SP 46-2003”, BIS, New Delhi, 2003.
3. Shah, M.B. & B.C. Rana , *Engineering Drawing and Computer Graphics*, Pearson Education,2008

**CS1101      FUNDAMENTALS OF COMPUTING AND PROGRAMMING      3 0 0 3**

**AIM:**

To provide an awareness to Computing and Programming

**OBJECTIVES:**

- To enable the student to learn the major components of a computer system
- To know the correct and efficient ways of solving problems
- To learn to use office automation tools
- To learn to program in C

**UNIT - I Introduction to Computers      9**

Introduction – Characteristics of Computers – Evolution of Computers - Computer Generations – Classification of Computers – Basic Computer organization – Number Systems

**UNIT -II Computer Software      9**

Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – Getting connected to Internet Applications.

**UNIT – III Problem Solving and Office Application Software      9**

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode - Application Software Packages- Introduction to Office Packages (not detailed commands for examination).

**UNIT – IV Introduction to C      9**

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping.

**UNIT – V Functions and Pointers      9**

Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Ashok.N.Kamthane, “ Computer Programming”, Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, “A Structured Programming Approach Using C”, II Edition, Brooks-Cole Thomson Learning Publications, (2007).

**REFERENCES:**

1. Pradip Dey, Manas Ghoush, “Programming in C”, Oxford University Press. (2007).
2. Byron Gottfried, “Programming with C”, 2<sup>nd</sup> Edition, (Indian Adapted Edition), TMH publications, (2006).
3. Stephen G.Kochan, “Programming in C”, Third Edition, Pearson Education



- India, (2005).
4. Brian W.Kernighan and Dennis M.Ritchie, “The C Programming Language”, Pearson Education Inc., (2005).
  5. E.Balagurusamy, “Computing fundamentals and C Programming”, Tata McGraw-Hill Publishing Company Limited, (2008).
  6. S.Thamarai Selvi and R.Murugan, “C for All”, Anuradha Publishers, (2008).

**CS1171**

**COMPUTER PRACTICE LAB - I**

**0 1 2 2**

**LIST OF EXERCISES**

**a) Word Processing 15**

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

**b) Spread Sheet 15**

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
8. Sorting and Import / Export features.

**c) Simple C Programming \* 15**

9. Data types, Expression Evaluation, Condition Statements.
10. Arrays
11. Structures and Unions
12. Functions

**\* For programming exercises flow chart and pseudo code are mandatory.**

**TOTAL: 45 PERIODS**

**Hardware / Software required for a batch of 30 Students**

**Hardware**

LAN System with 33 nodes (OR) Standalone PCs– 33 Nos.  
Printers– 3 Nos.

**Software**

OS– Windows / UNIX Clone  
Application Package– Office suite  
Compiler– C

**ME1171      COMPUTER AIDED DRAFTING AND MODELING LAB**

**L-T-D: 0-0-2 Credits: 2**

- (i) Introduction to computer aided drafting and solid modeling: software and hardware.
- (ii) Understand basic 2D geometric construction techniques.
  - a. Cartesian and polar coordinate systems: locating points, coordinate entry methods, units and limits.
  - b. Object generation: lines, arcs, polylines, and multilines; rectangles, circles, polygons, and ellipses.
  - c. Transformations: move, copy, rotate, scale, mirror, offset and array; trim, extend, fillet, chamfer
  - d. Layers: creation, naming, properties manager.
  - e. Blocks: create, edit, import and explode.
  - f. Text: creating and editing, formatting, text styles.
  - g. Dimensions: creating and editing, dimension styles.
- (iii) Exercise on basic drafting principles to create technical drawings.
  - a. Create orthographic views of machine parts from pictorial views.
  - b. Create isometric views of machine parts from orthographic views
  - c. Create hatched sectional views of machine parts.
- (iv) Understanding basic solid modeling techniques
  - a. Creation of solid primitives
  - b. Boolean operations
  - c. Extrude, Revolve operations
  - d. 3D Views
- (v) Exercise on basic modeling to create machine parts Create solid models from pictorial views

**TOTAL: 45 PERIODS**

**University Examination:**

Question paper may contain two parts. Part A shall contain 2D drafting which carries 40% marks, Part B shall contain 3D drafting which carries 40% marks and 20% marks is for viva voce conducted during the exam.

**PH1171**

**PHYSICS LAB- I**

**0 0 2 1**

**LIST OF EXPERIMENTS**

(Any five experiments)

1. (a) Particle size determination using Diode Laser  
(b) Determination of Laser parameters- Wavelength and Numerical aperture
2. Determination of velocity of sound and compressibility of liquid- Ultrasonic Interferometer.
3. Determination of thermal conductivity of a bad conductor- Lee's Disc method
4. Determination of thickness of a thin wire- Airwedge
5. Torsional Pendulum- Determination of rigidity modulus
6. Compound pendulum- Determination of acceleration due to gravity
7. Determination of Young's Modulus- Non-Uniform bending

**Reference: Physics lab manual- Department of Physics**

**CH1171**

**CHEMISTRY LAB - I**

**0 0 2 1**

**List of Experiments**

1. Determination of total hardness of water by EDTA method.
  2. Determination of alkalinity (titrimetry method)
  3. Determination of percentage purity of washing soda
  4. Conductometric titration of a strong acid with a strong base
  5. Determination of strength of hydrochloric acid (p<sup>H</sup>metry)
  6. Determination of the amount of Na<sup>+</sup> in water sample (Flame photometry)
  7. Determination of molecular weight and degree of polymerization of a polymer
  8. Determination of the amount of Ca<sup>2+</sup> in water sample .
  9. Determination of iron in rust by Permanganometry.
- Minimum five experiments shall be offered.

**References:**

1. J. Bassette, R. B. Deanen & G. H. Jeffery & J. Mendham, Text book of Vogel Quantitative Inorganic Analysis, ELBS, England.

**TOTAL: 45 PERIODS**

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**B.E. AERONAUTICAL ENGINEERING**

**CURRICULUM & SYLLABUS**

**SEMESTER II**

*(Common for All B.E/B.Tech Programmes Except Marine Engineering)*

<b>Sl. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b>						
1.	EG1102	Technical English – II	3	0	0	3
2.	MA1102	Engineering Mathematics – II	3	1	0	4
3.	PH1102	Engineering Physics – II	3	0	0	3
4.	CH1102	Engineering Chemistry – II	3	0	0	3
5.	ME1102	Engineering Mechanics	3	0	0	3
6.	BE1101	Basic Engineering - I (Basic Electrical and Electronics Engineering)	3	1	0	4
7.	BE1102	Basic Engineering – II (Basic Mechanical and Civil Engineering)	3	1	0	4
<b>Practical</b>						
8.	CS1172	Computer Practice Lab - II	0	1	2	2
9.	PH1172	Physics Lab – II	0	0	2	1
10.	CH1172	Chemistry Lab - II	0	0	2	1
11.	BE1171	Basic Engineering Lab – I (Basic Electrical and Electronics Engineering Lab)	0	0	4	2
12.	BE1172	Basic Engineering Lab – II (Basic Mechanical and Civil Engineering Lab)	0	0	4	2
<b>TOTAL</b>			21	4	14	32

**\*Those who have admitted from the Academic Year 2013-2014 onwards.**

**EG1102**

**TECHNICAL ENGLISH - II**

**3 0 0 3**

**UNIT-I**

**9**

Technical Vocabulary - Active and Passive Vocabulary – Articles - Prepositions – Expansion of Abbreviations and Acronyms

**UNIT-II**

**9**

Phrases- Adverbs –Different grammatical forms of the same word –Active Voice-Passive Voice

**UNIT-III**

**9**

Phonemes - Vowels, Consonants and Diphthongs – Word Stress and Intonation

**UNIT-IV**

**9**

Writing Recommendations – Checklists - Essay Writing - Business Letters: - Letter Calling for quotation, Letter Placing Order, Letter of Complaint, Letter Seeking Clarification - Business Proposal Writing

**UNIT-V**

**9**

Numerical Adjectives – CV/Resume Writing – One Word Substitutes – Virtual Communication: E-Mail Writing

**TOTAL: 45 PERIODS**

**TEXT BOOK:**

Department of Humanities and Social Sciences, Anna University, English for Engineers and Technologists, Combined Edition (Volumes 1 @ 2), Chennai: Orient Black Swan Pvt.Ltd. 2006 Themes 5-8 (Technology, Communication, Environment, Industry)

**EXTENSIVE READING:**

Shiv Khera, You Can Win, Milan, Delhi, 2004

**OR**

CanField Jack, Chicken Soup for the Soul, Westland, Chennai, 1999.

**NOTE:**

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

**AIM:**

To impart the fundamental knowledge of Engineering Mathematics to the students in order to achieve a well founded knowledge about the principles of Mathematics.

**OBJECTIVE:**

To develop basic knowledge to the students in differential equations and vector calculus. This subject is further broadened to the functions of complex variables and complex integration. A thorough knowledge about Laplace transforms is also covered to aid the students solve the differential equations.

**UNIT I ORDINARY DIFFERENTIAL EQUATIONS****9**

Linear differential equations of second order with constant and variable coefficients- Cauchy's and Legendre's linear equations – Method of variation of parameters

**UNIT II COMPLEX VARIABLES****9**

Functions of a complex variable – Analytic function – Necessary conditions- Cauchy-Riemann equations in cartesian and polar co-ordinates - Sufficient conditions(excluding proof) – Properties of analytic function – Harmonic and its conjugate – Construction of analytic function by Milne Thomson method – Conformal mappings  
 $w = z + c$ ,  $cz$ ,  $1/z$  and Bilinear transformation.

**UNIT III COMPLEX INTEGRATION****9**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Laurent's expansion – Singular points – Residues – Cauchy's Residue theorem – Evaluation of real definite integral using contour integration(excluding poles on the real

axis) -  $\int_0^{2\pi} f(\cos \theta, \sin \theta) d\theta$  and  $\int_{-\infty}^{\infty} \frac{f(x)}{g(x)} dx$

**UNIT IV VECTOR CALCULUS****9**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

**UNIT V LAPLACE TRANSFORMS****9**

Laplace transform –Existence condition– Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Transform of Periodic functions. Inverse Laplace transform – Convolution, Initial and Final value theorems (statement only) – Solutions of linear ordinary differential equation of second order with constant coefficients using Laplace transform techniques.

**L: 45 + T: 15, TOTAL: 60 PERIODS**

**TEXT BOOK:**

Grewal B.S., "Higher Engineering Mathematics"- 40<sup>th</sup> Edition , Khanna Publishers, Delhi 2007.

**REFERENCES:**

1. Erwin Kreyszig, " Advanced engineering Mathematics", 7<sup>th</sup> Edition, Wiley India, 2007
2. Veerarajan T, " Engineering Mathematics (for first year)", Tata McGraw- Hill Publishing Company Ltd.,New Delhi,2007.
3. P.Kandasamy , K.Thilagavathy , K.Gunavathy" Engineering Mathematics" S.Chand & Company Ltd.2002.
4. B.V. Ramana,"Higher Engineering Mathematics" Tata McGraw- Hill Publishing Company Ltd.,New Delhi,2006.

**PH1102****ENGINEERING PHYSICS – II****3 0 0 3****AIM:**

To enable the students' understand the Physics behind various engineering materials and correlate it to technological applications.

**OBJECTIVE:**

At the end of the course students would be exposed to

- Fundamentals of quantum mechanics and its application to electron microscopy
- Various crystal structures and their defects
- The synthesis, properties and applications of various engineering materials

**UNIT –I Quantum Mechanics****9**

Matter waves- de-Broglie wavelength - Schrodinger's wave equation-time independent and time dependent equations- physical significance of wave function- particle in a one dimensional box- electron microscope- scanning electron microscope- transmission electron microscope.

**UNIT II Elementary crystal physics****9**

Lattice – Unit cell, Bravais lattice ,lattice planes-Miller indices ,d-spacing in cubic lattice. Calculation of number of atoms per unit cell,atomic radius, coordination number and packing factor for SC,BCC,FCC and HCP structures- diamond cubic, NaCl and ZnS structures. Crystal defects.

**UNIT- III Conducting & Semiconducting Materials****9**

Conducting materials – Drawbacks of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states Semiconducting materials: intrinsic semiconductor-carrier concentration derivation

- fermi level - electrical conductivity- band gap determination, extrinsic semiconductors, compound semiconductors (qualitative), Hall effect -determination of hall coefficient - applications.

**UNIT- IV Magnetic, Superconducting and Dielectric Materials** **9**

Magnetic Materials: Origin of magnetic moment-Bohr magneton - ferromagnetism – magnetic domains- hysteresis-soft and hard magnetic materials- applications.

Superconductivity: Properties-types of super conductors - BCS theory of superconductivity (qualitative) - applications of superconductors.

Dielectric materials - active and passive dielectrics - types of polarization- dielectric loss- dielectric breakdown – uses of dielectric materials.

**UNIT- V New Engineering Materials** **9**

Metallic glasses: preparation, properties and applications. Shape Memory Alloys (SMA): characteristics, properties and applications.

Nanomaterials -synthesis-top-down approach (Ball milling), bottom-up approach (CVD)- properties and applications.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Rajendran, V, and Marikani A, ‘Materials science’ TMH publications, New Delhi
2. Palanisamy P.K “Materials Science”, Scitech publications Pvt Ltd, Chennai
3. Arumugam M, “Materials Science”, Anuradha publications, Kumbakonam
4. R.K. Gaur and S.L.Gupta, ‘Engineering Physics’ Dhanpat Rai publications, New Delhi

**REFERENCES:**

1. Charles Kittel ,” Introduction to solid state physics “, John Wiley & sons, 8ed.
2. Charles P.Poole and Frank J. Owner, “ Introduction to Nanotechnology, Wiley India.
3. Pillai, S.O. ‘Solid state physics’ NewAge international publishers, Chennai.

