

NOOURL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

B.E. AIRCRAFT MAINTENANCE ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER I

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

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
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
PRACTICAL						
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
TOTAL			18	4	8	26

*** 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”- 40th 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”, 7th 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, CO₂- 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 MoS₂.

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”, 2nd 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^Hmetry)
 6. Determination of the amount of Na⁺ in water sample (Flame photometry)
 7. Determination of molecular weight and degree of polymerization of a polymer
 8. Determination of the amount of Ca²⁺ 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. AIRCRAFT MAINTENANCE ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER II

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

Sl. No	Course Code	Course Title	L	T	P	C
Theory						
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
Practical						
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
TOTAL			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"- 40th Edition , Khanna Publishers, Delhi 2007.

REFERENCES:

1. Erwin Kreyszig, " Advanced engineering Mathematics", 7th 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-TiS₂)- H₂-O₂ fuel cell.

UNITV 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 ΔE & ΔH -II law of thermodynamics (statement only)- concept of entropy – Clausius-Clapeyron equation (no derivation)- Importance, terms involved (problem) -Free energy changes- ΔG – 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

- | | |
|---|-----------|
| 1. Unix Commands | 15 |
| Study of Unix OS - Basic Shell Commands - Unix Editor | |
| 2. Shell Programming | 15 |
| Simple Shell program - Conditional Statements - Testing and Loops | |
| 3. C Programming on Unix | 15 |
| 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,

15 Sets. |
| 2. Carpentry vice (fitted to work bench) | 15 Nos. |
| 3. Standard woodworking tools | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints | 5 each |
| 5. Power Tools: | |

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

6. Surveying equipment for Demonstration

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

B.E. AIRCRAFT MAINTENANCE ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER III

SL. No.	SUBJECT CODE	SUBJECT	L	T	P	C
THEORY						
1.	MA1201	Engineering Mathematics - III	3	1	0	4
2.	AC1201	Aircraft Rules and Regulations	3	1	0	4
3.	AC1202	Aircraft Engineering Materials-I	3	1	0	4
4.	EE1217	Electrical Engineering for Aircraft Maintenance	3	1	0	4
5.	AE1203	Introduction to Aircraft/Aerospace Vehicle	3	1	0	4
6.	AC1203	Aircraft General Engineering and Maintenance Practices	3	0	0	3
PRACTICAL						
7.	AC1271	Aircraft Component Drawing	0	1	2	2
8.	AC1272	Airframe Repair and Maintenance Lab	0	1	2	2
9.	EE1278	Electrical Lab for Aircraft Maintenance	0	1	2	2
TOTAL			18	8	6	29

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" – 40th 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.

AC1201

AIRCRAFT RULES AND REGULATIONS

3 1 0 4

OBJECTIVE

To teach the civil air rules and regulations which are being followed by Directorate General of Civil Aviation.

1. **CAR 66:** Licensing of Aircraft Maintenance Engineers **9**
CAR 145: Approval of Maintenance Organizations
Aircraft Rules, AIC & AAC

2. **C.A.R. SERIES ‘B’ – Part I – MEL** **9**
C.A.R. SERIES ‘C’ Part I, II– Defect recording, reporting, investigation, rectification and analysis; Flight Report - Recording of IN-FLIGHT instrument reading and reporting of flight defect

C.A.R. SERIES ‘D’ Part V –AIRCRAFT MAINTENANCE PROGRAMMES
Maintenance of fuel and oil consumption records - Light aircraft piston engines

C.A.R. SERIES ‘E’ – APPROVAL OF ORGANISATIONS

Part – I, VI, VIII: Approval of organizations in categories E & G - Requirements of infrastructure at stations and approval procedures.

3. **C.A.R. SERIES ‘F’ – AIR WORTHINESS AND CONTINUED AIR WORTHINESS:** **9**
Part – I, III, V, VI, VII, XII, XIII, XIV, XV, XVI, XVII, XX, XXI, XXII: Procedure relating to registration of aircraft of A, Suspension of Certificate of Airworthiness and its subsequent revalidation, Rebuilding of aircraft, Special Flight permits, Inspection of wooden aircraft, Airworthiness requirements for Gliders / micro light aircraft/ hot air balloon Approval of flight manuals and their amendments, pooling, Age of Aircraft to be imported for Scheduled / Non-Scheduled including Charter, General Aviation and other Operations, Import/Export of aircraft, spares, item of equipment etc. for use on aircraft, load and trim sheet

C.A.R. SERIES ‘H’ Part I, II, III

Requirements of Aircraft Fuel, Refuelling of Aircraft and Calibration of Aircraft Fuels

C.A.R. SERIES ‘I’

Aircraft instrument, equipment and accessories.

4. **C.A.R. SERIES ‘L’, ‘M’, ‘O’** **9**
Aircraft maintenance engineer – licensing, mandatory modifications and inspections, operational requirement for aircraft.

5. **C.A.R. SERIES ‘R’, ‘S’, ‘T’ & ‘X’** **9**
Airborne communication, navigation and radar, storage of aircraft parts, flight testing of aircraft, miscellaneous requirements

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

TEXT BOOKS

1. “Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness)” – Published by DGCA, The English Book Store, 17-1, Connaught Circus, New Delhi 2000.
2. Aeronautical Information Circulars (relating to Airworthiness) from DGCA 2000.
3. C.A.R. 66
4. C.A.R. 145
5. Aircraft Rules & Regulations 1937.

REFERENCES

1. “Aircraft Manual (India) Volume” – Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.
2. Advisory Circulars from DGCA 2003.

AC1202

AIRCRAFT ENGINEERING MATERIALS - I

3 1 0 4

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 WOODEN STRUCTURES & CORROSION

9

Construction methods of wooden airframe structures;Characteristics, properties and types of wood and glue used in aero planes;Preservation and maintenance of wooden structure;Types of defects in wood material and wooden structures;The detection of defects in wooden structure; Repair of wooden structure.Characteristics, properties and types of fabrics

used in aero planes; Inspections methods for fabric;Types of defects in fabric; Repair of fabric covering.Chemical fundamentals;Formation by, galvanic action process, microbiological, stress;Types of corrosion and their identification;Causes of corrosion;Material types, susceptibility to corrosion.

UNIT IV FASTENERS

9

Screw nomenclature;Thread forms, dimensions and tolerances for standard threads used in aircraft;Measuring screw threads;Bolt types: specification, identification and marking of aircraft bolts, international standards;Nuts: self locking, anchor, standard types; Machine screws: aircraft specifications;Studs: types and uses, insertion and removal;Self tapping screws, dowels.

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.

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

TEXT BOOK

1. Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.
2. O.P.Kanna “Material Science and metallurgy” Dhanpat Rai Publications (P) Ltd.

REFERENCES

1. William D Callsber “Material Science and Engineering”, John Wiley and Sons 1997.
2. Raghavan.V “Materials Science and Engineering”, Prentice Hall of India Pvt., Ltd., 1999.
3. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw Hill Book Company, 1994.

EE1217 ELECTRICAL ENGINEERING FOR AIRCRAFT MAINTENANCE

3 1 0 4

UNIT 1 INTRODUCTION

9

Structure and distribution of electrical charges within: Atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators. Static electricity and distribution of electrostatic charges; Electrostatic laws of attraction and repulsion; Units of charge, Coulomb’s Law; Conduction of electricity in solids, liquids, gases and a vacuum; potential difference, Electromotive force, voltage, current, resistance, conductance, charge, conventional current flow

UNIT II GENERATION OF ELECTRICITY & ELECTRICAL MEASURING INSTRUMENTS

9

Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.Principle and construction of ‘D’ Arsenal meter, Ammeter,

Voltmeter, Ohmmeter and megger. Moving coil and hotwire instruments. Meters sensitivity, extending their range. Functions and use of rectifier AC meters, electro dynamo meter movement, AM and VM Thermocouple meter, watt meter and frequency meters.

