B. S. ABDUR RAHMAN UNIVERSITY, CHENNAI – 48.

B. Tech. AERONAUTICAL ENGINEERING

(Regulations 2009)

(Eight Semesters / Full time)

CURRICULUM AND SYLLABUS

Sl. No	Course Codes	Course	L	T	P	C	TC
		Semester I					
Theory							
1.	MA 101	Mathematics I	3	1	0	4	
2.	EN 101	Technical English	2	2	0	4	
3.	PH 101	Physics I	3	0	0	3	
4.	CH 101	Chemistry I	3	0	0	3	
5.	GE 101	Engineering Graphics	2	0	3	3	
6.	GE 105	Fundamentals of Computing	3	0	0	3	
Practical							
1.	CH 102	Chemistry Lab	0	0	2	1	
2.	PH 102	Physics Lab	0	0	2	1	
3.	GE 102	Basic Engineering Practice Lab	0	0	3	1	
4.	GE 106	Computer Practice Lab	0	0	3	1	**24**
		Semester II					
Theory							
1.	MA 102	Mathematics II	3	1	0	4	
2.	PH 103	Physics II	3	0	0	3	
3.	CH 104	Chemistry II	3	0	0	3	
4.	EE 185	Basic Electrical Engineering	3	0	0	3	
5.	GE 107	Engineering Mechanics	3	1	0	4	
6.	ME 105	Engineering Design Concepts	3	0	0	3	
Practical							
1.	EE 186	Electrical Engineering Lab	0	0	3	1	
2.	ME 106	Computational Lab	0	0	3	1	
3.	ME 107	Design Appreciation Lab	0	0	3	1	
4.	EN 102	Communication Skill Lab – I	0	0	3	1	**24**

Semester III

Theory

1.	MA 201	Mathematics – III	3	1	0	4
2.	AE 201	Mechanics of Machines	3	1	0	4
3.	ME 202	Fluid Mechanics & Machinery	3	0	0	3
4.	AE 202	Aero Engineering Thermodynamics	3	1	0	4
5.	AE 203	Solid Mechanics	3	1	0	4
6.	AE 204	Elements of Aeronautics	3	0	0	3

Practical

1.	ME 206	Fluid Mechanics and Machinery Lab	0	0	3	1	
2.	AE 205	Strength of Materials Lab	0	0	3	1	
3.	AE 206	Thermodynamics Lab	0	0	3	1	
4.	EN 201	Communication Skill Lab – II	0	0	3	1	**26**

Semester IV

Theory

1.	MA 205	Numerical Methods	3	1	0	4
2.	AE 207	Aerodynamics – I	3	0	0	3
3.	AE 208	Aircraft Systems and Instrumentations	3	0	0	3
4.	AE 209	Aircraft Structures – I	3	1	0	4
5.	AE 211	Propulsion-I	3	0	0	3
6.	GE 201	Environmental Science and Engineering	3	0	0	3

Practical

1.	AE 212	Aircraft Structures Lab – I	0	0	3	1	
2.	AE 213	Aircraft Component Drawing	0	0	3	1	
3.	AE 214	Aircraft Systems Lab	0	0	3	1	
4.	GE 202	Confidence Building & Behavioral Skills	0	0	2	1	**24**

Semester V

Theory

1.	AE 301	Flight Dynamics	3	0	0	3
2.	AE 302	Aerodynamics – II	3	1	0	4
3.	AE 303	Aircraft Structures – II	3	1	0	4
4.	AE 304	Propulsion-II	3	1	0	4
5.	AE 305	Theory of Elasticity	3	1	0	4
6.	EI 382	Basic Electronics and Control Systems	3	0	0	3

Practical

1.	AE 306	Aerodynamics Lab	0	0	3	1	
2.	AE 307	Aircraft Structures Lab – II	0	0	3	1	
3.	AE 308	Propulsion & Aero Engine Maintenance Lab	0	0	3	1	
4.	GE 301	Career Building & People Skills	0	0	2	1	**26**

Semester VI

Theory

1.	AE 309	Heat Transfer	3	0	0	3
2.	AE 310	Introduction to CFD	3	1	0	4
3.	AE 311	Finite Element Method	3	1	0	4
4.	AE 312	Theory of Vibration	3	0	0	3
5.	AE 313	Aircraft Materials	3	0	0	3
6.		Elective – I	3	0	0	3

Practical

1.	AE 314	Aircraft Design Project – I	1	0	3	2	
2.	AE 315	Aircraft Structures Repair Lab	0	0	3	1	
3.	AE 316	CAD/CAM Lab	0	0	3	1	**24**