**CH1102**

**ENGINEERING CHEMISTRY-II**

**3 0 0 3**

**AIM**

To have a thorough knowledge of the basics of chemistry particularly engineering oriented topics to engineering students

**OBJECTIVES**

To make the students conversant with the principles of the following topics: (i) Fuels And Combustion,(ii) Electrochemistry And Corrosion, (iii) Energy Sources And Batteries, (iv) Phase Rule And Alloys And (v) Thermodynamics.



**UNIT I FUELS AND COMBUSTION 9**

Classification of fuels with examples– characteristics of a good fuel- fossil fuels- Coal – proximate and ultimate analysis- metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and refining – cracking (definition only) - knocking – octane number and cetane number – synthetic petrol – Bergius process- Calorific value –GCV, LCV (problems)- Gaseous fuels- water gas and producer gas, Flue gas analysis – Orsat apparatus – theoretical air for combustion (problems).

**UNIT-II ELECTROCHEMISTRY AND CORROSION 9**

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – single electrode potential – Nernst equation– reference electrodes – Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance- Electrochemical corrosion – protective coatings – paints – constituents and functions.

**UNIT –III ENERGY SOURCES AND BATTERIES 9**

Renewable & non-renewable energy sources- wind energy, solar energy and solar cell- Nuclear reactions – Fission and fusion – nuclear reactors – light water and breeder nuclear reactors (elementary ideas only) – Nuclear power plants in India. Batteries- primary and secondary cells- alkaline battery- lead acid battery- nickel cadmium battery- lithium battery (Li-TiS<sub>2</sub>)- H<sub>2</sub>-O<sub>2</sub> fuel cell.

**UNITIV PHASE RULE AND ALLOYS 9**

Statement and explanation of terms involved – one component system – water system – condensed phase rule – simple eutectic system (lead-silver system only) – alloys – importance, ferrous alloys – nichrome, invar and stainless steel – heat treatment of steel, non-ferrous alloys – brass, bronze and solder.

**UNIT-V THERMODYNAMICS 9**

Introduction- I law of thermodynamics (statement only)- Relation between  $\Delta E$  &  $\Delta H$  -II law of thermodynamics (statement only)- concept of entropy – Clausius-Clapeyron equation (no derivation)- Importance, terms involved (problem) -Free energy changes-  $\Delta G$  – Gibbs Helmholtz equation ( derivation) - III law of thermodynamics- concept of absolute entropy- zeroth law of thermodynamics (statement only).

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 P.C. Jain and Monica Jain, Engineering Chemistry DhanpatRai Pub, Co., New Delhi (2002)
- 2 S.S. Dara, A text book of engineering chemistry S. Chand & C. Ltd., New Delhi (2006)
3. B. Sivasankar Engineering Chemistry Tate McGraw- Hill Pub. Co. Ltd, New Delhi (2008).

## REFERENCES:

- 1 B. K. Sharma Engineering Chemistry Krishna Prakasan Media (P) Ltd., Meerut (2001)
- 2 Principles of physical chemistry by Samuel Glasstone, Van Nostrand pub.comp, Newyork.
- 3 Principles of physical chemistry by Puri & Sharma, Vikas pub.comp, 2008.

**ME1102**

**ENGINEERING MECHANICS**

**3 0 0 3**

## OBJECTIVE

This is a basic engineering course common to all branches to inculcate in the students, problem solving abilities and to enhance their analytical abilities.

### Unit I - Statics of Particles

**10**

Statics –Basics Concepts, Fundamental principles & concepts: Vector algebra, Newton’s laws, gravitation, force (external and internal, transmissibility), couple, moment (about point and about axis), Varignon’s theorem, resultant of concurrent and non-concurrent coplanar forces, static equilibrium, free body diagram, reactions. Problem formulation concept; 2-D statics, two and three force members, alternate equilibrium equations, constraints and static determinacy; 3-D statics.

### Unit II - Application of Statics & Friction

**9**

Analysis of Structures- Trusses: Assumptions, rigid and non-rigid trusses; Simple truss (plane and space), analysis by method of joints. Analysis of simple truss by method of sections;

**FRICITION:** Friction- Coulomb dry friction laws, simple surface contact problems, friction angles, types of problems, wedges. Sliding friction and rolling resistance

### Unit III - Centroid, Centre of Gravity and Moment of Inertia

**8**

Moment of Inertia- First moment of mass and center of mass, centroids of lines, areas, volumes, composite bodies. Area moments- and products- of inertia, radius of gyration, transfer of axes, composite areas. Rotation of axes, principal area-moments-of-inertia,. Second moment of mass, Mass moments- and products- of inertia, radius of gyration, transfer of axes, flat plates (relation between area- and mass- moments- and products- of inertia), composite bodies. Rotation of axes, principal mass-moments-of-inertia.

### Unit IV - Particle Dynamics

**8**

Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton’s 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

### Unit V Kinematics & Kinetics of Rigid Bodies:

**10**

Plane kinematics of rigid bodies- Rotation; Parametric motion. Relative velocity,

instantaneous center of rotation. Relative acceleration, rotating reference frames. Rotating reference frames, 3-part velocity and 5-part acceleration relations, Coriolis acceleration. Plane kinetics of rigid bodies- Kinetics of system of particles and derivation of moment equation. Translation. Fixed axis rotation; General planar motion.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Beer F P and Johnson E R, “Vector Mechanics for Engineers, Statics and Dynamics”, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi, 2006.
2. Tayal A K, “Engineering Mechanics- Statics and Dynamics” , Umesh Publications, Delhi,2004
3. Irving H. Shames, Engineering Mechanics, Prentice Hall, New Delhi 1997.

**REFERENCES:**

1. Bansal R K, “Engineering Mechanics”, Laxmi Publications Pvt. Ltd., New Delhi, 2006.
2. Bhavikatti S S, “Engineering Mechanics”, New Age International Pvt. Ltd., New Delhi, 2003.
3. Young D H and Timashenko S, “Engineering Mechanics”, Tata Mcgraw-Hill, Fourth Edition, 2006.
4. Jivan Khachane, Ruchi Shrivastava, “Engineering Mechanics: Statics and Dynamics”, ANE Books, 2006.
5. Rajasekaran S and Sankarasubramanian G, “Engineering Mechanics-Statics and Dynamics”, Vikas Publishing House Pvt. Ltd., New Delhi, 2006.
6. NPTEL courses: <http://nptel.iitm.ac.in/courses.php>, web and video resources on *Engineering Mechanics*.

**BE1101**

**BASIC ENGINEERING - I**

**3 1 0 4**

(Basic Electrical and Electronics Engineering)

**Objectives:**

- To understand the basic solutions of AC and DC circuits.
- To study the basic principle and operation of AC and DC machines.
- To study the fundamental operations of measuring instruments.
- To study the layout of power system.

**Unit: 1 – Electrical circuits**

**9**

Ohms Law, Kirchoff’s laws, Mesh and Nodal Analysis for DC Circuits. Introduction to AC Circuits, Faraday’s Law of Electromagnetic Induction, Lenz law, Inductor, Capacitor, Power factor, Waveforms and RMS value, Average Value, Peak factor and Form factor, Single phase circuits- Series and Parallel, Three phase balanced circuits. Fundamentals of wiring and earthing.

**Unit: II – Electrical Measurements, Machines and Power system 9**

Operating principles of Moving coil and Moving iron instruments (Ammeter and voltmeter), Dynamometer type watt meter and Energy meter, Errors in Measurements. Construction, Principle of operation and Applications of DC Generators, DC Motors, Single phase transformers. Structure of power system

**UNIT- III Semiconductor devices and applications 9**

Characteristics of PN Junction diode-Zener Effect-Zener diode and its characteristics-Half wave and Full wave Rectifiers-Voltage regulation,Bipolar Junction transistor-CB,CE,CC Configuration and characteristics.

**UNIT-IV Digital Electronics 9**

Binary number system-logic gates-Boolean algebra-Combinational Circuit-half and Full adder,Sequential Circuit-Flip flops-Shift Registers(SIPO,SISO,PIPO,PISO) – Counters: Synchronous and Asynchronous –A/D conversion-Successive approximation,D/A conversion-Weighted Resistor

**UNIT – V Fundamentals of Communication Engineering 9**

Types of Signals: Analog and Digital Signals – Modulation and Demodulation – Principles of Amplitude and Frequency modulation – Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fiber (Block Diagram)

**L: 45 + T: 15, TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. V.N. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. V.K.Mehta “Principles of Power System”, S.Chand & Company Ltd, New Delhi, 2001.
3. R.S.Sedha,”Applied electronics”S.Chand&Co.,2006.

**REFERENCES:**

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press (2005).
3. Chakrabarti A, Soni M.L, Gupta P.V, Bhatnagar U.S , “ A Text book on Power System Engineering,” Dhanpat Rai & Co, New Delhi,2010.
4. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basc Electrical Electronics and Computer engineering”,Tata McGraw Hill, Second edition(2006).
5. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford Press(2005).
6. Mehta V K, “Principles of Electronics”,S.Chand&Company Ltd(1994).
7. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series McGraw Hill,(2002).
8. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers,(2003)

**BE1102**

**BASIC ENGINEERING – II**  
(Basic Mechanical and Civil Engineering)

**3 1 0 4**

**Aim:**

To introduce students to the profession of Mechanical and Civil Engineering and involve them in small-scale projects which would allow them to develop teamwork skills.

**Objective:**

- To understand the basic knowledge about the Mechanical components used in various application
- To be aware of the different fields of Civil Engineering, such as Surveying, Structural and Transportation Engineering.

**Unit I – IC Engine and Boilers**

**9**

IC Engines: Working and comparison of two stroke and four stroke petrol and diesel engines - general description of various systems using block diagrams – air system, fuel system and ignition system. A brief description of CRDI, MPFI, GDI and Hybrid Vehicles.

Steam boilers: Classification – Cochran boiler, Babcock and Wilcox boiler, High pressure Boilers - Lamont, Benson boiler

**Unit II – Compressor, Blower, Pumps, Power plants, Refrigeration and Air Conditioning**

**9**

Principles and fields of application of compressors - reciprocating and centrifugal, blower principle, pumps- reciprocating, and centrifugal pumps steam

Elementary ideas of hydroelectric, thermal and nuclear power plants

Refrigeration & Air Conditioning: Refrigerants, Vapor compression system, Vapor absorption system window air conditioning unit -types (general description only).

**Unit III – Manufacturing Processes**

**9**

Basic Principles of Manufacturing processes – casting, metal forming - forging, rolling, Metal joining - soldering, Welding Machining processes- Lathe construction, operation - turning, taper turning, thread cutting

**UNIT - IV Civil Engineering and Materials**

**9**

**Introduction:** Civil Engineering, branches of Civil Engineering, contribution to society, Scope,

**Civil Engineering Materials:** Bricks – stones – sand – cement – concrete – steel sections, glass, wood, FRP

**Surveying:** Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

**Sub Structure:** Types, Bearing capacity – Requirement of good foundations.

**Superstructure:** Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering– Types of Bridges and Dams

## UNIT- V Civil Engineering structures

### Building planning

9

Residential, Institutional and industrial – functional requirements. – Basics of Interior Design and Landscaping.

**Roads-** benefits- classifications- traffic signs

**Bridges-** components of bridges-Dam-Purpose of reservoir.

**Environmental Engineering:** Protected water supply, water treatment methods-sewage treatment- Pollution-Types-causes-remedial measures

**L: 45 + T: 15, TOTAL: 60 PERIODS**

### TEXT BOOKS

- 1) Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kr. Jain, “Basic Civil Engineering”, Laxmi Publications,
- 2) Roy and Choudhary, “*Elements of Mechanical Engineering*”
- 3) J Benjamin, “*Basic Mechanical Engineering*”

### References

1. K.Venugopal and v prabu raja “*Basic Mechanical Engineering*” Anuradha Agencies
2. Shanmugam G and Palanichamy M.S “*Basic Mechanical Engineering*” Tata MC Graw Hill.
3. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi, (1996).
4. Ramamrutham. S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. (1999).
5. Seetharaman S. “Basic Civil Engineering”, Anuradha Agencies, (2005).

**CS1172                      COMPUTER PRACTICE LAB – II                      0 1 2 2**

**Prerequisite: None**

#### List of Experiments

- |   |           |
|---|-----------|
| <b>1.      Unix Commands</b>                                      | <b>15</b> |
| Study of Unix OS - Basic Shell Commands - Unix Editor             |           |
| <b>2.      Shell Programming</b>                                  | <b>15</b> |
| Simple Shell program - Conditional Statements - Testing and Loops |           |
| <b>3.      C Programming on Unix</b>                              | <b>15</b> |
| Dynamic Storage Allocation-Pointers-Functions-File Handling       |           |

**TOTAL: 45 PERIODS**

**Hardware / software requirements for a batch of 30 students**

**Hardware**

1 UNIX Clone Server  
33 Nodes (thin client or PCs)  
Printer– 3 Nos.

**Software**

OS– UNIX Clone (33 user license or License free Linux)  
Compiler- C

**PH1172**

**PHYSICS LAB - II**

**0 0 2 1**

**LIST OF EXPERIMENTS**

(Any five experiments)

1. Determination of focal length of convex lens- Newtons Rings
2. Determination of wavelength of mercury spectrum- Spectrometer grating
3. Determination of Viscosity of a liquid- Poiseuille's method.
4. Determination of hysteresis loss in a ferromagnetic material.
5. Determination of dielectric constant of a material at room temperature.
6. Determination of band gap of a semiconducting material.
7. Determination of Young's modulus- Uniform bending.