UNIT III DC SOURCES OF ELECTRICITY & DC CIRCUITS 9

Construction and basic chemical action of: primary cells, Secondary cells, lead acid cells, nickel cadmium cells, other Alkaline cells, Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermal sensors Operation of photo-cells. Ohms Law, Kirchoff's Voltage and Current Laws; Calculations using the above laws to find resistance, voltage and current; Significance of the internal resistance of a supply.

UNIT IV RESISTANCE/RESISTOR 9

Resistance and affecting factors; Specific resistance & Conductance Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel, Calculation of total resistance using series, parallel and series parallel combinations; Construction, operation and use of potentiometers and rheostats; Construction and operation of Wheatstone bridge. Positive and negative temperature coefficient. Fixed resistors, stability, tolerance and limitations, methods of construction, variable resistors, thermistors, voltage dependent resistors; Construction and application of potentiometers and rheostats; Construction of Wheatstone Bridge;

UNIT V POWER & CAPACITANCE/CAPACITOR 9

Power, work and energy (kinetic and potential); Dissipation of power by a resistor, Power formula & Calculations; Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, number of plates and dielectric constant ; Working voltage, voltage rating; capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; exponential charge and discharge of capacitor, time Constants, Testing of capacitors.

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

TEXT BOOKS:

1. V.N.Mittle, "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990
2. Nagsarkar T.K. and Sukhija M.S., "Basics of Electrical Engineering", Oxford Press(2005)

REFERENCES:

1. A.K.Shanny, "Measurements and Instrumentation"
2. Mehta V.K., "Electrical Engineering " Volume I

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.

L: 45 + T: 15 = 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.

AC1203 AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE PRACTICES 3 0 0 3

OBJECTIVE

To study the concepts of aircraft general engineering and maintenance practices.

UNIT I AIRCRAFT MAINTENANCE PRACTICES 9

General knowledge of procedure of jacking, leveling and mooring of aircraft - Knowledge of maintenance and handling of equipments used in the maintenance of aircraft- Knowledge of safety and fire precautions to be observed during maintenance, refueling and defueling of aircraft.

Knowledge of colour coding ,symbols or other markings to identify fluid systems pipelines, rubber parts and other aircraft systems of aircraft - Knowledge of various Aircraft manuals, ATA system of classification, inspection schedules, time limit.

UNIT II WORKSHOP PRACTICES

9

Knowledge of material, parts and use of hand tools , simple machine tools and precision measuring instruments - Detailed knowledge of identification, terminology, correct use and inspection of aircraft bolts, nuts, rivets, screws and locking devices of British and American systems-Detailed knowledge of the interpretation of engineering drawings including symbols-Detailed knowledge of various types of gears and bearings, their use and common defects.-Knowledge of various forms of threads used in British and American system.- Knowledge of various types of threads, drills, taps, reamers. Knowledge of hardness testing machines and various types of hardness numbers. Knowledge of various types of Aircraft cables and swaging procedures used.

UNIT III AIRCRAFT METALLURGY

9

Knowledge of commonly used ferrous, nonferrous and composite materials , their identification, properties, heat treatment processes, testing and their application in aircraft industry. Knowledge of various types of corrosion, its cause and protection.- Detailed knowledge of the hot oil and chalk , dye penetrant and fluorescent and magnetic particle techniques and the subsequent inspection of the parts- Knowledge of the X-ray, Ultrasonic and eddy current inspections-Knowledge of arc welding, gas welding, brazing and soldering.

UNIT IV ELECTRICAL AND INSTRUMENT AND RADIO

9

Knowledge of electrical terminology and components used in AC/DC circuitry, Ohm's law, Kirchoff's law and their application- Principle of Electromagnetic Induction and their application. Various methods of voltage regulation. Principle of operation of electrical test equipments. Knowledge of Batteries and their maintenance. Knowledge of principle of operation of aircraft and engine instruments. Knowledge of various types of diodes/ triodes/ transistors and their function. Knowledge of conversion from decimal to binary system and vice-versa. Symbols used in logic gates. Elementary knowledge of computers, its applications. Identify the bands of frequency spectrum, their use and propagation characteristics.

UNIT V AIRCRAFT AND ENGINE

9

Knowledge of the functions of the major aircraft components and types of propulsion systems used in aircraft industry. Knowledge of the terms lift, drag, angle of attack, stall. Knowledge of principle of four stroke cycle and Brayton's cycle as applied to piston engines and jet engines.

TOTAL: 45 PERIODS

TEXT BOOKS

1. C.H. FRIEND, "Aircraft Maintenance Management", 2000.

REFERENCES

1. GENE KROPF, "Airline Procedures".
2. WILSON & BRYON, "Air Transportation".
3. PHILIP LOCKLIN D, "Economics of Transportation".

4. “Indian Aircraft manual” – DGCA Pub.
5. ALEXANDER T WELLS, “Air Transportation”, Wadsworth Publishing Company, California, 1993.

AC1271 AIRCRAFT COMPONENT DRAWING

**L T P C
0 1 2 2**

OBJECTIVE

To introduce the concept of design of basic structural components and to draft both manually and using modelling package.

LIST OF EXERCISES

1. Design and Drafting of riveted joints
2. Design and Drafting of welded joints.
3. Design and Drafting Control Components Cam
4. Design and Drafting Control Components Bell Crank
5. Design and Drafting Control Components Gear
6. Design and Drafting Control Components Push-pull rod
7. Three view diagram of a typical aircraft
8. Layout of typical wing structure.
9. Layout of typical fuselage structure.
10. Layout of Control System

TOTAL: 45 PERIODS

LIST OF EQUIPMENT

(for a batch of 30 students)

Sl.No	Equipments	Quantity
1	Drawing Boards	30
2	Drafting machines	30

AC1272

AIRFRAME REPAIR & MAINTENANCE LAB

0 1 2 2

LIST OF EXPERIMENTS

1. Aircraft wood gluing – single scarf joint
2. Aircraft wood gluing – Double scarf joint
3. Study of MIG, TIG and PLASMA Welding of aircraft components
4. Fabric Patch repair
5. Riveted patch repairs.
6. Tube bending and Flaring
7. Preparation of Glass Epoxy of composite Laminates and Specimens
8. Determination of Elastic constants of Composite Specimens
9. Repair of composites
10. Repair of Sandwich panels

LIST OF EQUIPMENT

(for a batch of 30 students)

Sl.No.	Name of the Equipment	Quantity
1	Shear cutter pedestal type	1
2	Drilling Machine	1
3	Bench Vices	1
4	Radius Bend bars	1
5	Pipe Flaring Tools	1
6	Carbide Gas Plant	1
7	MIG Weld Plant	1
8	TIG Weld Plant	1
9	Glass Fiber and Epoxy Resin	1
10	Strain Gauges and strain indicator	1

EE1278

ELECTRICAL LAB FOR AIRCRAFT MAINTENANCE

0 1 2 2

Sl No.	List of Experiments
1.	Familiarization and usage of analogue, electrical measuring instruments like VM, AM & ohm meter
2.	Familiarization on usage of Digital Electrical measuring instruments in V, A & range and frequency
3.	Familiarization on Construction of analogue meter on an exploded instrument and safety precautions to be observed while using the meters
4.	Familiarization and Practicing on soft soldering techniques and safety precaution thereof.
5.	Verification of Ohm's law
6.	Verification of Kirchoff's current CL & VL
7.	Familiarization on L.A. Ni-Cad batteries, Charging, C. T. and practice on Hydrometer check.
8.	Identification of types of resistors and finding their values with the help of colour coding
9.	Making a parallel circuit and checking its characteristics.
10.	Checking the operation of potentiometer and rheostat
11.	Testing of Capacitors
12.	Familiarization on Trouble Shooting in a basic electrical circuit

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

B.E. AIRCRAFT MAINTENANCE ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER IV

SL. No.	SUBJECT CODE	SUBJECT	L	T	P	C
THEORY						
1.	MA1203	Numerical Methods	3	1	0	4
2.	AC1204	Theory of Flight	3	0	0	3
3.	AC1206	Industrial Ergonomics	3	1	0	4
4.	AC1207	Aircraft Digital Electronic and Instrumentation	3	0	0	3
5.	AC1208	Electrical Machines for Aircraft Engineering	3	1	0	4
6.	ME1206	Strength of Materials	3	1	0	4
PRACTICAL						
7.	AC1273	Digital Electronic and Instrumentation Lab	0	1	2	2
8.	AC1275	Electrical Machines Lab	0	1	2	2
9.	ME1274	Strength of Materials Lab	0	0	2	1
TOTAL			18	6	6	27

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

AC1204**THEORY OF FLIGHT****3 0 0 3****OBJECTIVES:**

- To introduce the concepts of flying, International standard atmosphere, structural aspects of airplanes, brief description of systems, instruments and power plants used in airplanes.