**REFERENCE:** Physics lab manual- Department of Physics

**CH1172**

**CHEMISTRY LAB- II**

**0 0 2 1**

**LIST OF EXPERIMENTS**

1. Determination of concentration of ferrous ion by potentiometry.
  2. Conductometric titration of mixture of acids.
  3. Estimation of copper in brass by EDTA method.
  4. Determination of chloride content in water sample by argentometry.
  5. Determination of acidity by titrimetry.
  6. Determination of iron content in a solution by spectrophotometric method.
  7. Determination of amount of water of crystallization in hydrated barium chloride.
  8. Percentage purity of limestone (permanganometry)
- Minimum five experiments shall be offered.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. J. Bassette, R. B. Deanen & G. H. Jeffery & J. Mendham, Text book of Vogel Quantitative Inorganic Analysis, ELBS, England.

**BE1171**

**BASIC ENGINEERING LAB – I**  
(Basic Electrical and Electronics Engineering Lab)

**0 0 4 2**

**I. Electrical Engineering Lab**

- 1 Study of Symbols, Cables and Earthing.
- 2 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 3 Fluorescent lamp wiring.
- 4 Stair case wiring / Lamp control from three different places/ Doctor Room control/ Go down control
- 5 Measurement of electrical quantities – voltage, current, power & computation of power factor in RLC circuit.
- 6 Measurement of energy using single phase energy meter.
- 7 Fan Wiring.

**II. Electronics Engineering Lab**

- 1 Study of Electronic components and equipments – Resistor, colour coding, Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
- 2 Study of logic gates AND, OR, EX-OR and NOT, NAND and NOR.
- 3 Generation of Clock Signal.
- 4 Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
- 5 Measurement of ripple factor of HWR and FWR.
- 6 Characteristics of PN Junction diode
- 7 Characteristics of Zener diode
- 8 Voltage Regulator using Zener diode

**TOTAL: 45 PERIODS**

**BE1172**

**BASIC ENGINEERING LAB – II**  
(Basic Mechanical and Civil Engineering Lab)

**0 0 4 2**

**OBJECTIVE:**

Introduction to different materials in engineering practices with respect to their workability, formability & machinability with hand tools & power tools and to develop skills through hands on experience.

**I. Mechanical Engineering Lab**

1. Welding - Metal arc welding tools and equipment, exercises.
2. Fitting - Tools, operations, exercises, types of joints. (*Term work to include one job involving fitting to size, male-female fitting with drilling and tapping.*)



3. Foundry- Tools, preparation of moulding sand, patterns, cores, foundry exercises.
4. Carpentry- Tools, carpentry process, carpentry exercises, types of joints.
5. Assembly and Inspection.( *Assembly and Disassembly of some products, tools used. Videos of advancement in manufacturing technology. Inspection of various components using different measuring instruments.*)
6. Machine Tools I - Demonstration of drilling machine.
7. Machine Tools II - Demonstration of Lathe.
8. Study of Automobile and Power Transmission.
9. Wood working - Demonstration of wood working machinery and furniture manufacturing.( *Term work includes one job involving joint and woodturning*)

## II. Civil Engineering Lab

### Buildings:

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

### Plumbing Works:

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:  
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

### Carpentry using Power Tools only:

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.
- (c) Demonstration of elementary surveying techniques

**TOTAL: 45 PERIODS**

### List of equipment and components (For a Batch of 30 Students)

- |  |                                       |
|--|---------------------------------------|
| 1. Assorted components for plumbing consisting of metallic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | plastic pipes,<br><br><b>15 Sets.</b> |
| 2. Carpentry vice (fitted to work bench)   | <b>15 Nos.</b>                        |
| 3. Standard woodworking tools  | <b>15 Sets.</b>                       |
| 4. Models of industrial trusses, door joints, furniture joints   | <b>5 each</b>                         |
| 5. Power Tools:  |                                       |

- |                           |              |
|---------------------------|--------------|
| (a) Rotary Hammer         | <b>2 Nos</b> |
| (b) Demolition Hammer     | <b>2 Nos</b> |
| (c) Circular Saw          | <b>2 Nos</b> |
| (d) Planer                | <b>2 Nos</b> |
| (e) Hand Drilling Machine | <b>2 Nos</b> |
| (f) Jigsaw                | <b>2 Nos</b> |

6. Surveying equipment for Demonstration

**NOORUL ISLAM CENTRE FOR HIGHER EDUCATION**

**NOORUL ISLAM UNIVERSITY, KUMARACOIL**

**B.E. AERONAUTICAL ENGINEERING**

**CURRICULUM & SYLLABUS**

**SEMESTER III**

<b>SL. No.</b>	<b>SUBJECT CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	MA1201	Engineering Mathematics - III	3	1	0	4
2.	AE1201	Aero Engineering Thermodynamics	3	1	0	4
3.	AE1202	Solid Mechanics	3	1	0	4
4.	AE1203	Introduction to Aircraft/Aerospace Vehicles	3	1	0	4
5.	ME1202	Fluid Mechanics & Machinery	3	1	0	4
6.	ME1210	Engineering Materials & Metallurgy	3	0	0	3
<b>PRACTICAL</b>						
7.	AE1271	Thermal & Heat Transfer Lab	0	1	2	2
8.	AE1272	Solid Mechanics Lab	0	1	2	2
9.	ME1271	Fluid Mechanics & Machinery Laboratory	0	1	2	1
<b>TOTAL</b>			<b>18</b>	<b>8</b>	<b>6</b>	<b>28</b>

**AIM:**

To impart the fundamental knowledge of Engineering Mathematics to the students in order to achieve a well founded knowledge about the principles of Mathematics.

**OBJECTIVE:**

To develop the skill of the students in the areas of boundary value problems and Transform techniques. This will be necessary for their effective studies in a large number of Engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. This course will also serve as a prerequisite for post graduate and specialized studies and research.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Homogeneous linear partial differential equations of second and higher order with constant coefficients.

**UNIT II FOURIER SERIES 9**

Dirichlet's conditions – Fourier series – Change of interval - Odd and Even functions – Half range sine and cosine series – Parseval's identity – Harmonic Analysis.

**UNIT III BOUNDARY VALUE PROBLEMS 9**

Classification of second order linear partial differential equations – One dimensional wave and heat equations – Assumptions – Fourier series solution – Steady state solution of two dimensional heat equation (insulated edges excluded) – Fourier series solution in Cartesian co-ordinates.

**UNIT IV FOURIER TRANSFORMS 9**

Fourier integral theorem (without proof) – Fourier transform – Sine and Cosine transforms – Properties - Inverse Fourier transform – Inverse sine and cosine transforms – Properties - Transforms of simple functions – Convolution theorem – Parseval's identity

**UNIT V Z-TRANSFORMS 9**

Z- transform – Elementary properties – convolution theorem - Inverse Z-transform – Partial fraction Method, Inversion integral method and Convolution – Initial and Final value theorems – Formation of difference equations – Solution of difference equations using Z- transform

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

**TEXT BOOK:**

Grewal B.S., "Higher Engineering Mathematics" – 40<sup>th</sup> Edition , Khanna Publishers, Delhi 2011.

**REFERENCES:**

1. Kandasamy P, Thilagavathy K, and Gunavathy K., "Engineering Mathematics Volume III", First Edition, S.Chand & Company Ltd., New Delhi, 1996
2. Veerarajan T., "Engineering Mathematics(for Semester III), Third Edition, Tata McGraw – Hill Publishing Company Limited, New Delhi 2007.
3. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Seventh Edition, Lakshmi Publications Pvt. Ltd., New Delhi, 2009.

**AE1201****AERO ENGINEERING THERMODYNAMICS****3 1 0 4****OBJECTIVE**

To give a brief background of application of various laws of thermodynamics and its application in heat transfer, refrigeration and air-conditioning, jet propulsion system.

**1. BASIC THERMODYNAMICS****9**

Systems, Zeroth Law, First Law - Heat and work transfer in flow and non-flow processes, Second law, Kelvin- Planck statement - Clausius statement - concept of entropy - Clausius inequality - entropy change in non-flow processes.

**2. AIR CYCLES****9**

Otto, Diesel, Dual combustion and Brayton combustion cycles – Air standard efficiency - Mean effective pressure – Actual and theoretical PV diagrams of four stroke and two stroke IC Engines.

**3. KINETIC THEORY OF GASES AND CHEMICAL KINETICS****9**

Gas mixtures – Properties of ideal and real gasses , equation of state, Avagadro's law, Gay Lussac's law, Graham's law diffusion, RMS and average velocity, ideal gas and deviation from it, Vander wall's equation of state - Basic concepts: reaction order, molecularity, rate laws - Reaction mechanisms: time dependence of reactance, intermediates, and products

**4. REFRIGERATION AND AIR CONDITIONING****9**

Properties of steam - Principles of refrigeration, Air conditioning - Heat pumps - Vapour compression - Vapour absorption types - Coefficient of performance, Properties of refrigerants.

**5. AIR COMPRESSORS****9**

Classification and working principle, work of compression with and without clearance, Isothermal and Isentropic efficiency of reciprocating air compressors, multistage compression and inter cooling. Various types of compressors (Descriptive treatment only) Isentropic flow of ideal gases through nozzles - Simple jet propulsion system - Thrust equation – Specific impulse.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

## TEXT BOOKS

1. Rathakrishnan, E, "Fundamentals of Engineering Thermodynamics", Prentice – Hall, India, 2000
2. Nag. P.K., "Engineering Thermodynamics", Tata McGraw-Hills Co., Ltd., Seventh Edn., 1993.
3. Yunus A.Cengal. "Thermodynamics and Engineering Approach", Tata McGraw-Hill Co. Ltd., 3<sup>rd</sup> Edition, 2002.

## REFERENCES

1. Mayhew, A. and Rogers, B., "Engineering Thermodynamics", Longman Green & Co. Ltd., London, E.L.B.S. Edition, 1990.
2. Van Wylen, G.J. and Sonntag, R.E., "Fundamentals of Classical Thermodynamics (S.I.Version)", Second Edition, 1986.
3. Bacon, D.H., "Engineering Thermodynamics", Butterworth & Co., London, 1989.
4. Saad, M.A., "Thermodynamics for Engineers", Prentice-Hall of India Pvt. Ltd., 1989.
5. Reynolds, "Thermodynamics", Int. Student Edn., McGraw-Hill Book Co., Ltd., 1990

AE1202

SOLID MECHANICS

3 1 0 4

## OBJECTIVE

To give brief descriptions on the behaviour of materials due to axial, bending and torsional and combined loads.

### 1. BASICS AND AXIAL LOADING

9

Stress and Strain – Hooke's Law – Elastic constants and their relationship– Statically determinate cases - bar with uniform and varying section statically indeterminate cases – composite bar. Thermal Stresses – stresses due to freely falling weight.

### 2. STRESSES AND DEFLECTION OF BEAMS

9

Shear force and bending moment diagrams for simply supported and cantilever beams – Bending stresses in straight beams – Shear Stresses in bending of beams with various cross sections – beams of uniform strength. Double integration method – McCauley's method.

### 3. TORSION AND COLUMNS

9

Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts – closely coiled helical springs. Columns with various end conditions – Euler's Column curve – Rankine's formula - Column with initial curvature - Eccentric loading – South well plot – Beam column.

### 4. BI AXIAL STRESSES

9

Stresses in thin circular cylinder and spherical shell under internal pressure – volumetric Strain. Combined loading – Principal Stresses and maximum Shear Stresses - Analytical and Graphical methods.

## **5. ENERGY METHODS**

**9**

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.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

### **TEXT BOOKS**

1. Nash William – “Strength of Materials”, TMH, 1998
2. Timoshenko.S. and Young D.H. – “Elements of strength materials Vol. I and Vol. II”, T. Van Nostrand Co-Inc Princeton-N.J. 1990.

### **REFERENCES**

1. Dym C.L. and Shames I.H. – “Solid Mechanics”, 1990.
2. L.Sreenath, “Advanced solid Mechanics” – 2005.

## **AE1203 INTRODUCTION TO AIRCRAFT/AEROSPACE VEHICLES 3 1 0 4**

### **OBJECTIVE**

To introduce the basic concepts of aerospace engineering and the current developments in the field.

### **1. HISTORICAL EVALUATION AND AIRCRAFT CONFIGURATION 9**

Early airplanes, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years. Components of an airplane and their functions. Different types of flight vehicles, classifications. Conventional control, Powered control, Basic instruments for flying, typical systems for control actuation.

### **2. INTRODUCTION TO PRINCIPLES OF FLIGHT 9**

Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Aerofoils, Mach number, High lift devices.

### **3. INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS 9**

General types of construction, Monocoque, semi-monocoque and geodesic construction, Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials – Introduction to high temperature materials.

### **4. POWER PLANTS USED IN AIRPLANES 9**

Basic ideas about piston, ramjet, pulse jet, turbojet, turbo prop, turbo fan engines, Use of propeller and jets for thrust production. Comparative merits, Principles of operation of rocket, types of rockets and typical applications – Auxiliary propulsion.

### **5. AIRCRAFT PERFORMANCE AND FLIGHT MECHANICS 9**

Aero plane take off, climbing process and maneuvers. Factors affecting take off and climb. Minimum and maximum speed of horizontal flight . Effects of changes of power, altitude and weight. Introduction to stability and control.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

**TEXT BOOK**

1. Anderson, J.D., "Introduction to Flight", McGraw-Hill, 1995.

**REFERENCE**

1. Kermode, A.C., "Flight without Formulae", McGraw-Hill, 1997.

**ME1202**

**FLUID MECHANICS AND MACHINERY**

**3 1 0 4**

**OBJECTIVES:**

- The applications of the conservation laws to flow through pipes and hydraulic machines are studied
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

**UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9**

Units and dimensions- Properties of fluids. Pressure-height relation for incompressible fluid - Manometers, Types of flow - laminar, turbulent, unsteady, steady, non-uniform and uniform flows. Stream line, streak line and path line. Bernoulli's equation, applications - Venturi meter, Orifice meter, Pitot tube. Statement of Navier Stokes equation, derivation of Euler's equation

**UNIT II IDEAL FLOW & BOUNDARY LAYER THEORY 9**

Ideal Flow: Ir-rotational and rotational, stream function, potential function, continuity equation, derivation of three dimensional equation, applications to one dimensional flows steady flow, differential momentum equation.

Boundary Layer Theory- D'Alembert paradox, Development of boundary layer, Prandtl's boundary layer equations, Blasius solution, integral momentum equation, drag on a flat plate, boundary layer separation and its control, streamlined and bluff bodies -flow around circular bodies and aero foils, calculation of lift and drag.

Introduction to CFD: Necessity, limitations, philosophy behind CFD, applications.

**UNIT III FLOW THROUGH CIRCULAR & PIPES, DIMENSIONAL ANALYSIS 9**

Pipes in series and parallel. Reynolds number, Darcy-Weisbach equation, use of Moody diagram, minor losses-sudden expansion, sudden contraction and losses in pipe fittings. Dimensional analysis - Buckingham's Pi theorem- applications - similarity laws and models.

**UNIT IV HYDRAULIC TURBINE: 9**

Hydraulic Turbines- Fluid machines definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagram's - head and specific work - components of energy transfer - degree of reaction. Hydro turbines definition and classifications - Pelton turbine - Francis turbine - propeller turbine Kaplan turbine .Working principles - velocity triangles - work done - specific speed – efficiencies - performance curve for turbines.



## UNIT V PUMPS

9

Hydraulic Pumps- Pumps definition and classifications. Centrifugal pump classifications, working principles, velocity triangles, specific speed, efficiency and performance curves. Reciprocating pump classification, working principles, indicator diagram, work saved by air vessels and performance curves ,cavitation in pumps Rotary pumps working principles of gear and vane pumps, Selection of pumps

**L: 45 + T: 15 = TOTAL: 60 PERIODS**

### TEXT BOOK:

1. Kumar D S, "Fluid Mechanics and Fluid Power Engineering ", Kataria S K and Sons, New Delhi, 1997.
2. Robert W Fox, "Introduction to Fluid Mechanics", Fourth Edition, John Wiley and sons, Singapore, 1994.

### REFERENCES:

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. NPTEL courses: <http://nptel.iitm.ac.in/courses.php> - web and video resources on Fluid Mechanics.
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
5. John D Anderson, "Computational Fluid Dynamics – The Basics with Applications", McGraw Hill, New Delhi, 1995.

**ME1210      ENGINEERING MATERIALS AND METALLURGY**

**3 0 0 3**

### OBJECTIVE

To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

**To Know:** Crystal Structure BCC, FCC and HCP structure- unit cell –crystallographic planes and directions, miller indices–Grain size, ASTM grain size number

## UNIT I ENGINEERING STEELS & ALLOYS

9

Allotropy, Iron - Iron carbide equilibrium diagram, critical temperatures. cooling curve and volume changes of pure iron. Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA. Gray, White malleable, spheroidal -Graphite - alloy cast-iron. Microstructures of slowly cooled steels, Estimation of carbon from Microstructures, non-equilibrium cooling of steels. Widman statten structures, Structures - property relationship.

Copper and Copper alloys, Aluminium and Aluminium alloys, Titanium alloys, Magnesium alloys, Standards, precipitation strengthening treatment – Bearing alloys.

## **UNIT II HEAT TREATMENT**

**9**

Heat treatment of steels, Transformation products of austenite, Time temperature Transformation diagrams(TTT), Critical cooling rate(CCR), continuous cooling transformation diagrams. Cooling media. Types - Annealing, normalizing, hardening. Tempering, Carburising, nitriding, carbonitriding, Flame and Induction hardening. Commercial heat treatment practice of gears of different sizes, tools, lathe beds, springs, etc.

## **UNIT III NON-METALLIC MATERIALS**

**9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of Al<sub>2</sub>O<sub>3</sub>, SiC, Si<sub>3</sub>N<sub>4</sub>, PSZ and SIALON – Powder metallurgy, Manufacturing Process, Compacting, Sintering, Vacuum processing. Properties of Powder processed materials, high energy compaction. Metal matrix composites, properties, Applications of Composites.

## **UNIT IV NANO MATERIALS**

**9**

Nano structured materials, Low-dimensional structures: Quantum wells, Quantum wires, and Quantum dots, Nano clusters & Nano crystals. Electronic and optical properties of nano crystallites, Metallic and semiconducting super lattices. Synthesis of nanostructured materials, Fabrication and characterization of nano electronic devices. Basics of synthesis and characterization of nano-multi-component systems for sensors (magnetic, electronic and optical) and electrodes. Synthesis and fabrication of carbon nano structures for fuel cell and energy storage applications.

## **UNIT V MECHANICAL PROPERTIES AND TESTING**

**9**

Mechanical Properties And Testing: Mechanism of plastic deformation, slip and twinning. Types of fracture – Testing of materials under tension, compression and shear loads Hardness tests (Brinell, Vickers and Rockwell) Impact test, Izod and Charpy, fatigue and creep test. Non Destructive Testing: basic principles and testing method for Radiographic testing, Ultrasonic testing, Magnetic particle inspection and Liquid penetrant inspections, Eddy current testing.

**TOTAL: 45 PERIODS**

### **TEXT BOOK:**

1. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4<sup>th</sup> Indian Reprint, 2002
2. Sydney H. Avner “Introduction to Physical Metallurgy” McGraw Hill Book Company, 2007

### **REFERENCES:**

1. William D Callister, “Material Science and Engineering”, John Wiley and Sons, 1997.
2. Raghavan V, “Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd., 1999.
3. Dieter G. E., Mechanical Metallurgy, Mc Graw Hill Book Company, 1988
4. O.P. Khanna, A text book of Materials Science and Metallurgy, Khanna Publishers, 2003.

5. NPTEL courses, <http://www.nptel.iitm.ac.in/courses.php?disciplineId=112>: related web and video resources under Mechanical Engineering & Metallurgy and Material Science categorie

**AE1271**

**THERMAL & HEAT TRANSFER LAB 0 1 2 2**

**OBJECTIVE**

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
8. Determination of Convective Heat Transfer Coefficient.
9. Determination of Thermal Resistance of a Composite wall.
10. Heat balance test on multi cylinder diesel engine.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**

(for a batch of 30 students)

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	4 stroke twin cylinder diesel engine	1	1
2.	Cut section model of 4 stroke kirloskar diesel engine and cut section model of 2 stroke petrol engine	1	2
3.	Parallel and counter flow heat exchanger test rig	1	3,4
4.	Red wood viscometer	1	5
5.	Vapour compression refrigeration test rig	1	6
6.	Vapour compression air-conditioning test rig	1	7
7.	Gas Turbine Engine	1	8
8.	Conductive Heat Transfer set up	1	9
9.	Composite wall	1	10

**OBJECTIVE**

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

**LIST OF EXPERIMENTS**

1. Hardness test - a)Vickers b)Brinell c) Rockwell d) Shore
2. Impact test – a) Izod b)Charpy
3. Fatigue test - a) Reverse plate bending b) Rotating Beam
4. Testing of springs
7. Deflection of beams with various end conditions.
8. Verification of Maxwell’s Reciprocal theorem & principle of superposition
9. Block Compression Test
10. Determination of Young’s modulus of steel using mechanical extensometers.
11. Determination of Young’s modulus of aluminum using electrical extensometers
12. Determination of fracture strength and fracture pattern of ductile materials
13. Determination of fracture strength and fracture pattern of brittle materials
14. Stress Strain curve for various engineering materials.
15. Determination of Young’s modulus for composite materials.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**

*(for a batch of 30 students)*

Sl.No	Details of Equipments	Qty Required	For Experiments
1.	Vickers Hardness Testing Machine	1	1
2.	Brinell Hardness Testing Machine	1	1
3.	Rockwell Hardness Testing Machine	1	1
4.	Shore Hardness Testing Machine	1	1
5.	Universal Testing Machine	1	2,3
6.	Izod Impact Testing Machine	1	4
7.	Charpy Impact Testing Machine	1	4
8.	Fatigue tester- Rotating Beam	1	5
9.	Fatigue tester –Reverse plate bending	1	5
10.	Dial Gauges	2	8
11	Beam Test set up with various end conditions	1	7
12.	Weight 1 Kg	5	7
13.	Weight 2 Kg	5	7

**OBJECTIVES:**

Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

**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/Mass flowmeter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.
11. Model study in wind tunnel.

**TOTAL: 30 PERIODS**

**NOORUL ISLAM CENTRE FOR HIGHER EDUCATION**

**NOORUL ISLAM UNIVERSITY, KUMARACOIL**

**B.E. AERONAUTICAL ENGINEERING**

**CURRICULUM & SYLLABUS**

**SEMESTER IV**

<b>SL. No.</b>	<b>SUBJECT CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	MS1201	Environmental Science	3	0	0	3
2.	MA1203	Numerical Methods	3	1	0	4
3.	AE1204	Aerodynamics - I	3	1	0	4
4.	AE1205	Aircraft Systems & Instrumentation	3	1	0	4
5.	AE1206	Aircraft Structures	3	1	0	4
6.	ME1204	Manufacturing Technology - I	4	0	0	4
<b>PRACTICAL</b>						
7.	AE1273	Aircraft Structures Lab	0	1	2	2
8.	AE1274	Aircraft Systems Lab	0	1	2	2
9.	ME1272	Manufacturing Technology Lab - I	0	1	2	1
<b>TOTAL</b>			<b>19</b>	<b>7</b>	<b>6</b>	<b>28</b>

**OBJECTIVES**

- To provide the students about general aspirants of environment and ecology, the environment pollution and the current social issues.

**UNIT I: NATURE OF ENVIRONMENT STUDIES AND NATURAL RESOURCES****9**

Environment studies- definition- multi disciplinary nature – scope and importance- need for public awareness- Natural resources- Forest resources- energy resources- food Resources- water resources – land resources - mineral resources.

**UNIT II: ECO SYSTEMS AND BIO-DIVERSITY****9**

Concept and component of eco systems- producer, consumer, decomposer- structure and function of eco system- food chain and food web- energy flow model- aquatic eco system- forest eco system- desert eco system- pyramid of biomass- ocean eco system- grass land eco system- Bio diversity in India- value of bio diversity- biodiversity threatens- biodiversity protection- In-situ and Ex-situ conservation.

**UNIT III: ENVIRONMENTAL POLLUTION****9**

Meaning of environmental pollution- air pollution- acid rain – global warming- water pollution- water pollution control- soil pollution- urban waste and soil pollution- marine pollution- noise pollution- thermal pollution- solid and hazardous waste management- waste disposal methods- solid waste and India- natural disaster and disaster management. Low carbon perspectives, Energy savings, Safety and Security

**UNIT IV: SOCIAL ISSUES AND THE ENVIRONMENT****9**

Unsustainable to sustainable development- sustainable development in India- water conservation, watershed management and water harvesting- environmental ethics- role of engineer in environmental protection- economic aspects of environment.

**UNIT V: HUMAN POPULATION AND ENVIRONMENT****9**

Population growth- distribution of population- factors affecting variation in population- theories of population- future of human population- family welfare programme- HIV and AIDS- environment and human health- human rights- value education- women and child welfare.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Cunnigham & saigo: 'Environmental science :A global concern' 4<sup>th</sup> Ed.W.c. Brown Publishers. USA. 1997
2. Chauhan A.S, 'Environmental studies' 2<sup>nd</sup> revised ed.2004, Jain Brother publishers, New Delhi

## REFERENCE BOOKS

1. Benny Joseph : 'Environmental Science and Engineering', 2006, Tata McGraw- Hill Publication.
2. Siddique K.A. : Elements of Ecology and Environmental Pollution, 1<sup>st</sup> Ed. 2002, Kushal Publication, Varanasi.

MA1203

NUMERICAL METHODS

3 1 0 4

### AIM:

With the present development of Computer Technology, it is necessary to develop efficient algorithms for solving problems in science, Engineering and Technology. This course gives a complete procedure for solving different kinds of problems in engineering numerically.

### OBJECTIVE:

To have the basic concepts in numerical methods and find the solutions of large system of linear equations where analytical methods fail to give solution. To gain the ability to solve engineering problems characterized in the form of non- linear ordinary differential equation or partial differential equation.

### UNIT I SOLUTION OF EQUATIONS

9

Solution of non-linear equations-Method of false position, Newton Raphson method , Fixed point iteration method – Solution of linear system of Equations-Direct methods: Gaussian elimination and Gauss-Jordan methods – Iterative methods: Gauss Jacobi and Gauss – Seidel methods- Inverse of a matrix by Gauss-Jordan method.

### UNIT II INTERPOLATION

9

Difference Operators-Forward and Backward – Differences of a polynomial -Missing terms- Interpolation for equal intervals- Newton's forward and Backward formula- Interpolation for unequal intervals-Newton's divided difference and Lagrange's formula – Interpolation with a cubic spline .

### UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION

9

Numerical differentiation using Newton's Forward, Backward, Newton's divided difference and Lagrange's formula – Numerical integration by Trapezoidal , Simpson's 1/3 and 3/8 rules , Romberg's method – Gaussian Quadrature -Two and three point formulae – Double integrals using trapezoidal and Simpson's rules.

### UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

9

Solution of first order differential equations -Single step Methods : Taylor Series , Euler ,Modified Euler methods and Fourth order Runge-Kutta method . Multi-step methods : Milne's and Adam's predictor and corrector methods.

### UNIT V BOUNDARY VALUE PROBLEMS

9

Finite difference solution of the second order ordinary differential equations. Classification of partial differential equation- Finite difference solution of one dimensional heat equation by



implicit and explicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

**TEXT BOOK:**

1. Venkatraman M.K, “Numerical Methods” Fifth Edition, National Pub. Company, Chennai 2005.

**REFERENCES:**

1. Kandasamy, P.Thilakavathy, K and Gunavathy, K. “Numerical Methods” Second Edition, S.Chand and Co. New Delhi. 2008
2. Balagurusamy, E., “Numerical Methods”, First Edition Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2009.
3. Gerald, C.F, and Wheatley, P.O, “Applied Numerical Analysis”, Sixth Edition, Pearson Education Asia, New Delhi, 2006

**AE1204**

**AERODYNAMICS – I**

**3 1 0 4**

**OBJECTIVE**

To understand the behaviour of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime.

- 1. BASIC AERODYNAMIC AND FLUID MECHANICS 9**  
Aerodynamic forces and moments, centre of pressure, non-dimensional analysis, flow similarity, buoyancy forces, types of flows, substantial derivative, conservation of mass, momentum and energy equations.
- 2. INCOMPRESSIBLE AND INVISCID FLOWS 9**  
Velocity potential and stream function, angular velocity, vorticity and strain, Elementary flows – uniform, source and sink, doublets and vortex flows. Superposition of elementary flows - pressure and velocity distributions on bodies with and without circulation in ideal fluid flow, Bernoulli’s equation, Pitot tube.
- 3. PARAMETERS FOR AIRFOIL AND WING CHARACTERISTICS 9**  
Airfoil and wing geometry parameters, Wing of finite span, lift, drag. Lift/drag ratio, circulation and generation of lift, thin airfoil theory (Kutta-Joukowski’s theorem), Kutta condition, high lift airfoil section.
- 4. INCOMPRESSIBLE FLOWS ABOUT WINGS OF FINITE SPAN 9**  
Vortex system, Biot - Savart law, Horse shoe vortex, trailing vortices and downwash, lift on wing, vortex induced drag, lifting line theory and its limitations. Panel methods, Aircraft at high angle of attack

## **5. VISCOUS FLOW**

**9**

Viscous flows, Navier-Stokes equations, boundary layer properties – boundary layer, displacement, momentum thickness, the boundary layer equations, boundary conditions, incompressible boundary layer flow over a flat plate, Blasius solution.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

### **TEXT BOOK**

1. Anderson, J.D., “Fundamentals of Aerodynamics”, McGraw-Hill Book Co., New York, 1985.

### **REFERENCES**

1. Houghton, E.L., and Carpenters, N.B., “Aerodynamics for Engineering students”, Edward Arnold Publishers Ltd., London, 1989.
2. Bertin, J. J., Aerodynamics for Engineers, Pearson Education, Fourth Edition, 2002.
3. Clancey, L.J., “Aerodynamics”, Pitman, 1986.

**AE1205**

**AIRCRAFT SYSTEMS AND INSTRUMENTATION 3 1 0 4**

### **OBJECTIVE**

To describe the principle and working of aircraft systems and instruments

#### **1. AIRPLANE CONTROL SYSTEMS**

**9**

Conventional Systems - Power assisted and fully powered flight controls - Power actuated systems – Engine control systems - Push pull rod system, flexible push pull rod system - Components - Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology, Communication and Navigation systems Instrument landing systems, VOR - CCV case studies.

#### **2. AIRCRAFT SYSTEMS**

**9**

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.

#### **3. ENGINE SYSTEMS**

**9**

Fuel systems for Piston and jet engines, - Components of multi engines. Lubricating systems for piston and jet engines - Starting and Ignition systems - Typical examples for piston and jet engines.

#### **4. AUXILLIARY SYSTEM**

**9**

Basic Air cycle systems - Vapour Cycle systems, Boost-Strap air cycle system - Evaporative vapour cycle systems - Evaporative air cycle systems - Oxygen systems - Fire protection systems, Deicing and anti icing systems.

## **5. AIRCRAFT INSTRUMENTS**

**9**

Flight Instruments and Navigation Instruments – Gyroscope - Accelerometers, Air speed Indicators – TAS, EAS- Mach Meters - Altimeters - Principles and operation - Study of various types of engine instruments - Tachometers - Temperature gauges - Pressure gauges - Operation and Principles.

**TUTORIAL: 15**

**TOTAL: 60**

### **TEXT BOOKS**

1. McKinley, J.L., and Bent, R.D., “Aircraft Maintenance & Repair”, McGraw-Hill, 1993.
2. “General Hand Books of Airframe and Powerplant Mechanics”, U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi 1995.

### **REFERENCES**

1. McKinley, J.L. and Bent, R.D., “Aircraft Power Plants”, McGraw-Hill, 1993.
2. Pallet, E.H.J., “Aircraft Instruments & Principles”, Pitman & Co., 1993.
3. Treager, S., “Gas Turbine Technology”, McGraw-Hill, 1997.

**AE1206**

**AIRCRAFT STRUCTURES**

**3 1 0 4**

### **OBJECTIVE**

To study the behaviour of various aircraft structural components under different types of loads.

#### **1. STATICALLY DETERMINATE AND INDETERMINATE STRUCTURES**

**9**

Analysis of plane truss – Method of joints – 3 D Truss - Plane frames. Composite beam - Clapeyron's Three Moment Equation

#### **2. UNSYMMETRICAL BENDING**

**9**

Bending stresses in beams of unsymmetrical sections – Bending of symmetric sections with skew loads.

#### **3. SHEAR FLOW IN OPEN AND CLOSED SECTIONS**

**9**

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. Bredt – Batho formula, Single and multi – cell structures. Approximate methods. Shear flow in single & multicell structures under torsion. Shear flow in single and multicell under bending with walls effective and ineffective.

#### **4. BUCKLING OF PLATES**

**9**

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, inter rivet and sheet wrinkling failures.

#### **5. STRESS ANALYSIS AND FAILURE THEORY**

**9**

Procedure – Shear and bending moment distribution for semi cantilever and other types of wings and fuselage - Tension field web beams (Wagner's). Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.

**TUTORIAL: 15**

**TOTAL: 60**

#### **TEXT BOOK**

1. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2<sup>nd</sup> edition, McGraw-Hill, N.Y., 1993.

#### **REFEENCES**

1. Megson, T.M.G., "Aircraft Structures for Engineering Students", Edward Arnold, 1995.
2. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri – state off set company, USA, 1985.
3. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, 1993.

**ME1204**

**MANUFACTURING TECHNOLOGY – I**

**4 0 0 4**

#### **OBJECTIVES:**

To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components & Composites

#### **UNIT I METAL CASTING PROCESSES**

**9**

Sand Casting : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Principle of special casting processes : Investment casting, shell moulding, squeeze casting, vacuum casting, counter-gravity low - pressure casting, directional and monocrystal solidification, semisolid metal casting, Defects in casting

#### **UNIT II JOINING PROCESSES**

**9**

Gas Welding: Oxy-acetylene welding, types of flames, welding torches, welding techniques: Arc Welding And Resistance Welding: Arc welding-carbon arc, shielded metal arc, submerged arc, TIG and MIG welding. Welding electrodes-function and characteristics of electrode coating. Resistance welding-spot, seam, projection and butt welding, heat flow in welded components. Other welding process, Laser beam welding, Electron beam welding. Friction welding, Friction stir welding and Ultra sonic welding. Weld defects: types, causes and cure.

**UNIT III METAL FORMING PROCESSES****9**

Cold and hot working, rolling, drawing, extrusion and forging, sheet metal cutting, bending. Drawing applications, defects.- Forging tools and equipment , Press tool works-Basic principles, system, operations and applications. Special forming methods - explosive forming, electro hydraulic forming, magnetic pulse forming – super plastic forming – thermo forming – petro forge hammer and Dynapak process.

**UNIT IV MANUFACTURING OF PLASTIC COMPONENTS****9**

Different thermosetting and thermoplastic compounds, compression moulding, transfer moulding, injection moulding, film and sheet forming, thermoforming and their applications.

**UNIT V MANUFACTURING OF COMPOSITES****9**

Fabrication of Metal Matrix Composites: Commonly used Matrices, Basic Requirements in Selection of constituents, solidification processing of composites - XD process, Spray processes - Osprey Process, Rapid solidification processing, Dispersion Processes - Stir-casting & Compo casting, Screw extrusion, Liquid-metal impregnation technique , Pinciple of molten alloy infiltration, rheological behaviour of melt-particle slurry, Synthesis of In situ Composites; Fabrication of Polymer Matrix Composites - Commonly used Matrices Basic Requirements in selection of Constituents, Moulding method, Low pressure closed moulding, pultrusion, Filament winding, Fabrication of ceramic matrix composites - Various techniques of vapour deposition, Liquid phase method and Hot pressing etc., Fabrication of nano-composites

**TOTAL: 60 PERIODS****TEXT BOOKS:**

1. Hajra Choudhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997
2. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006

**REFERENCES:**

1. NPTEL courses, <http://www.nptel.iitm.ac.in/courses.php?disciplineId=112> web and video resources on Manufacturing Processes I.
2. Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, 2006
3. Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" Eight Edition, Prentice – Hall of India, 1997.
4. Krishna K Chawla, "Composite Materials-Science and Engineering", Springer Verlag, New York, 1987.
5. Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 2nd Edition, TMH-2003;
6. ASM Hand Book, "Casting", ASM International, 1998.
7. Nanocomposite Science and Technology, P. M. Ajayan, L. S. Schadler, P. V. Braun, (2003), Wiley-VCH Verlag GmbH Co. KGaA, Weinheim

**OBJECTIVE**

To experimentally study the unsymmetrical bending of beams, find the location of shear centre, obtain the stresses in circular discs and beams using photoelastic techniques, calibration of photo – elastic materials and study on vibration of beams.

**LIST OF EXPERIMENTS**

1. Unsymmetrical bending of beams
2. Shear centre location for open sections
3. Shear centre location for closed sections
4. Constant strength beam
5. Flexibility matrix for cantilever beam
6. Beam with combined loading
7. Calibration of Photo- elastic materials
8. Stresses in circular discs and beams using photoelastic techniques
9. Vibrations of beams
10. Wagner beam – Tension field beam
11. Column – Testing
12. South – well's plot.

**TOTAL: 45 PERIODS****LIST OF EQUIPMENT***(for a batch of 30 students)*

Sl.No.	Name of the Equipment	Qty	Experiments Number
1	Beam Test set –up	2	1, 2, 3,4
2	Unsymmetrical sections like 'Z' sections	2	1, 2, 3
3	Channel section and angle section	2	1, 2, 3
4	Dial gauges	12	1, 2, 3
5	Weights 1Kg	10	1, 2, 3
6	Weights 2 Kg	10	1, 2, 3
7	Beam Test Set – up	2	3, 4
8	Strain indicator and strain gauges	One set	4,5,6
9	Photo – elastic apparatus	1	7,8
10	Amplifier	2	9
11	Exciter	2	9
12	Pick – up	2	9
13	Oscilloscope	2	9
14	Wagner beam	1	10
15.	Hydraulic Jack	1	10

**AE1274**

**AIRCRAFT SYSTEMS LAB**

**0 1 2 2**

**OBJECTIVE**

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.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**

*(for a batch of 30 students)*

<b>S.No.</b>	<b>Items</b>	<b>Quantity</b>	<b>Experiment No.</b>
1.	Serviceable aircraft with all above systems	1	1,2,3,4,5,6,7,8,9,10
2.	Hydraulic Jacks (Screw Jack)	5	1,2,4,8
3.	Trestle adjustable	5	1,2,4,8
4.	Spirit Level	2	8
5.	Levelling Boards	2	8
6.	Cable Tensiometer	1	8
7.	Adjustable Spirit Level	1	8
8.	Plumb Bob	1	8

**ME1272**

**MANUFACTURING TECHNOLOGY LAB – I**

**0 0 2 1**

**OBJECTIVE**

- To impart practical training to the students on various welding processes
- To develop procedural and manual skills in machining and also to provide training in making greensand moulds

1. Facing, plain turning and step turning

2. Drilling and taper turning
3. Grooving, chamfering and knurling
4. Thread cutting operation – external and internal
5. Demonstration of press operations
6. Horizontal and Vertical welding.
7. Gas Cutting, Gas Welding
8. Mould with solid, split patterns
9. Mould with loose-piece pattern
10. Mould with Core
11. Fabrication of a job involving turning, drilling, milling and welding
12. Visit to industry to study any one of the manufacturing process and submission its report.