UNIT 1 INTRODUCTION**9**

International Standard Atmosphere (ISA), application to aerodynamics. Airflow around a body; Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, up wash and downwash, vortices, stagnation; The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, centre of pressure, Angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio; Thrust, Weight, Aerodynamic Resultant; Generation of Lift and Drag: Angle of Attack, Lift coefficient, Drag coefficient, Aerofoil contamination including ice, snow, frost.

UNIT II THEORY OF FLIGHT**9**

Relationship between lift, weight, thrust and drag; Glide ratio; Steady state flights, performance; Theory of the turn; Influence of load factor: stall, flight envelope and structural limitations; Lift augmentation. Longitudinal, lateral and directional stability (active and passive)

UNIT III FLIGHT CONTROLS OPERATION**9**

Roll control: Ailerons and spoilers; various types of Ailerons: Differential aileron movement .Pitch control: elevators, stabilizers, variable incidence stabilizers and canards; Yaw control, rudder limiters; Roll causes Yaw and Yaw causes Roll; Dutch Roll.Control using elevons, ruddervators; High lift devices, slots, slats, flaps, flaprons; Drag inducing devices, spoilers, lift dampers, speed brakes; Effects of wing fences, saw tooth leading edges; Boundary layer control using, vortex generators, stall wedges or leading edge devices; Operation and effect of trim tabs, balance and anti balance (leading) tabs, servo tabs, spring tabs, mass balance; Control surface bias, aerodynamic balance panels.

UNIT IV HIGH SPEED FLIGHT**9**

Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number, compressibility effect, shock wave, aerodynamic heating, area rule; Sonic Bubble, Mach Cone, Sonic Bang, Aileron Reversal; Factors affecting airflow in engine intakes of high speed aircraft; Effects of sweepback on critical Mach number.

UNIT V ROTARY WING AERODYNAMICS**9**

Terminology; Effects of gyroscopic precession; Torque reaction and directional control; Dissymmetry of lift, Blade tip stall; Translating tendency and its correction; Coriolis effect

and compensation; Vortex ring state, power settling, over pitching; Auto-rotation; Ground effect.

TOTAL: 45 PERIODS

OUTCOMES

- Identify the component of Flight
- Identify suitable materials for Aircraft structure
- Perform basic calculation on Mechanics using Newton law for lift, drag and moment.

TEXT BOOKS:

1. Anderson, J.D., "Introduction to Flight", McGraw-Hill, 1995.
2. Stephen. A. Brandt, "Introduction to Aeronautics: A design perspective" American Institute of Aeronautics & Astronautics,1997

REFERENCES:

1. Kermode, A.C., "Mechanics of Flight", Himalayan Book, 1997

AC1206

INDUSTRIAL ERGONOMICS

3 1 0 4

AIM: To introduce the concepts of Ergonomics and to indicate the areas of Applications.

OBJECTIVES: To make the students familiarize with various concepts of Ergonomics, so that students will able to apply the concepts of ergonomics to Design of man – machine system.

UNIT I HUMAN PERFORMANCE AND LIMITATIONS

9

Concepts of human factors engineering and ergonomics – Man – machine system and design philosophy – Physical work – Heat stress – manual lifting – work posture – repetitive motion. The need to take human factors into account-Incidents attributable to human factors/human error; 'Murphy's' law. Vision – Hearing - Information processing- Attention and perception; Memory; Claustrophobia and physical access.

UNIT II SOCIAL PSYCHOLOGY & FACTORS AFFECTING PERFORMANCE

9

Responsibility: individual and group; Motivation and de-motivation; Peer pressure; Fitness/health; Stress: domestic and work related; Time pressure and deadlines; Workload: overload and under load; Sleep and fatigue, shift work; Alcohol, medication, drug abuse. Fitness/health, Stress: domestic and work related; Time pressure and deadlines; Workload: overload and underload; Sleep and fatigue, shiftwork; Alcohol, medication, drug abuse.

UNIT III DESIGN OF SYSTEMS

9

Displays – Controls – Workplace – Seating – Work process – Duration and rest periods – Hand tool design – Design of visual displays – Design for shift work. Physical work- Repetitive task, Visual Inspection, Complex Systems

UNIT IV ENVIRONMENTAL FACTORS IN DESIGN

9

Temperature – Humidity – Noise – Illumination –Vibration – Measurement of illumination and contrast – use of photometers – Recommended illumination levels. The ageing eye – Use of indirect (reflected) lighting – cost efficiency of illumination – special purpose lighting for

inspection and quality control – Measurement of sound – Noise exposure and hearing loss – Hearing protectors – analysis and reduction of noise – Effects of Noise on performance – annoyance of noise and interference with communication – sources of vibration discomfort.

UNIT V WORK PHYSIOLOGY & HUMAN ERRORS 9

Provision of energy for muscular work – Role of oxygen physical exertion – Measurement of energy expenditure Respiration – Physical work capacity and its evaluation – Error models and theories, Types of errors, implication of errors, avoiding an damaging errors-Recognizing and avoiding hazards, dealing with emergencies.

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

REFERENCES:

1. Martin Helander, A guide to the ergonomics of manufacturing, East West press, 2007
2. E.J. McCormic & Mark S. Sangers, Human factors in engineering design, McGraw Hill 2007

AC1207 AIRCRAFT DIGITAL ELECTRONICS AND INSTRUMENTATION 3 0 0 3

OBJECTIVES:

- To explain the principles of digital electronics and the fundamentals of instrumentation
- To impart knowledge about the sensors.
- Be exposed to the aircraft instruments and servo mechanism.

UNIT I ANALOG ELECTRONICS 9

Introduction – PN diode – Zener diode –Varactor diode – Tunnel diode – Schottky diode - Theory and switching characteristics. Transistor – Principles and characteristics of Transistor- CE, CB, CC Configurations - Uni Junction Transistor (UJT), Silicon Controlled Rectifier (SCR), Field Effect Transistor (FET)-, TRIAC.

UNIT II DIGITAL AND COMBINATIONAL CIRCUITS 9

Introduction – Logic families - RTL and DTL circuits – Transistor-Transistor Logic (TTL), Emitter Coupled Logic (ECL) – Complementary Metal Oxide Semiconductor (CMOS) – CMOS Transmission Gate. Logic and Boolean Functions, Number Systems. Logic Gates & Truth Tables, Demorgan's law, Flip-flop – Adders - Subtractors – Multiplexer/ Demultiplexer - encoder/decoder – parity checker – code converters, Shift Register. Implementation of combinational logic using MUX, ROM, PAL and PLA - HDL for combinational Circuits.

UNIT III TRANSDUCERS AND MEASUREMENTS 9

Introduction- Classification of Transducers– Static and Dynamic Characteristics. Selection of Transducers - Principle and Operation of variable resistance, variable inductance and variable capacitance transducers – Strain gauge transducers- Potentiometers – Applications of transducers.