**TOTAL: 30 PERIODS**



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**B.E. AERONAUTICAL ENGINEERING**

**CURRICULUM & SYLLABUS**

**SEMESTER V**

<b>SL. No.</b>	<b>SUBJECT CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	MS1202	Professional and Business Ethics	3	0	0	3
2.	AE1207	Mechanics of Machines	3	1	0	4
3.	AE1208	Aerodynamics II	3	1	0	4
4.	AE1209	Propulsion I	3	1	0	4
5.	AE1210	Flight Dynamics	3	1	0	4
6.	xxExx1	Elective I	3	0	0	3
<b>PRACTICAL</b>						
7.	AE1275	Aircraft Component Design and Drafting	0	1	2	2
8.	AE1276	Aerodynamics Lab	0	1	2	2
9.	AE1277	Aircraft Design Project I	0	1	2	2
<b>TOTAL</b>			<b>18</b>	<b>7</b>	<b>6</b>	<b>28</b>

**OBJECTIVES**

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

**UNIT I: HUMAN VALUES****9**

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

**UNIT II: ENGINEERING ETHICS****9**

Senses of 'Engineering Ethics' - variety of moral issues - 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 III: ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

**UNIT IV: SAFETY, RESPONSIBILITIES AND RIGHTS****9**

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 V: GLOBAL ISSUES****9**

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - oral 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.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York.1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

**REFERENCES**

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available).

2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

**AE1207**

**MECHANICS OF MACHINES**

**3 1 0 4**

**OBJECTIVE**

To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working

- 1. MECHANISMS 9**  
Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.
- 2. FRICTION 9**  
Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.
- 3. GEARS AND CAMS 9**  
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 - 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
- 4. BALANCING 9**  
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
- 5. VIBRATION 9**  
Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

**TEXT BOOKS**

1. Rattan.S.S, "Theory of Machines", Tata McGraw–Hill Publishing Co, New Delhi, 2004.
2. Ballaney.P.L, "Theory of Machines", Khanna Publishers, New Delhi, 2002.

## REFERENCES

1. Rao, J.S and Dukkipati, R.V, "Mechanism and Machine Theory", Second Edition, Wiley Eastern Ltd., 1992.
2. Malhotra, D.R and Gupta, H.C., "The Theory of Machines", Satya Prakasam, Tech. India Publications, 1989.
3. Gosh, A. and Mallick, A.K., "Theory of Machines and Mechanisms", Affiliated East West Press, 1989.
4. Shigley, J.E. and Uicker, J.J., "Theory of Machines and Mechanisms", McGraw-Hill, 1980.
5. Burton Paul, "Kinematics and Dynamic of Planer Machinery", Prentice Hall, 1979.

**AE1208**

**AERODYNAMICS – II**

**3 1 0 4**

## OBJECTIVE

To understand the behaviour of airflow both internal and external in compressible flow regime with particular emphasis on supersonic flows.

### **1. ONE DIMENSIONAL COMPRESSIBLE FLOW**

**7**

Mass, Momentum, Energy, continuity and state equations, velocity of sound, Adiabatic steady state flow equations, Flow through converging, diverging passages, Performance under various back pressures, Isentropic, Mach Number and Area Mach number Relation.

### **2. NORMAL AND OBLIQUE SHOCK RELATIONS.**

**15**

Prandtl equation and Rankine – Hugoniot relation, Normal shock equations, Pitot static tube, corrections for subsonic and supersonic flows, Oblique shocks and corresponding equations, Hodograph and pressure turning angle, shock polars, flow past wedges and concave corners, strong, weak and detached shocks, Rayleigh and Fanno Flow.

### **3. EXPANSION WAVES AND HIGH SPEED WIND TUNEELS**

**8**

Prandtl Meyer Function, Flow past convex corners, Expansion hodograph, Reflection and interaction of shocks and expansion, waves, Families of shocks, Methods of Characteristics, Compatibility equation, Two dimensional supersonic nozzle contours. Blow down, indraft and induction tunnel layouts and their design features.

### **4. STEADY COMPRESSIBLE FLOWS**

**9**

Introduction to differential equation of motion, 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.

### **5. AIRFOIL IN HIGH SPEED FLOWS**

**6**

Lower and upper critical Mach numbers, Lift and drag divergence, Super Critical aerofoil, shock induced separation, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule, Tip effects.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

**TEXT BOOK**

1. Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2003.
2. John D. Anderson, Jr. "Fundamentals of aerodynamics"
3. Anderson Jr., D., – "Modern compressible flows", McGraw-Hill Book Co., New York 1999

**REFERENCES**

1. Shapiro, A.H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronald Press, 1982.
2. Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1989.
3. Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, New York, 1979.

**AE1209**

**PROPULSION – I**

**3 1 0 4**

**OBJECTIVE**

To understand the principles of operation and design of aircraft engines.

**1. FUNDAMENTALS OF GAS TURBINE ENGINES**

**8**

Types of gas turbine engines, Illustration of working of gas turbine engine, Thermodynamics Cycles, The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet – Performance characteristics.

**2. SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES**

**8**

Internal flow and Stall in subsonic inlets – Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and external deceleration ratio – Diffuser performance – Supersonic inlets – Starting problem on supersonic inlets – Shock swallowing by area variation – External declaration – Modes of inlet operation.

**3. COMBUSTION CHAMBERS**

**8**

Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – Use of flame holders – Numerical problems.

**4. NOZZLES**

**8**

Theory of flow in isentropic nozzles – Convergent nozzles and nozzle choking – Nozzle throat conditions – Nozzle efficiency – Losses in nozzles – Over expanded and under expanded nozzles – Ejector and variable area nozzles – Interaction of nozzle flow with adjacent surfaces – Thrust reversal.

## **5. COMPRESSORS**

**13**

Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of pre whirl – Rotation stall – Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Free Vortex – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

### **TEXT BOOK**

1. Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion” Addison – Wesley Longman INC, 1999.

### **REFERENCES**

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. “Gas Turbine Theory”, Longman, 1989.
2. Oates, G.C., “Aero thermodynamics of Aircraft Engine Components”, AIAA Education Series, New York, 1985.
3. “Rolls Royce Jet Engine” – Third Edition – 1983.
4. Mathur, M.L. and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers & Distributors, Delhi, 1999.
5. Physics of Electric propulsion by Robert G Jahn. Third edition 1999.

**AE1210**

**FLIGHT DYNAMICS**

**3 1 0 4**

### **OBJECTIVE**

To study the performance of airplanes under various operating conditions and the static and dynamic response of aircraft for both voluntary and involuntary changes in flight conditions

#### **1. DRAG ON THE AIRPLANE**

**7**

International Standard Atmosphere - Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag - Drag polars of vehicles from low speed to high speeds - Variation of thrust, power and SFC with velocity and altitudes for air breathing engines and rockets - Power available and power required curves.

#### **2. AIRCRAFT PERFORMANCE**

**10**

Performance of airplane in level flight - Maximum speed in level flight - Conditions for minimum drag and power required - Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turn radius). Bank angle and load factor - Limitations of pull up and push over - V-n diagram and load factor.

#### **3. STATIC LONGITUDINAL STABILITY**

**10**

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 fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG 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. Determination of neutral points and maneuver points from flight test.

**4. LATERAL AND DIRECTIONAL STABILITY 8**

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

**5. DYNAMIC STABILITY 10**

Dynamic longitudinal stability: Equations of motion - Stability derivatives - Characteristic equation of stick fixed case - Modes and stability criterion - Effect of freeing-the stick - Brief description of lateral and directional. Dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

**TEXT BOOK**

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, New York, 1988.

**REFERENCES**

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
3. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
4. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998.

**AE1275 AIRCRAFT COMPONENT DESIGN AND DRAFTING 0 1 2 2**

**OBJECTIVE**

- To introduce the concept of design of basic structural components and to draft both manually and using modelling package.
- Ability to design and draw different joints and components using manual drafting method.

<b>Sl. No</b>	<b>TOPICS TO BE COVERED</b>	<b>NO. OF PRACTICAL PERIODS</b>
1.	Design and drafting of riveted joints	3
2.	Design and drafting of welded joints	6
3.	Design and drafting control components cam	6

4.	Design and drafting control components bell crank	6
5.	Design and drafting control components gear	6
6.	Design and drafting control components push-pull rod	6
7.	Three view diagram of a typical aircraft	6
8.	Layout of typical wing structure	6
9.	Layout of typical fuselage structure	6
10.	Layout of control system	6
11.	3-D Printing	3
<b>TOTAL</b>		60

**AE1276**

**AERODYNAMICS LAB**

**0 1 2 2**

**OBJECTIVE**

To study experimentally the aerodynamic forces on different bodies at low speeds.

**LIST OF EXPERIMENTS**

1. Calibration of subsonic wind tunnel.
2. Pressure distribution over smooth and rough cylinder.
3. Pressure distribution over symmetric airfoils.
4. Pressure distribution over cambered airfoils & thin airfoils
5. Force measurement using wind tunnel balance.
6. Flow over a flat plate at different angles of incidence
7. Flow visualization studies in low speed flows over cylinders
8. Flow visualization studies in low speed flows over airfoil with different angle of incidence
9. Calibration of supersonic wind tunnel.
10. Supersonic flow visualization with Schlieren system.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENT**

*(for a batch of 30 students)*

<b>Sl. No.</b>	<b>Items</b>	<b>Quantity</b>	<b>Experiment No.</b>
1.	Wind Tunnel test section size around 300 x 300 mm with test section flow speed of 70 m/s.	1 No.	1, 2,3,4,5
2.	Wings of various airfoil sections (Symmetrical & cambered airfoils)	2 Nos. each	3, 4
3.	Angle of incidence changing mechanism	1 No.	3, 4
4.	Multiple Manometer stands with 20 – 30 manometer tubes	4 Nos.	2,3,4



5.	U-Tube Manometer	1 No.	1,2,3,4
6.	Static Pressure Probes	4 Nos.	1,2,3,4
7.	Total Pressure Probest	4 Nos.	1,2,3,4
8.	Pitot-Static Tubes	4 Nos.	1,2,3,4
9.	Wooden Models of Three Dimensional bodies (eg. Cylinder etc.,)	2 Nos. each	2
10.	Wind Tunnel balances (3 or 5 or 6 components)	1 No.	5
11.	Pressure Transducers with digital display	1 No.	1,2,3,4
12.	Hele-Shaw apparatus, Smoke Tunnel, Water flow channel	1 each	6,7,8
13.	Supersonic Wind tunnel of test section size 100 x 100 mm with storage tank capacity of 500ft <sup>2</sup> at 20 bar	1 No.	9,10
14.	Wooden models of cone, wedge and blunt body configurations of suitable size for flow visualization in a supersonic wind tunnel test section	1 No.	9,10
15.	Schlieren System	1 No.	9,10

**AE1276**

**AIRCRAFT DESIGN PROJECT – I**

**0 1 2 2**

### **OBJECTIVE**

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. Preparation of comparative data sheets
4. Work sheet layout procedures
5. Comparative graphs preparation and selection of main parameters for the design
6. Preliminary weight estimations, selection of main parameters,
7. Power plant selection, Aerofoil selection, Wing tail and control surfaces
8. Preparation of layouts of balance diagram and three view drawings
9. Drag estimation
10. Detailed performance calculations and stability estimates

**TOTAL: 45 PERIODS**

### **LIST OF EQUIPMENTS**

*(for a batch of 30 students)*

<b>Sl.No.</b>	<b>Name of the Equipment</b>	<b>Quantity</b>	<b>Experiments Number</b>
1	Engineering Drawing Board	30	3
2	Engineering Drawing Instruments	30	3

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**CURRICULUM & SYLLABUS**

**SEMESTER VI**

<b>SL. No.</b>	<b>SUBJECT CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	IT1212	Cyber Security	3	0	0	3
2.	AE1212	Aero Acoustics	3	0	0	3
3.	AE1213	Propulsion II	3	1	0	4
4.	EE12A3	Control Engineering	3	0	0	3
5.	AE1214	Heat Transfer	3	0	0	3
6.	AE1215	Aircraft Design	3	1	0	4
<b>PRACTICAL</b>						
7.	AE1278	CAD & FEM Lab	0	1	2	2
8.	AE1279	Aircraft Design Project II	0	1	1	1
9	AE1280	Navigation & Guidance Lab	0	1	2	2
10	AE1281	Propulsion Lab	0	1	1	1
<b>TOTAL</b>			<b>18</b>	<b>6</b>	<b>6</b>	<b>26</b>

**AIM**

The Course curriculum aims at imparting the fundamentals of cyber crime investigation, the tools used for the investigation, in addition to giving an exposure to the various kinds of cyber security threats and their impact on connected systems/resources.

**OBJECTIVES**

- The course also gives an exposure to the different types of mechanisms to sanitize the cyber space by adopting standardized operating procedures while transacting business/commerce online, and also to ensure security of information handled over the net.
- Introduction to the Cyber Laws and the IPC/Cr.PC equips the students with sufficient legal knowledge about deterrence in preventing cyber crimes.

**UNIT I COMPUTER ORGANIZATION & ARCHITECTURE AND OPERATING SYSTEMS 6**

Computer Organization, Architecture, Operating Systems, Process Management, CPU Scheduling, I/O Memory Management, file systems and deadlocks. LAN, MAN, WAN, ISO/OSI seven layer architecture.

**UNIT II INFORMATION SECURITY FUNDAMENTALS 6**

Background, Importance, statistics, national and international scenarios. Identification and authentication, confidentiality, privacy, integrity, non-repudiation. Goals of security: prevention, detection and recovery. E-commerce security. Critical Infrastructure Protection.

**UNIT III SECURITY THREATS AND VULNERABILITIES 9**

Overview of security threats, various kinds of threats; Authentication-weak passwords. Insecure internet connection- internet cookies, viruses and other infections. Security of hard drives, security of laptops; sniffers, backdoors and Trojans. Buffer overflow and other programming bugs. Common attacks- DoS, man-in-the-middle, brute force attacks

**UNIT IV OVERVIEW OF SECURITY PRINCIPLES 15**

Security policies and procedures, International standards, Security consideration of OS- OS hardening - Internet protocols and security: SSL/TLS, IP Security, Application layer security - Access Control: Physical, Logical and Biometric - Tools and Techniques: Firewalls, Antivirus, IDS, Log analysis, Cryptography, steganography - Security Infrastructure: PKI, VPN, Digital signature - Network scanners, vulnerability scanners - Device Security - Cloud computing security, Database security.

**UNIT V CYBER CRIMES. 9**

Cyber crimes, Cyber crime Investigation, and Cyber forensic tools. Cyber Laws. Information Technology Act, Cyber laws and cyber crime investigation. Social networks and analysis.

**TOTAL: 45 PERIODS**

## **TEXT BOOKS**

1. Thomas Calabres and Tom Calabrese, "Information Security Intelligence: Cryptographic Principles & Application", Thomson Delmar Learning, 2004.
2. Bernadette H Schell, Clemens Martin, "Cyber Crime", ABC-CLIO Inc, California, 2004.
3. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.
4. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Prentice Hall, 2008.

## **REFERENCES**

1. Silberschatz A, Galvin P, Gagne G, "Operating Systems Concepts", John Wiley & Sons, Singapore, 2006.
2. Principles and Practices of Information Security by Michael.E. Whiteman and Herbert .J. Mattord.
3. Cyber Laws by Aparna Viswanathan.
4. Joseph M Kizza, "Computer Network Security", Springer Verlag, 2005.

**AE1212**

**AERO ACOUSTICS**

**3 0 0 3**

### **OBJECTIVE:**

To expose the students to the acoustic principle, transmission, measurement, various types of noise control and various methods of acoustic insulation.

### **UNIT I**

#### **INTRODUCTION**

**9**

Introduction – Basic acoustic principles – acoustic terminology and definitions –plane waves – harmonic solution – velocity of sound in inviscid fluids – relationship between wave length, particle velocities, acceleration – energy density – acoustic intensity – reference standards and measurement.

### **UNIT II**

#### **TRANSMISSION**

**9**

Transmission of sound through one, two, and three media. Transmission through pipes – branched and un-branched resonators – Transmission loss reflection at plane surface-standing waves and standing wave apparatus, spherical waves – radiation – simple source – hemispherical source – radiating piston – pressure intensity distribution – beam width and directivity index – sound absorbing materials.

### **UNIT III**

#### **NOISE MEASUREMENT TECHNIQUES**

**9**

Noise measurement: Decibel scale – relationship between pressure, intensity and power – sound level meter, noise analyser and graphic level recorder – measurement in anechoic and reverberation chambers, machinery noise control. Environmental noise control: Human reaction to sound – definitions of speech interference level, perceived noise level, phon and sone etc, hearing loss – principles of noise control –control at source, during transmission and at receiver – protection of receiver.

### **UNIT IV**

#### **ACOUSTIC INSULATION**

**9**

Acoustic insulation – acoustic materials – acoustic filter and mufflers – plenum chamber – noise criteria and standards –noise and number index guide lines for designing quieter equipments – machinery noise such as pumps, rotating machines, reciprocating machines etc.

**UNIT V METHODS OF CONTROL OF NOISE****9**

Methods of control of noise using baffles, coverings, perforations etc. Transmission through structures – control vibration by damping and other methods. Principles of noise control in an auditorium – requirements of a good auditorium.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Pertrusowicz and Longmore, Noise and Vibration Control for Industrialists, Elsevier, 1974.
2. Thumann A and R. K. Miller, Secrets of Noise Control, Fairmont Press, 1976.
3. J. D. Irvin and e. R. Graf, Industrial Noise and Vibration Control, Prantice-Hall, Englewood Cliffs, New Jersey, 1979.
4. Ford R. D., Introduction to Acoustics, Elsevier, New York, 1970.

**REFERENCES:**

1. Reynolds D. D., Engineering principles of Acoustics, Alyn and Bacon Inc., Boston, 1981.
2. Kindler L. E., A. R. Frey, A. B. Frey, A. B. Coppens and J. V. Sanders, Fundamentals of Acoustics, 3/e, John Willey and sons, New York, 1982
3. Berenekm L. L. and Istvan L. Ver., Noise and vibration control engineering: principles and applications, Wiley-Inter Science, 1992.
4. Harris C. M., Handbook of Noise Control, McGraw Hill, 1979.

**AE1213****PROPULSION – II****3 1 0 4****OBJECTIVE**

To study in detail about gas turbines, ramjet, fundamentals of rocket propulsion and chemical rockets

**1. AIRCRAFT GAS TURBINES****12**

Impulse and reaction blading of gas turbines – Velocity triangles and power output – Elementary theory – Vortex theory – Choice of blade profile, pitch and chord – Estimation of stage performance – Limiting factors in gas turbine design- Overall turbine performance – Methods of blade cooling – Matching of turbine and compressor – Numerical problems.

**2. RAMJET AND SCRAMJET PROPULSION.****10**

Operating principle – Sub critical, critical and supercritical operation – Combustion in ramjet engine – Ramjet performance – Sample ramjet design calculations – Introduction to scramjet – Preliminary concepts in supersonic combustion – Integral ram- rocket- Numerical problems.

**3. FUNDAMENTALS OF ROCKET PROPULSION****8**

Operating principle – Specific impulse of a rocket – internal ballistics- Rocket nozzle classification – Rocket nozzle contour optimization, Rocket performance considerations – Numerical Problems.

**4. CHEMICAL ROCKETS 10**

Solid propellant rockets – Selection criteria of solid propellants – Important hardware components of solid rockets – Propellant grain design considerations – Liquid propellant rockets – Cryogenic and semi cryogenic rockets -Selection of liquid propellants – Thrust control in liquid rockets – Cooling in liquid rockets – Limitations of hybrid rockets – Relative advantages of liquid rockets over solid rockets-Propellant Combustion-Combustion Instability, Numerical Problems.

**5. ADVANCED PROPULSION TECHNIQUES 5**

Electric Propulsion – Ion propulsion techniques – Nuclear rocket – Types – Solar sail-Preliminary Concepts in nozzle less propulsion.

**T: 15 + L: 45 = TOTAL: 60 PERIODS**

**TEXT BOOKS**

1. Sutton, G.P., “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 5<sup>th</sup> Edn., 1993.
2. Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion” Addison – Wesley Longman INC, 1999.

**REFERENCES**

1. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., “Gas Turbine Theory”, Longman Co., ELBS Ed., 1989.
2. Gorden, C.V., “Aero thermodynamics of Gas Turbine and Rocket Propulsion”, AIAA Education Series, New York, 1989.
3. Mathur, M., and Sharma, R.P., “Gas Turbines and Jet and Rocket Propulsion”, Standard Publishers, New Delhi, 1988.
4. “Physics of Electric propulsion” by Robert G Jahn. Third edition 1999.

**EE12A3 CONTROL ENGINEERING 3 0 0 3**

**OBJECTIVE**

To understand the basic concepts of flight control system.

1. **INTRODUCTION 9**  
Historical review - Simple pneumatic, hydraulic and thermal systems, Series and parallel systems, Analogies - Mechanical and electrical components, Development of flight control systems.
2. **OPEN AND CLOSED LOOP SYSTEMS 9**  
Feedback control systems – Block diagram representation of control systems, Reduction of block diagrams, Output to input ratios, Signal flow graph.
3. **CHARACTERISTIC EQUATION AND FUNCTIONS 9**  
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.

- 4. CONCEPT OF STABILITY 9**  
Necessary and sufficient conditions, Routh – Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.
- 5. AUTOMATIC FLIGHT CONTROL 9**  
Auto Pilots: Longitudinal Auto-Pilots: Brief description through Block diagrams and Root Locus of Displacement Auto Pilot, Pitch Orientational Control System. Acceleration control system
- TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. OGATO, “Modern Control Engineering”, Prentice – Hall of India Pvt. Ltd. New Delhi, 1998.
2. GOPAL.M. “Control Systems, Principles and design” – Tata McGraw-Hill Publication, New Delhi, 2000.
3. Automatic Control of aircraft and Missiles : John H.Blackelock, John Wiley & Sons, 2nd Ed. 1990

**REFERENCES**

1. Azzo, J.J.D. and C.H. Houpis, “Feed back control system analysis and synthesis”, McGraw – Hill International, 3<sup>rd</sup> Edition, 1998.
2. Kuo, B.C., “Automatic control systems”, Prentice – Hall of India Pvt. Ltd., New Delhi, 1998.
3. Houpis, C.H. and Lamont, G.B., “Digital Control Systems”, McGraw-Hill Book Co. New York, USA 1995.
4. Naresh K. Sinha, “Control Systems”, New Age International Publishers, New Delhi.

**AE1214**

**HEAT TRANSFER**

**3 0 0 3**

**OBJECTIVE**

To introduce the concepts of heat transfer to enable the students to design components subjected to thermal loading.

- 1. HEAT CONDUCTION 11**  
Basic Modes of Heat Transfer – One dimensional steady state heat conduction: Composite Medium – Critical thickness – Effect of variation of thermal Conductivity – Extended Surfaces – Unsteady state. Heat Conduction: Lumped System Analysis – Heat Transfer in Semi infinite and infinite solids – Use of Transient – Temperature charts – Application of numerical techniques.
- 2. CONVECTIVE HEAT TRANSFER 10**  
Introduction – Free convection in atmosphere free convection on a vertical flat plate – Empirical relation in free convection – Forced convection – Laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations, application of numerical techniques in problem solving.

- 3. RADIATIVE HEAT TRANSFER 8**  
Introduction to Physical mechanism – Radiation properties – Radiation shape factors – Heat exchange between non – black bodies – Radiation shields-Gas Radiation.
- 4. HEAT EXCHANGERS 8**  
Classification – Temperature Distribution – Overall heat transfer coefficient, Heat Exchange Analysis – LMTD Method and E-NTU Method.
- 5. HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING 8**  
High-Speed flow Heat Transfer, Heat Transfer problems in gas turbine combustion chambers – Rocket thrust chambers – Aerodynamic heating – Ablative heat transfer- Heat Transfer problem in turbine and nozzle blades.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Yunus A. Cengel., “Heat Transfer – A practical approach”, Second Edition, Tata McGraw-Hill, 2002.
2. Incropera. F.P.and Dewitt.D.P. “ Introduction to Heat Transfer”, John Wiley and Sons – 2002.

**REFERENCES**

1. Lienhard, J.H., “A Heat Transfer Text Book”, Prentice Hall Inc., 1981.
2. Holman, J.P. “Heat Transfer”, McGraw-Hill Book Co., Inc., New York, 6<sup>th</sup> Edn., 1991.
3. Sachdeva, S.C., “Fundamentals of Engineering Heat & Mass Transfer”, Wiley Eastern Ltd., New Delhi, 1981.
4. Mathur, M. and Sharma, R.P. “Gas Turbine and Jet and Rocket Propulsion”, Standard Publishers, New Delhi 1988.
5. C.P.Kothandaraman, Mathur Sharma “Fundamentals of Heat Transfer”

**AE1215**

**AIRCRAFT DESIGN**

**3 1 0 4**

**OBJECTIVE**

To introduce and develop the basic concept of aircraft design

**UNIT I POWER PLANT TYPES AND CHARACTERISTICS 9**

Characteristics of different types of power plants – Propeller characteristics and selection – Relative merits of location of power plant. Propellers - Froud momentum and blade element theories, propeller coefficients, use of propeller charts, performance of fixed and variable pitch propeller.

**UNIT II PERFORMANCE DESIGN 9**

Selection of geometric and aerodynamic parameters – Weight estimation and balance diagram – Drag estimation of complete aircraft – Level flight, climb, take – off and landing calculations – range and endurance.



**UNIT III STABILITY DESIGN****9**

Static and dynamic stability estimates – control requirements. Maximum range of climb, shallow angle of climb, High Lift devices

**UNIT IV SPECIAL PROBLEMS****9**

Layout peculiarities of subsonic and supersonic aircraft – optimisation – of wing loading to achieve desired performance – loads on undercarriages and design requirements.

**UNIT V STRUCTURAL DESIGN****9**

Estimation of loads on complete aircraft and components – Structural design of fuselage, wings and undercarriages, controls, connections and joints. Materials for modern aircraft – Methods of analysis, testing and fabrication.

**T: 15 + L: 45 = TOTAL: 60 PERIODS****REFERENCES**

1. G. Corning, “Supersonic & Subsonic Airplane Design”, II Edition, Edwards Brothers Inc., Michigan, 1953.
2. E.F. Bruhn, “Analysis and Design of Flight Vehicle Structures”, Tristate Offset Co., U.S.A., 1980.
3. A.A. Lebedenski, “Notes on airplane design”, Part-I, I.I.Sc., Bangalore, 1971.
4. E. Torenbeek, “Synthesis of Subsonic Airplane Design”, Delft University Press, London, 1976.
5. D.P. Raymer, “Aircraft conceptual design”, AIAA Series, 1988.
6. H.N.Kota, “ Integrated design approach to Design fly by wire” Lecture notes Interline Pub. Bangalore, 1992.
7. S.C. Keshu & K.K. Ganapathi “Aircraft Production Techniques and Management”, 1995.
8. Perkins C.D., & Hage, R.E, “Airplane performance, stability and control”, Wiley Toppan, 1974.

**AE1278****CAD & FEM LABORATORY****0 1 2 2****OBJECTIVE**

To teach and train the students in the lab about the design and drafting of aero components

**LIST OF EXPERIMENTS**

1. Scaling, rotation, translation, editing, dimensioning – Typical CAD command structure.
2. Wire frame modeling – surface modeling
3. Solid Modeling
4. Incremental programme G 90 operation.
5. Mirroring.
6. Incremental Programme G 91 operation
7. Absolute Programme G 90 operation
8. Absolute Programme G 91 operation
9. Computer aided modeling of typical aircraft wing.
10. Computer aided modeling of typical fuselage structure.