Mechanical Measurements – Measurement of Speed, torque, temperature, pressure, flow –Transmitters- inductance and capacitance transmitters – Flapper-nozzle system – V-I and I-V converters.

UNIT IV AIRCRAFT INSTRUMENTS**9**

Cockpit panel of an aircraft; Flight instruments: Airspeed, Altimeter, Vertical speed, Angle of attack indicator, Mach-meter, Accelerometer, Heading indicator, Direction gyro., Turn & bank indicator, Pitot tube, Gyro power sources, Air data computer, Tachometer, Oil pressure indicator, Exhaust gas temperature, Engine pressure ratio, Fuel quantity indicator, Fuel pressure, fuel flow meter, Black box recorder; operations and Principles and location on aircraft.

UNIT V CONTROL MECHANISMS**9**

Operation and components of a typical servomechanism system- Construction, operation and use of the synchro system - Servomechanism defects, Servomechanism troubleshooting, reversal of synchro leads, hunting. Open and closed loop systems- Electrical analogy of mechanical and thermal systems – Transfer function – AC and DC servomotors- E and I transformers; Final control elements- I/P Converter, Pneumatic and electric actuators, Control valves- valve characteristics.

TOTAL: 45 PERIODS**OUTCOMES:**

- Ability to identify electronics components, instrument components and its use.

TEXT BOOKS

1. Aircraft Electricity and electronics-by Bent Mekinley and also by Eismen/ Bent Mekinley (M.C.Graw Hill Publication)
2. Pallet, E.H.J., "Aircraft Instruments & Principles", Pitman & Co., 1993.

REFERENCES

1. Floyd T.L, "Electronic Devices" 6th edition, Pearson Education, 2003.
2. M.Morris Mano, Digital Design, 3rd edition, Prentice Hall of India Pvt Ltd.,
3. S.Renganathan,"Transducers Engineering", Allied Publishers Ltd.,1999
4. E.O.Doeblin, "Measurement systems, Applications and Design" McGraw-Hill, 4th edition, 1990.

AC1208 ELECTRICAL MACHINES FOR AIRCRAFT ENGINEERING**3 1 0 4****OBJECTIVES:**

- To explain the different types of electric motor used aircraft and its function.
- To explain the fundamentals of AC theory, different circuits and applications.
- To impart basic knowledge of different cable and connectors.

UNIT I: DC Motor & Generator**9**

Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors;

UNIT II: Transformers**9**

Transformer construction principles and operation; Transformer losses and methods for overcoming them; Transformer action under load and no-load conditions; Power transfer,

efficiency, Calculation of line and phase voltages and currents; Primary and Secondary current, voltage, turns ratio, Power, efficiency; Auto transformers.

UNIT III: AC Generators AND AC Motors 9

Operation and construction of revolving armature and revolving field type AC generators; Single phase, and three phase alternators; Three phase star and delta connections advantages and uses; Permanent Magnet Generators. Construction, principles of operation and characteristics of: AC synchronous and induction motors both single and poly phase; Methods of speed control and direction of rotation; Types of single phase induction motors.

UNIT IV: AC Theory, R, L, C Circuits and filters 9

Sinusoidal waveform: phase, period, frequency, cycle; Instantaneous, average, root mean square, peak, peak to relation to voltage, current and power. Phase relationship of voltage and current in L, C and R Circuits, parallel, series and series parallel; Power dissipation in L, C and R circuits; Impedance, phase angle, power factor and current calculations; True power, apparent power and reactive power calculations. Operation, Application and uses of the following filters, Low pass, high pass, band pass, band stop.

UNIT 5: Electrical Cables and Connectors 9

Cable types, construction and characteristics; insulators, High tension and co-axial cables; Crimping; Connector types, pins, plugs, sockets, Current and voltage rating, coupling, identification codes. Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions;

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

OUTCOMES:

- Ability to identify the electrical motors explains the characteristics of electrical machines.
- Ability to understand about different electrical circuits, application of cable and connectors.

TEXT BOOKS

1. Aircraft Electricity and electronics-by Bent Mekinley and also by Eismin/ Bent Mekinley (M.C.Graw Hill Publication)
2. Electrical Technology-by B. L.Theraja
3. Aircraft Electrical System-by E . H .J . Pallett

REFERENCES

1. Basic Electricity-by Dale Crane
2. Aviation Electronics Vol. I(Every Pilot Guide to Aviation Electronics-by John M.Ferrara -Air and Space Company)

OBJECTIVES:

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

UNIT I STRESS & STRAIN**9**

Stress and strain due to axial force, elastic limit, Hooke's law-factor of safety - stepped bars, uniformly varying sections, stresses in composite bar due to axial force and temperature. Elastic Constant Strain Energy due to axial force- proof resilience, stresses due to gradual load, sudden load and impact load.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM**9**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams Shear stress distribution.

UNIT III TORSION OF CIRCULAR SHAFT**9**

Theory of torsion of shafts of circular, cross section. Assumptions, Derivation of torsion formulae, stresses strains and deformation in determinate and indeterminate shafts of hollow, solid, homogeneous and composite circular cross section subjected to twisting moments, stresses due to combine torsion, bending and axial force on shafts.

UNIT IV DEFLECTION OF BEAMS**9**

Relation between B.M., slope and deflection slope and deflection by double integration method (McCauley's method). Slope and Deflection in determinate beams by Moment Area method and conjugate beam method. Euler & Rankine Formula.

UNIT V PRINCIPAL STRESSES ,PRINCIPAL STRAIN AND PRESSURE VESSELS.**9**

Principal stresses and principal strain-Normal and shear stresses on any oblique planes and concept of principal planes and principal planes by analytical and graphical methods (Mohr's circle of stress 2-D). Stresses, strains and deformation in thin walled seamless cylindrical and spherical vessels due to internal fluid pressure. Change in volume, effects of additional compressible or Incompressible Fluid injected under pressure. Thick cylinders. Derivation of Lane's equation for stresses.

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

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

REFERENCES:

1. Egor. P. Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001

2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series
3. NPTEL courses, <http://nptel.iitm.ac.in/courses.php>, web and video courses on Strength of Materials by Prof. Sharma, S. C., and Prof. Harsha, S. P.

AC1273 DIGITAL ELECTRONIC AND INSTRUMENTATION LAB 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 Navigation.

LIST OF EXPERIMENTS

DIGITAL ELECTRONICS

1. Addition/Subtraction of binary numbers.
2. Multiplexer/Demultiplexer Circuits.
3. Encoder/Decoder Circuits.
4. Timer Circuits, Shift Registers, Binary Comparator Circuits.

MICROPROCESSORS

5. Addition and Subtraction of 8-bit and 16-bit numbers.
6. Sorting of Data in Ascending & Descending order.
7. Sum of a given series with and without carry.
8. Greatest in a given series & Multi-byte addition in BCD mode.
9. Interface programming with 4 digit 7 segment Display & Switches & LED's.
10. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.

AVIONICS DATA BUSES

11. Study of Different Avionics Data Buses.
12. MIL-Std – 1553 Data Buses Configuration with Message transfer.
13. MIL-Std – 1553 Remote Terminal Configuration.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT

(for a batch of 30 students)

S.No.	Details of Equipments	Quantity	Experiment Nos.
1.	Adder/Subtractor Binary bits Kit	6	1
2	Timer Kit	6	1
3	Encoder Kit	6	3

4	Decoder Kit	6	3
5	Comparator Kit	6	4
6	Multiplexer Kit	6	2
7	Demultiplexer Kit	6	2
8	Shift Registers Kit	6	4
9	Electronic Design Experimeter	6	6,7,9,10
10	Microprocessor 8085 Kit	9	5,6,7,8,9,10
11	4 Digit 7 Segment Display	3	6
12	Switches & LED's Circuit	3	6
13	16 Channel AD Converter	6	10,9
14	Digital to Analog Converter	6	10
15	Cathode Ray Oscilloscope	3	9,10
16	Regulated Power Supply (5V DC)	9	1, 2,3,4
17	MIL-Std 1553B Setup with Remote Terminal	1	12,13
18	Computers	2	11,12,13

AC1275

ELECTRICAL MACHINES LAB

0 1 2 2

OBJECTIVE

- To impart practical training to the students on various electrical machine for electrical engineers.
 - To develop procedural and operational skills in function of electrical machine.
1. Open circuit and load characteristics of separately and self excited DC shunt generators.
 2. Load characteristics of DC compound generator with differential and cumulative connection.
 3. Load characteristics of DC shunt and compound motor.
 4. Load characteristics of DC series motor
 5. Load test on single and three phase transformer connections
 6. Open circuit and short circuit tests on single phase transformer.
 7. Equivalent Circuit of a single phase induction motor.
 8. Measurements of negative sequence and zero sequence impedance of alternators.
 9. Load test on three-phase induction motor
 10. Load test on single-phase induction motor.
 11. LRC Circuit (Power Amplifier, Voltage Sensor)
 12. Resonance in an RLC Series Circuit

TOTAL: 45 PERIODS

OBJECTIVES

- To impart practical training on simple machines like screw jack, worm wheel, etc.,
 - To understand the theoretical and practical aspects of elasticity and plasticity of the materials through a variety of experiments
1. Tension test on metals-stress strain characteristics, ductility, resilience, toughness.
 2. Cupping test on metal sheets-load deformation characteristics, cupping load, cupping number.
 3. Hardness test on metals-Brinell, Vicker and Rockwell Hardness tests.
 4. Impact test on metals-Charpy, Izod impact tests.
 5. Shear test on metals-direct shear strength, single shear, double shear.
 6. Tests on helical springs-compression, tension springs-load deformation characteristics, stiffness, shear stress , modulus of rigidity, energy.
 7. Torsion test on beams-torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.
 8. Tests on wood-tension, compression and bending-load deformation characteristics, Young's modulus, modulus of rupture.

TOTAL: 30 PERIODS

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SL. No.	SUBJECT CODE	SUBJECT	L	T	P	C
THEORY						
1	MS1202	Professional and Business Ethics	3	0	0	3
2	AC1205	Aircraft Engineering Material - II	3	1	0	4
3	AC1209	Aircraft Structures	3	1	0	4
4	AC1210	Aircraft Avionics system	3	0	0	3
5	AC1211	Aircraft Engine - I	3	0	0	3
6	AC1212	Manufacturing Technology II	3	0	0	3
PRACTICAL						
7	AC1274	Aircraft Structure Lab	0	1	2	2
8	AC1276	Aero Engine Lab - I	0	1	2	2
9	AC1277	Manufacturing Technology lab	0	1	2	2
TOTAL			18	5	6	26

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.

AC1205

AIRCRAFT ENGINEERING MATERIALS II

3 1 0 4

OBJECTIVES

- To study the different engineering material used for aircraft applications.

UNIT I LOCKING DEVICES AND AIRCRAFT RIVETS

9

Tab and spring washers, locking plates, split pins, pal-nuts, wire locking, quick release fasteners, keys, circlips, cotter pins. Types of solid and blind rivets: specifications, identification and Heat Treatment.

UNIT II PIPES ,UNIONS ,SPRINGS AND BEARINGS

9

Identification of, and types of rigid and flexible pipes And their connectors used in aircraft; Standard unions for aircraft hydraulic, fuel, oil, Pneumatic and air system pipes.Types of springs, materials, characteristics and applications. Purpose of bearings, loads, materials, construction;Types of bearings and their application.

UNIT III TRANSMISSIONS AND CONTROL CABLES

9

Gear types and their application; Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh Patterns; Belts and pulleys, chains and sprockets. Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.

UNIT IV ELECTRICAL CABLES AND CONNECTORS

9

Cable types, construction and characteristics; High tension and co-axial cables; Crimping; Connector types, pins, plugs, sockets, insulators, Current and voltage rating, coupling, identification codes.

UNIT V AIRCRAFT MATERIALS – COMPOSITE AND NON-METALLIC

9

Composite and non-metallic other than wood and fabric -Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealant and bonding agents. Detection of defects / deterioration in composite and non-metallic materials -Repair of Composite and Non-Metallic material.

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

OUTCOMES

- Role of locking device, pipe unions, control cables of aircraft.
- Knowledge in usage of composite materials in aircraft component design.
- Exposure to high temperature materials for space applications

TEXT BOOKS:

1. Hajra Chouldhary 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.

AC1209**AIRCRAFT STRUCTURES****3 1 0 4****OBJECTIVES:**

- To provide the students various methods for analysis of aircraft wings and fuselage.
- To provide the the behavior of major aircraft structural components.

UNIT I UNSYMMETRICAL BENDING**9**

Bending of symmetric beams subject to skew loads - bending stresses in beams of unsymmetrical sections – generalized ‘k’ method, neutral axis method, principal axis method.

UNIT II SHEAR FLOW IN OPEN SECTIONS**9**

Thin walled beams – concept of shear flow – the shear centre and its determination – shear flow distribution in symmetrical and unsymmetrical thin-walled sections – structural idealization – shear flow variation in idealized sections.

UNIT III SHEAR FLOW IN CLOSED SECTIONS**9**

Bredt - Batho theory – single-cell and multi-cell tubes subject to torsion – shear flow distribution in thin-walled single & multi-cell structures subject to combined bending torsion – with walls effective and ineffective in bending – shear centre of closed sections.

UNIT IV BUCKLING OF PLATES**8**

Bending of thin plates – rectangular sheets under compression - local buckling stress of thin walled sections – crippling strength estimation – thin-walled column strength – load carrying capacity of sheet stiffener panels – effective width.

UNIT V STRESS ANALYSIS OF WING AND FUSELAGE**10**

Loads on an aircraft – the V-n diagram – shear force and bending moment distribution over the aircraft wing and fuselage – shear flow in thin-webbed beams with parallel and non-parallel flanges – complete tension field beams – semi-tension field beam theory.

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

- Ability to analyse the aircraft wings and fuselage
- Ability to demonstrate the behavior of major aircraft structural components.

TEXT BOOKS:

1. Megson T M G , "Aircraft Structures for Engineering Students", Elsevier Ltd, 2007
2. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2nd edition, McGraw – Hill, N.Y., 1999
3. Bruhn. E.H., "Analysis and Design of Flight Vehicles Structures", Tri-state off-set Company, USA, 1985.

REFERENCES:

1. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw Hill, 1993.
2. Howard D Curtis, "Fundamentals of Aircraft Structural Analysis", WCB-McGraw Hill, 1997

AC1210**AIRCRAFT AVIONICS SYSTEM****3 0 0 3****OBJECTIVES:**

- To introduce the basic of avionics and its need for civil and military aircrafts
- To impart knowledge about the avionic architecture and various avionics data buses
- To gain more knowledge on various avionics subsystems

UNIT I INTRODUCTION TO AVIONICS**9**

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

UNIT II DIGITAL AVIONICS ARCHITECTURE**9**

Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

UNIT III FLIGHT DECKS AND COCKPITS**9**

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

UNIT IV INTRODUCTION TO NAVIGATION SYSTEMS**9**

Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellite navigation systems – GPS.

UNIT V AIR DATA SYSTEMS, AUTO PILOT & FLIGHT MANAGEMENT SYSTEM**9**

Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot. Flight management system:- Flight management system and data interface, Automatic flight and landing systems – (i) Speed control system (ii) Flight direction system (iii) Flight station equipments.

TOTAL: 45 PERIODS**OUTCOMES:**

- Ability to built Digital avionics architecture
- Ability to Design Navigation system
- Ability to design and perform analysis on air system

TEXT BOOKS:

1. Albert Helfrick.D., "Principles of Avionics", Avionics Communications Inc., 2004
2. Collinson.R.P.G. "Introduction to Avionics", Chapman and Hall, 1996.