11. Computer aided modeling of landing gear

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENT**  
*(for a batch of 30 students)*

<b>Sl.No.</b>	<b>Name of the Equipment</b>	<b>Quantity</b>	<b>Experiment No.</b>
1	Computer nodes	30	1 to 7
2	Pro-E – 2001, 2002 – CAD Packages	30 licenses	1 to 7
3	ANSYS- 7, STAR – CD	30 licenses	1 to 7
4	UPS	1	1 to 7

**AE1279**

**AIRCRAFT DESIGN PROJECT – II**

**0 1 1 1**

**OBJECTIVE**

To enhance the knowledge in continuation of the design project given in project–I

Each student is assigned with work in continuation of the design project – I. The following assignments are to be carried out.

**LIST OF EXPERIMENTS**

1. V-n diagram for the design study
2. Gust and maneuverability envelopes
3. Critical loading performance and final V-n graph calculation
4. Structural design study – Theory approach
5. Load estimation of wings
6. Load estimation of fuselage.
7. Balancing and Maneuvering loads on tail plane, Aileron and Rudder loads.
8. Detailed structural layouts
9. Design of some components of wings, fuselage
10. Preparation of a detailed design report with CAD drawings.

**TOTAL: 30 PERIODS**

**LIST OF EQUIPMENTS**

*(for a batch of 30 students)*

<b>S.No.</b>	<b>Items</b>	<b>Quantity</b>	<b>Experiment No.</b>
1.	Drawing Board	30	4 and 5
2.	Drawing Instrument	20	4 and 5

**AE1280**

**NAVIGATION AND GUIDANCE LABORATORY**

**0 1 2 2**

**OBJECTIVE**

This laboratory is divided into three parts to train the students to learn about basic digital electronics circuits, programming with microprocessors, design and implementation of data buses in avionics with MIL – Std. 1553B and remote terminal configuration and their importance in different applications in the field of Avionics.

**LIST OF EXPERIMENTS**

**MATLAB**

- 1 Introduction to MATLAB
- 2 Working with Matrices
- 3 Expressions
- 4 Relational and Logical Operations

**MICROPROCESSORS**

- 1 Addition and Subtraction of 8-bit and 16-bit numbers.
- 2 Sorting of Data in Ascending & Descending order.
- 3 Sum of a given series with and without carry.
- 4 Greatest in a given series & Multi-byte addition in BCD mode.
- 5 Interface programming with 4 digit 7 segment Display & Switches & LED's.
- 6 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.

**AVIONICS DATA BUSES**

- 1 Study of Different Avionics Data Buses.
- 2 MIL-Std – 1553 Data Buses Configuration with Message transfer.
- 3 MIL-Std – 1553 Remote Terminal Configuration.

**TOTAL: 45 PERIODS**

**AE1281**

**PROPULSION LABORATORY**

**0 1 1 1**

**OBJECTIVE**

To understand the basic concepts and carryout experiments in Aerospace Propulsion.

**LIST OF EXPERIMENTS**

1. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
2. Study of an aircraft jet engine (Includes study of assembly of sub systems, various components, their functions and operating principles)
3. Forced convective heat transfer over a flat plate.
4. Free convective heat transfer over a flat plate
5. Cascade testing of a model of axial compressor blade row.
6. Study of performance of a propeller.
7. Determination of heat of combustion of aviation fuel.
8. Combustion performance studies in a jet engine combustion chamber.
9. Study of free jet.
10. Study of wall jet.

**TOTAL: 30 PERIODS**

**LIST OF EQUIPMENTS**

*(for a batch of 30 students)*

Sl.No	Equipments	Qty	Experiments No.
1	Piston engines	2	1
2	Jet Engine /Engine model	1	2
3	Forced Convective apparatus	1	3
4	Free Convective apparatus	1	4
5	Axial compressor blade row model with pressure tapping	1	5
6	Watertube manometers (20 tubes)	2	5,8,9
7	Subsonic wind tunnel	1	4
8	Propeller model static and total pressure probes	4	8,9
9	2-D travers in mechanism	2	8
10.	Freejet test setup	1	9
11.	Aluminium plates with deflection mechanisms	1	10

**NOORUL ISLAM CENTRE FOR HIGHER EDUCATION**

**NOORUL ISLAM UNIVERSITY, KUMARACOIL**

**B.E. AERONAUTICAL ENGINEERING**

**LIST OF ELECTIVES**

<b>SI. NO</b>	<b>CODE</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	AE12A1	Aero Engine Maintenance and Repair	3	0	0	3
2	AE12A2	Airframe Maintenance and Repair	3	0	0	3
3	AE12A3	Aircraft Production Planning and Control	3	0	0	3
4	AE12A4	Industrial Aerodynamics	3	0	0	3

**OBJECTIVE**

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.

**1. CLASSIFICATION OF PISTON ENGINE COMPONENTS 5**

Types of piston engines – Principles of operation – Function of components – Materials used – Details of starting the engines – Details of carburetion and injection systems for small and large engines – Ignition system components – Spark plug details – Engine operating conditions at various altitudes – Maintenance and inspection check to be carried out.

**2. INSPECTIONS OF PISTON ENGINES 8**

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.

**3. INSPECTIONS OF PISTON ENGINES 10**

Symptoms of failure – Fault diagnostics – Case studies of different engine systems – Tools and equipment requirements for various checks and alignment during overhauling – Tools for inspection – Tools for safety and for visual inspection – Methods and instruments for non destructive testing techniques – Equipment for replacement of part and their repair. Engine testing: Engine testing procedures and schedule preparation – Online maintenance.

**4. CLASSIFICATION OF JET ENGINE COMPONENTS 12**

Types of jet engines – Principles of operation – Functions of components – Materials used – Details of starting and operating procedures – Gas turbine engine inspection & checks – Use of instruments for online maintenance – Special inspection procedures : Foreign Object Damage – Blade damage – etc.

Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures – Component maintenance procedures – Systems maintenance procedures.

Gas turbine testing procedures – test schedule preparation – Storage of Engines – Preservation and de-preservation procedures.

**5. OVERHAUL PROCEDURES 10**

Engine Overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of Gas turbine components.

Trouble Shooting - Procedures for rectification – Condition monitoring of the engine on ground and at altitude – engine health monitoring and corrective methods.

**TOTAL: 45 PERIODS****TEXT BOOK**

1. KROES & WILD, “Aircraft Power plants”, 7<sup>th</sup> Edition – McGraw Hill, New York, 1994.

## REFERENCES

1. TURBOMECA, "Gas Turbine Engines", The English Book Store, New Delhi, 1993.
2. UNITED TECHNOLOGIES PRATT & WHITNEY, "The Aircraft Gas turbine Engine and its Operation", (latest edition) The English Book Store, New Delhi.

**AE12A2      AIRFRAME MAINTENANCE AND REPAIR      3 0 0 3**

## OBJECTIVE

To study the maintenance aspect of airframe systems and rectification of snags

### **1.      WELDING IN AIRCRAFT STRUCTURAL COMPONENTS      10**

Equipments used in welding shop and their maintenance – Ensuring quality welds – Welding jigs and fixtures – Soldering and brazing.

## **SHEET METAL REPAIR AND MAINTENANCE**

Inspection of damage – Classification – Repair or replacement – Sheet metal inspection – N.D.T. Testing – Riveted repair design, Damage investigation – reverse technology.

### **2.      PLASTICS AND COMPOSITES IN AIRCRAFT      10**

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.

### **3.      AIRCRAFT JACKING, ASSEMBLY AND RIGGING      8**

Airplane jacking and weighing and C.G. Location. Balancing of control surfaces – Inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

### **4.      REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM      10**

Trouble shooting and maintenance practices – Service and inspection. – Inspection and maintenance of landing gear systems. – Inspection and maintenance of air-conditioning and pressurisation 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)

### **5.      SAFETY PRACTICES      7**

Hazardous materials storage and handling, Aircraft furnishing practices – Equipments. Trouble shooting - Theory and practices.

**TOTAL: 45 PERIODS**

## **TEXT BOOK**

1. KROES, WATKINS, DELP, "Aircraft Maintenance and Repair", McGraw-Hill, New York, 1992.

## **REFERENCES**

1. LARRY REITHMEIR, "Aircraft Repair Manual", Palamar Books, Marquette, 1992.

2. BRIMM D.J. BOGGES H.E., "Aircraft Maintenance", Pitman Publishing corp. New York, 1940

**AE12A3 AIRCRAFT PRODUCTION PLANNING AND CONTROL 3 0 0 3**

**OBJECTIVE:**

To understand the various components and functions of production planning and control such as product planning, product scheduling and inventory control.

**UNIT I INTRODUCTION**

**8**

Factors affecting planning-Forecasting information necessary for pre-planning-sources of information-Methods of forecasting-aircraft components requiring overhaul-repair/modifications - premature-failures-project planning-estimates of plant, machinery, buildings, manpower, materials, spare parts, time, and cost estimates.

**UNIT II MATERIALS, MACHINES AND PROCESSES**

**9**

Production engineering knowledge necessary for Planning, machine tools and processes - Materials including aircraft materials and their processing-Spare parts required for overhaul and maintenance-Ground handling equipment-testing of components and aircraft overhaul-standards for acceptance after overhaul.

**UNIT III EQUIPMENT AND TOOLS**

**10**

Pre-planning required for provision of special tools, jigs, fixtures and test equipment required for overhaul and maintenance-types and description of major test equipment.

**UNIT IV PRODUCTION PLANNING**

**10**

Production planning function of routing, estimating and scheduling –LOB-CPM and PERT. Queuing theory, sequencing in jobs, shop scheduling, assembly line balancing-charts and graphs.

**UNIT V PRODUCTION CONTROL**

**8**

Production control functions of dispatching, progressing and evaluation-Activities of progressing-shop procedures-maintenance of critical data statistics of evaluation control charts.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Thomas. L. "Production planning and control" Mc Graw Hill, 1985.
2. Jain. K. C. and Aggarwal. L. N. "Production planning and control and Industrial Management, Khanna publishers, 1990.

**REFERENCES:**

1. Buffa. E. S. and Sarin. R. K. "Modern production / operations management "8<sup>th</sup> ed, John Willey and sons, 2000.
2. MacNiece. E. H. "Production forecasting, planning and control", John Willey, 1986.
3. Mages. J. F. "Production planning and Inventory control", McGraw Hill, 1990.



**AE12A4**

**INDUSTRIAL AERODYNAMICS**

**3 0 0 3**

**OBJECTIVE**

To understand the behaviour of airflow in vehicle, Buildings and the flow induced vibrations.

**UNIT I      ATMOSPHERE**

**9**

Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height, Structure of turbulent flows.

**UNIT II      WIND ENERGY COLLECTORS**

**9**

Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.

**UNIT III     VEHICLE AERODYNAMICS**

**9**

Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and Hovercraft.

**UNIT IV     BUILDING AERODYNAMICS**

**9**

Pressure distribution on low rise buildings, wind forces on buildings. Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics.

**UNIT V      FLOW INDUCED VIBRATIONS**

**9**

Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Galloping and stall flutter.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. M.Sovran (Ed), "Aerodynamics drag mechanisms of bluff bodies and road vehicles", Plenum press, New York, 1978.
2. P. Sachs, "Winds forces in engineering", Pergamon Press, 1978.
3. R.D. Blevins, "Flow induced vibrations", Van Nostrand, 1990.
4. N.G. Calvent, "Wind Power Principles", Charles Griffin & Co., London, 1979.

**AE12A5**

**THEORY OF VIBRATIONS**

**3 0 0 3**

**OBJECTIVE**

To study the dynamic behaviour of different aircraft components and the interaction among the aerodynamic, elastic and inertia forces

**1.            INTRODUCTION**

**8**

Simple harmonic motion, definition of terminologies, Review of Newton's, Laws, D'Alembert's principle, Energy methods.

- 2. SINGLE DEGREE OF FREEDOM SYSTEMS 8**  
Free vibrations free damped vibrations, forced excitations with and without damping, support excitation, vibration measuring instruments.
- 3. MULTI-DEGREE OF FREEDOM SYSTEMS 12**  
Two degrees of freedom systems, Static and dynamic couplings, vibration absorber, Principle coordinates, Principal modes, orthogonality conditions. Hamilton's Principle, Lagrangean equation and applications. Vibrations of elastic bodies, String or stretched cord, Longitudinal vibration, Lateral vibration, Torsional vibration. Approximate methods for calculating natural frequencies.
- 4. ELEMENTS OF AEROELASTICITY 9**  
Aeroelastic problems – Collar's triangle of courses – Wing divergence – Aileron control reversal – Flutter.
- 5. SOLUTION METHOD 8**  
Computational technique in vibration, Vibrating string, General method, Beam element, Global matrices, Transformation of matrices, Equation of motion of complete system, Consistent and Lambard mass

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Timoshenko.S, “ Vibration Problems in Engineering ”, John Wiley & Sons, Inc., 1987.
2. Meirovitch, L, Elements of Vibration Analysis ”, McGraw-Hill Inc., 1986.
3. F.S. Rse., I.F. Morse and R.T. Hinkle, “ Mechanical Vibrations ”, Prentice-Hall of India, 1985.
4. Fung, Y.C, “ An Introduction to the Theory of Aeroelasticity ”, John Wiley & Sons Inc., New York, 1985.
5. Rao.J.S. and Gupta.K, “ Theory and Practice of Mechanical Vibrations ”, Wiley Eastern Ltd., New Dehli, 1999.