REFERENCES:

1. Middleton, D.H., Ed., "Avionics systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
2. Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J.,U.S.A. 1993.

3. Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000
4. Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Longman Scientific

AC1211

AIRCRAFT ENGINE - I

3 0 0 3

UNIT I AIRCRAFT PISTON ENGINES

8

The internal combustion engine process, brief historical sketch, spark ignition and compression ignition, (SI and CI) engines, 4-stroke and 2-stroke engines. Combustion processes various types of arrangements for multi cylinder aircraft engines. Intake and Exhaust manifolds. IHP, BHP and SHP Engine performance, Effect of altitude and speed, power required and power available. Super charging, types of super chargers.

UNIT II PROPELLERS

9

Ideal Froude Momentum theory, blade element theory, vortex theory, relative merits, numerical problems, use of propeller charts. Selection and choice of propellers. Fixed/variable pitch and constant speed propellers, Relative merits and applications, Ducted propellers, prop-fan, Helicopter Rotor in Hover and climbing. Materials for propellers.

UNIT III ELEMENTS OF HEAT TRANSFER

9

Conduction : Heat Transfer process, Heat conduction, Thermal conductivity, General equation of heat conduction in 1-D and 2-D. Convection and Radiation Heat Transfer: Convection process, free convection heat transfer from vertical flat plate, planes, cylinder and sphere, free convection. Thermal Radiation and Emissive power. The Plank distributive law, Radiation properties

UNIT IV AIRCRAFT GAS TURBINE ENGINE

10

Compressor and Turbine work, compressor and turbine efficiencies, general layout, gas flow diagram. Engine intake and Exhaust nozzles, After burner arrangements for thrust augmentation. Compressors; centrifugal and axial types of compressors, Materials of Construction. Combustion chambers : Various arrangements, simplex and Duplex type of Burners. Materials for combustion chambers Expansion process : Turbine and its action, constructional details of turbine. Materials of construction, general arrangement of turbo-prop and turbo-shaft engines. High and Low by pass ratio, turbo-fan engines, dual shaft gas turbine engines, its merits over single shaft engines.

UNIT V GAS TURBINE SYSTEMS AND COMPONENTS

9

Fuel system components, various types of fuel systems, lubricating oils and lubricating systems. Secondary air systems, arrangements of bleeding of compressor air for aircraft pressurization and oxygen systems. Engine starting systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. J P Holman, Heat Transfer, 2nd Ed., McGraw Hill
2. J D Mattingly, Elements of Gas Turbine Propulsion, McGraw Hill, 1997
3. H. Cohen, G F C Rogers and H I H Sarvanmatto, Gas Turbine Theory, Longman 1987

REFERENCE BOOKS:

1. B Gebhart, Heat Transfer, 2nd Ed., McGraw Hill

2. J L Kererbrock, Aircraft Engine and Gas Turbine, MIT Press, 1991
3. Gordon C Oates, Aircraft Propulsion, System Technology & Design, AIAA Publications

AC1212 MANUFACTURING TECHNOLOGY II

3 0 0 3

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: 45 PERIODS

TEXT BOOKS:

1. Hajra Chouldhary 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.

AC1274 AIRCRAFT STRUCTURES LABORATORY

L T P C
0 1 2 2

OBJECTIVES

- To study the properties of materials used in Aircraft structure.
- To study the failure of different component under different loading condition

LIST OF EXPERIMENTS

1. Determination of young's modulus for metallic materials
2. Determination of flexural strength of metallic materials.
3. Deflection of a simply-supported beam
4. Deflection of a cantilever beam.
5. Verification of superposition theorem
6. Verification of maxwell's reciprocal theorem
7. Influence line study on beams
8. Buckling load estimation of slender eccentric columns
9. Construction of south well plot
10. Study of non-destructive testing procedures
11. Determination of flexural rigidity of composite beams
12. Shear failure of bolted and riveted Joints
13. Calibration of proving ring and spring
14. Truss and frame analysis.

(Only 10 experiments will be conducted)

TOTAL: 45 PERIODS

OUTCOMES

- Ability to perform non-destructive testing to predict the properties of metallic materials used in aircraft application

AC1276

AERO ENGINE LAB - I

0 1 2 2

OBJECTIVES

- To introduce the knowledge of the maintenance and repair procedures followed for overhaul of aero engines.

LIST OF EXPERIMENTS

1. Dismantling and reassembling of an aircraft piston engine.
2. Study of Camshaft operation, firing order and magneto, valve timing
3. Study of lubrication and cooling system
4. Study of auxiliary systems, pumps and carburetor
5. Study of constructional arrange of Jet Engine and types (turbo shaft, turbo propeller, turbo fan etc)
6. Study of types of Inlet Ducts, Axial and centrifugal compressors, combustion chambers
7. Study of types of turbine method, turbine blade, exhaust collector, tail pipe and propelling nozzle subsonic and supersonic CD ducts
8. Study fuel system components exhibit and explanation of EEC and FADEC

TOTAL: 45 PERIODS

OUTCOMES :

Ability to maintain and repair the areo engines.

AC1277

MANUFACTURING TECHNOLOGY LAB

0 1 2 2

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

LIST OF EXPERIMENTS

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: 45 PERIODS

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION
NOORUL ISLAM UNIVERSITY, KUMARACOIL
B.E. AIRCRAFT MAINTENANCE ENGINEERING
CURRICULUM & SYLLABUS
SEMESTER VI

SL. No.	SUBJECT CODE	SUBJECT	L	T	P	C
THEORY						
1	IT1212	Cyber Security	3	0	0	3
2	AC1213	Aircraft Systems - I	3	0	0	3
3	AC1214	Aircraft Engine - II	3	1	0	4
4	AC1215	Dynamics of Aircraft Flights	3	1	0	4
5	AC1216	Aircraft Maintenance Process	3	0	0	3
6	xxxEx1	Elective – I (Maintenance of Electrical and Instrument Systems / Maintenance of Radio & Communication Systems)	3	0	0	3
PRACTICAL						
7	AC1278	Aircraft Systems Lab	0	1	2	2
8	AC1279	Aero engine Lab - II	0	1	2	2
9	AC1280	Aircraft Maintenance practice Lab	0	1	2	2
TOTAL			18	5	6	26

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 OPERATINGSYSTEMS 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.

AC1213

AIRCRAFT SYSTEMS – I

3 0 0 3

OBJECTIVES:

- To impart basic knowledge of the systems components and its operation to the students.

UNIT I GENERAL MAINTENANCE PRACTICES 8

Jacking, leveling, and mooring, refueling and defueling of aircraft, safety precautions. Hydraulic and fluid systems, precautions against contamination. Identification color coding, symbols and other markings to identify the fluid systems.

UNIT II HYDRAULIC SYSTEM, FUEL SYSTEM & LUBRICATION SYSTEMS 12

Advantages and disadvantages: types of circuits: flow through pipes: pumps and motors: static performance: actuators: seals and backup rings: reservoirs: accumulators: contamination control filters: tubing's and hose pipes: indicating and warning systems: emergency and redundant systems valves: flow dividers and integrators: cooling systems. Types of fuels: their properties and testing: color codes: fuel requirements: pumps: fuel transfer systems: fuel tanks: plumbing: valves: indications and warnings. Types of lubrication systems: lubricants: cleaning agents; Auxiliary Power Unit - Construction and operational features.

UNIT III SERVO-CONTROL SYSTEM & PNEUMATIC SYSTEMS 9

Stability and response: electro-hydraulic servo systems: position and force feedback: frequency response: principles of automatic control Air-conditioning and pressurization systems: deicing systems: heat loads: plumbing: coldair units: compact heat exchangers: valves: filters: air bottles: capsules and bellows: indication and warnings.

UNIT IV OXYGEN SYSTEMS & LANDING GEAR SYSTEMS 8

Gaseous and liquid oxygen systems: breathing masks: oxygen regulators: oxygen bottles: liquid to gas converters: emergency systems: pressure suits: indication and warnings. Types of landing gears and their design principles: shock absorbing devices: retracting mechanisms: wheels and brakes: antiskid system: steering systems: indications and warnings.

UNIT V SAFETY SYSTEMS

8

Types of systems: Flame proofing: Fire walls: Fire detection systems: Fire extinguishing systems. Seat Safety Systems : Ejection seats: Survival packs: Parachutes: Pilot's personal equipment: life rafts: Doors, Windows and Emergency exits, Seat belts. System Testing : Ground handling equipment.

TOTAL: 45 PERIODS

TEXT BOOKS

1. J V Casamassa and RD Bent, Jet Aircraft Power Systems, McGraw Hill.
2. E H J Pallet, Automatic Flight Control, BSP Profession Books. 1993
3. Civil Aircraft Inspection Procedures (CAP 459), Himalayan Books

REFERENCE BOOKS

1. W Thomson, Thrust for Flight, Sir Issac Pitman.1992
2. Michael J. Kroes Thomas W.Wild, Aircraft Power Plants, McGraw Hill
3. Michael J. Kroes, William A Watkins and Frank Delp, Aircraft Maintenance and Repair, McGraw Hill 1993
4. McGraw Hill 1993
5. Airframe and Power Plant, Mechanics General Hand Book (EA-AC 65-9A), Himalayan Books 1994

AC1214

AIRCRAFT ENGINE - II

3 1 0 4

OBJECTIVES:

- To introduce basic concepts and salient features of engine components of jet propelled engines which are operated in atmosphere to students. This course is also aimed at making students familiarize with advanced jet propulsion methods like hypersonic propulsion.

UNIT I FUNDAMENTALS OF AIR BREATHING ENGINES

8

Operating principles of piston engines – thermal efficiency calculations – classification of piston engines - illustration of working of gas turbine engine – the thrust equation – factors affecting thrust – effect of pressure, velocity and temperature changes of air entering compressor – methods of thrust augmentation – characteristics of turboprop, turbofan and turbojet – performance characteristics.

UNIT II INLETS, NOZZLES AND COMBUSTION CHAMBERS FOR JET ENGINES

10

Internal flow and Stall in subsonic inlets – relation between minimum area ratio and external deceleration ratio – diffuser performance – supersonic inlets – starting problem on supersonic inlets – shock swallowing by area variation – real flow in nozzles and nozzle efficiency – losses in nozzles – equilibrium flow and frozen flow in nozzles- two phase flow in nozzles – ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces – thrust reversal- classification of combustion chambers – combustion chamber performance – effect of operating variables on performance – flame stabilization

UNIT III COMPRESSORS FOR JET ENGINES

9

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

UNIT IV TURBINES FOR JET ENGINES

9

Principle of operation of axial flow turbines– limitations of radial flow turbines- Work done and pressure rise – Velocity diagrams – degree of reaction – free vortex and constant nozzle angle designs – performance characteristics of axial flow turbine– turbine blade cooling methods – stage efficiency calculations – basic blade profile design considerations – matching of compressor and turbine

UNIT V RAMJET PROPULSION

9

Operating principle of ramjet engine – various components of ramjet engines and their efficiencies – Combustion in ramjet engine – critical, subcritical and supercritical modes of operation -ramjet engine and its performance characteristics – sample ramjet design calculations – flame stability problems in ramjet combustors –integral ram rockets.

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

OUTCOMES

- Ability to identify the engine components of jet propelled engines
- Know the details of advanced Jet propulsion and hypersonic propulsion

TEXT BOOKS:

1. Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion” Addison – Wesley Longman INC, 1999.
2. James Award, "Aerospace Propulsion System"

REFERENCES:

1. Cohen, H. Rogers, G.F.C. and Saravana muttoo, 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", 5th Edition, Rolls Royce Technical Publications, 2005.
4. Mathur, M.L. and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers & Distributors, Delhi, 1999.

AC1215

DYNAMICS OF AIRCRAFT FLIGHTS

3 1 0 4

OBJECTIVES

- 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

UNIT I CRUISING FLIGHT PERFORMANCE

9

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

UNIT II MANOEUVERING FLIGHT PERFORMANCE

10

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 on turn - V-n diagram and load factor.

UNIT III 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.

UNIT IV 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.

UNIT V DYNAMIC STABILITY

8

Introduction to dynamic longitudinal stability: - Modes of stability, effect of freeing the stick – Brief description of lateral and directional. dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

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

OUTCOMES

- Ability to analyse the performance of aircraft under various Flight conditions such as take off, cruise, landing, climbing, gliding, turning and other maneuvers.

TEXT BOOK

1. Perkins, C.D., and Hage, R.E., “Airplane Performance stability and Control”, John Wiley & Son:, Inc, NY, 1988.
2. Nelson, R.C. “Flight Stability and Automatic Control”, McGraw-Hill Book Co., 2004.
3. Mc Cornick. W., “Aerodynamics, Aeronautics and Flight Mechanics”, John Wiley, NY, 1979.

REFERENCES

1. Etkin, B., “Dynamics of Flight Stability and Control”, Edn. 2, John Wiley, NY, 1982.
2. Babister, A.W., “Aircraft Dynamic Stability and Response”, Pergamon Press, Oxford, 1980.
3. Dommasch, D.O., Sherby, S.S., and Connolly, T.F., “Aeroplane Aero dynamics”, Third Edition, Issac Pitman, London, 1981.
4. Mc Cornick B. W, “Aerodynamics, Aeronautics and Flight Mechanics”, John Wiley, NY, 1995.

OBJECTIVES

- To teach the students about the basic concepts of aircraft general engineering and maintenance practices.

UNIT I AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT 10

Mooring, jacking, leveling and towing operations – Preparation – Equipment – precautions – Engine starting procedures – Piston engine, turboprops and turbojets – Engine fire extinguishing – Ground power unit.

UNIT II GROUND SERVICING OF VARIOUS SUB SYSTEMS 8

Air conditioning and pressurization – Oxygen and oil systems – Ground units and their maintenance

UNIT III MAINTENANCE OF SAFETY 5

Shop safety – Environmental cleanliness – Precautions

UNIT IV INSPECTION 10

Process – Purpose – Types – Inspection intervals – Techniques – Checklist – Special inspection Publications, bulletins, various manuals – FAR Air worthiness directives – Type certificate Data sheets
– ATA Specifications

UNIT V AIRCRAFT HARDWARE, MATERIALS, SYSTEM PROCESSES 12

Hand tools – Precision instruments – Special tools and equipments in an airplane maintenance shop – Identification terminology – Specification and correct use of various aircraft hardware (i.e. nuts, bolts, rivets, screws etc) – American and British systems of specifications – Threads, gears, bearings, etc – Drills, tapes and reamers – Identification of all types of fluid line fittings. Materials, metallic and non- metallic Plumbing connectors – Cables – Swaging procedures, tests, Advantages of swaging over splicing.

TOTAL: 45 PERIODS**OUTCOMES**

- Knowledge in various ground support system for aircraft operations
- Ability to carryout ground servicing of critical aircraft systems
- Knowledge in specifications standards of aircraft hardware systems.

TEXT BOOK

1. Kroes Watkins Delp, "Aircraft Maintenance and Repair", McGraw Hill, New York, 1993

REFERENCES

2. A&P Mechanics, "Aircraft Hand Book", F A A Himalayan Book House, New Delhi, 1996
3. A&P Mechanics," General Hand Book", F A A Himalayan Bok House, New Delhi, 1996

OBJECTIVES:

- To familiarize students and to expose them practically to various aircraft system components

LIST OF EXPERIMENTS

1. Practical on installation and maintenance of hydraulic system, routing maintenance, indication and warning system.
2. Demonstration construction of landing gear, components, shock absorbers, damping devices, type of arrangement of under carriage and their indication and warning system.
3. Practical on extension and retraction system, normal and emergency and their indication and warning system.
4. Practical on type of wheel brakes, track devices and anti shimmy devices, nose wheel steering self centering devices, antiskid devices.
5. Demonstration of construction of tires, identification marking on tires.
6. Inspection and maintenance of landing gears and its components.
7. Practical on type of pneumatic system, components, pressure, Controls and indication warning system, Inspection and maintenance of Pneumatic/vacuum system.
8. Practical on Inspection and maintenance of flight control and components.
9. Practical on maintenance and inspection for fuel leakage, refueling/defueling and type of test
10. Different types of fire protection system, its inspection and maintenance
11. Aircraft Electric power distribution, Bus bars, Split bus bar system, Electrical load analysis

TOTAL: 45 PERIODS**OBJECTIVES:**

- To familiarize students and to expose them practically to various aircraft piston and gas turbine engines
- To give practical exposure to various testing methods of variable area ducts, propellants, jet engine components
- To practically determine the flow behavior of jets

LIST OF EXPERIMENTS

1. Study of aircraft piston and gas turbine engines
2. Velocity profiles of free jets.
3. Velocity profiles of wall jets.
4. Wall pressure measurements of a subsonic ramjet duct.
5. Flame stabilization studies using conical flame holders.
6. Cascade testing of compressor blades
7. Velocity and pressure measurements in co-axial jets
8. Flow visualization of secondary injection in a supersonic cross flow
9. Wall pressure distribution in subsonic diffusers.
10. Wall Pressure measurements in supersonic nozzles

TOTAL: 45 PERIODS**OUTCOMES**

- Ability to understand details of piston and gas turbine engine
- Ability to perform various testing on ducts, propellants, jet engine components

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 “Leveling” 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)

S.No.	Items	Quantity	Experiment No.
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

OUTCOMES

Ability to understand details of aircraft systems and ability to inspect and maintain.

LIST OF ELECTIVES

AC12A1 MAINTENANCE OF ELECTRICAL AND INSTRUMENT SYSTEMS

3 0 0 3

OBJECTIVES

- To teach the students about the basic concepts of aircraft electrical and instrument system maintenance practices.

UNIT I GROUP 'A' INSTRUMENTS 8

Principle of operation of rate of climb and descent indicators and their design requirements. The use of variable leak and theory of equation of constant 'n' of the instrument. Theoretical basis of airspeed and Mach number measurement. Mathematical derivation of formula for indicated airspeed, Machmeter calibration and maximum safe airspeed indicator, design details of airspeed indicators, Machmeter and safe airspeed indicator Theory of operation of an accelerometer, constructional details, accuracy of measurement.

UNIT II PRESSURE, SPEED & GYROSCOPIC INSTRUMENT 9

Measurement of total and static pressure - design of a pressure head, accuracy of measurement of static and pilot pressure for subsonic and supersonic speed. Transmission of the measured pressure to the instruments and effect of errors in pressure measurement to the indicators.

Definition of a gyroscope and the effect of external torques on the gyroscopic system: -

- i) Effect of earth's rotation, Gyro wander and gimbal lock, Toppling of a gyroscope.
- ii) Monitored gyroscope and restrained gyroscope.
- iii) Design criteria of gyroscopic instruments and their errors.

UNIT III BOURDON TUBE AND COMPASS 8

Construction and Principle of operation of a Bourdon tube. Construction and operation characteristic of diaphragms and bellows under pressure reversals.

Theory of magnetism, magnetic moment, magnetic potential, terrestrial magnetism and description and constructional details of direct reading compass : i) Acceleration error and turning error. ii) Construction and working of a compass. iii) Installation and compensation of DR Compass.

UNIT IV GROUP 'B' INSTRUMENTS 8

Thevenin's theorem as applied to DC Circuits. The unit exponential functions. Transient response of RC circuits. Decibel conversion, converting ammeter to voltmeter. Input resistance of a voltmeter and voltmeter loading error. Construction of an ohm meter and volt ohm millimeter. Construction and operation of Deflection type instruments Permanent magnet moving coil types: Moving iron type-electrodynamics type - induction and electrostatic type.

UNIT V MEASUREMENT INSTRUMENTS 12

Temperature measurement in a fluid in motion: Construction and working principle of i) Electrical transmitting thermometers, ii) Resistance thermometers. , iii) Thermoelectric thermometers and their cold junction compensation by bimetallic and resistance element. Working principle of electric tachometer and synchroscope. The theory and working principle of the following remote indicating systems : Desyn, autosyn, selsyn and magnesyn. Theory and construction of electromechanical fluid flow indicators - positive

displacement type and inferential type. Measurement of fuel contents - Theory and working principle of ' Pacitron' systems developed by Honeywell and Smith.

TOTAL: 45 PERIODS

TEXT BOOKS AND REFERENCE BOOKS:

1. E H J Pallet; Aircraft Instruments; Himalayan Book New Delhi 1981
2. C A Williams; Aircraft Instruments, Galgotia Publications New Delhi 1973.
3. C A Williams, E W Knott and E Sloley - Aircraft Instruments, Himalayan Books
4. R W Sloley and Coulthard; Instruments.

AC12A2 MAINTENANCE OF RADIO & COMMUNICATION SYSTEMS

3 0 0 3

OBJECTIVES

- To teach the students about the basic concepts of aircraft communication system maintenance practices.

UNIT I TYPICAL ELECTRONIC AIRCRAFT SYSTEM 8

Basics of the application and identification of electrical cables used in Aircraft radio installation, crimping and soldering techniques, bonding continuity and insulation tests. Composition, performance (stability and tolerance) and limitations of the fixed resistors and varistors (carbon composition, carbon film, wire wound and metallic film).

UNIT II AC AND DC MEASURING INSTRUMENTS 7

Electrical power distribution systems, the operation and construction of static inverters, rotary inverters and transformer rectifier units. Basics of interference caused by electrical and ignition system to radio apparatus, methods of minimizing or suppressing such interference, bonding and screening.

UNIT III ANTENNA & GENERAL COMMUNICATION SYSTEM 12

Construction and Identification of various types of antennas; the voltage and current distribution along antenna of various length; characteristics of ground planes. Very high frequency (VHF) and high frequency (HF) airborne communications; frequency bands allocation; the methods of propagation and the ranges expected, both day and night; calculation of approximate range of communication (line of sight) with given data. The performance levels expected and specifications of typical airborne HF and VHF communication systems; the principle of operation, installation practices and procedures, functioning of the operating controls and indications and maintenance of typical HF and VHF communication transceivers.

UNIT IV AUDIO & COMMUNICATION SYSTEM 12

Theory of operation, performance level and specifications of an Audio Integration System. Working principles and testing of Lead Acid and Nickel Cadmium and Silver Zinc batteries Principles, Characteristics and operation of the under mentioned systems: Automatic Direction Finder (ADF) Systems, Very High Frequency (VHF) Omn, Directional Range System. Instrument Landing Systems, Weather Radar Systems. Microwave Devices. Air Traffic Control (ATC) Transponder System. Omega Navigation System. Radio Altimeter Systems Cockpit Voice Recorder. Distance Measuring Equipment Doppler Navigation System. Microwave Landing System GPWS 32 Emergency Locator Transmitters. Computers Simulators. Flight Control Systems.

UNIT V NAVIGATION SYSTEM**6**

Basics of state-of-the-art communication and navigation systems. Principles of Satellite Communications and its application to aircraft.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. RF Hansforde, Heywood and Company London: Radio Aids to Civil Aviation.
2. George Kannedy: Electronic Communication System, McGraw Hill
3. Brian Kendal: Manual of Avionics, Blackwell

REFERENCE BOOKS:

1. Dennis Reddy and John Cooler: Electronic Communication, Prentice Hall of India, New Delhi.
2. J. Powell: Aircraft Radio Systems, Himalayan Books
3. Keith W. Bose: Aviation Electronics, Jeppese