Semester VII

Theory

1.	AE	401	Total Quality Management	3	0	0	3	
2.	AE	402	Avionics	3	0	0	3	
3.	AE	403	Composite Materials and Structures	3	0	0	3	
4.	AE	404	Rocket and Missiles	3	0	0	3	
5.			Elective – II	3	0	0	3	
6.			Elective – III	3	0	0	3	

Practical

1.	AE	405	Aircraft Design Project – II	1	0	3	2	
2.	AE	406	CFD-Structural Simulation Lab	0	0	3	1	
3.	AE	407	Avionics Lab	0	0	3	1	
4.	AE	408	Mini Project	0	0	2	1	**23**

Semester VIII

Theory

1.			Elective – IV	3	0	0	3	
2.			Elective - V	3	0	0	3	

Practical

1.	AE	409	Project work	0	0	12	6	**12**

Total 183

Elective Subjects:

AEX 001	Wind Tunnel Techniques	3	0	0	3
AEX 002	Viscous Flows	3	0	0	3
AEX 003	Airframe Maintenance and Repair practice	3	0	0	3
AEX 004	Hypersonic Aerodynamics	3	0	0	3
AEX 005	Helicopter Aerodynamics	3	0	0	3
AEX 006	Combustion	3	0	0	3
AEX 007	Behavior of Materials at High Temperature	3	0	0	3
AEX 008	Experimental Stress Analysis	3	0	0	3
AEX 009	Theory of Plates and Shells	3	0	0	3
AEX 010	Industrial Aerodynamics	3	0	0	3
AEX 011	Air Traffic Control and Aerodrome Design	3	0	0	3
AEX 012	Fatigue and Fracture	3	0	0	3
AEX 013	Computer Integrated Manufacturing	3	0	0	3
AEX 014	Aviation Rules and Regulation	3	0	0	3
AEX 015	Professional Ethics in Engineering	3	0	0	3

SEMESTER – I

MA 101 **MATHEMATICS – I** **L T P C**
3 1 0 4

(Common to all branches)

OBJECTIVE

The course is aimed at developing the skills of engineering students in the basics of chosen topics of Mathematics that are imperative for effective understanding of engineering subjects. It also lays the foundation for learning further topics of Mathematics in higher semesters in a graded manner. The learners will be enabled to appreciate the important role of mathematical concepts in engineering applications.

UNIT I MATRICES 12

Rank of a Matrix – Consistency of Linear System of Equations – Eigen Value Problems – Eigen Values and Eigen vectors of a real matrix, Engineering Applications – Characteristic Equations – Properties of Eigen Values and Eigen Vectors – Cayley Hamilton Theorem (without proof) Similarity Transformation (Concepts only) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Direction cosines & ratios – angle between two lines – equations of a plane – equations of a straight line - coplanar lines - shortest distance between skew lines – sphere – tangent plane – plane section of a sphere – orthogonal spheres.

UNIT III GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS 12

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes & evolutes – envelopes – properties of envelopes and evolutes, evolute as envelope of normals .

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 12

Functions of two variables – partial derivatives – total differential – Taylor's expansion – maxima and minima – constrained maxima and minima – Lagrange's multiplier method – Jacobians – differentiation under integral sign.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS 12

Simultaneous first order linear equations with constant coefficients – Linear equations of second order with constant and variable coefficients – homogeneous equations of Euler type – equations reducible to homogeneous form – method of variation of parameters

.TOTAL : 60

REFERENCES:

1. Kreyszig .E., " Advanced Engineering Mathematics " (8th edition), John Wiley and Sons (Asia) Pte Ltd., Singapore, 2001
2. Kandasamy,P., Thilagavathy.K, and Gunavathy.K., "Engineering Mathematics" Volume I (Revised Edition) S.Chand &co , New Delhi, 2000
3. Rajasekaran.S., Chandrasekaran A., "Engineering Mathematics" Volume I (Revised Edition) Dhanam publishers, Chennai
4. Veerarajan.T., "Engineering Mathematics " Tata Mc Graw Hill Publishing Co. New Delhi
5. Venkataraman. M.K., "Engineering Mathematics – First Year" National Publishing Company. Chennai.

EN101 **TECHNICAL ENGLISH** **L T P C**
2 2 0 4

(Common for all branches of first semester B. Tech. courses)

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OBJECTIVES

- To enable students to give instructions and directions.
- To enable students to receive messages.
- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate the reading habit and to develop effective reading skills
- To enable students write letters and reports effectively in formal and business situations.
- To help learners improve their vocabulary and to enable them to use words appropriately in different contexts.

UNIT1 **12**

Focus on Language: Use of Suffixes, Change of word from one form to another, Tenses- simple present, present continuous, Interchange of voices, Impersonal passive form.
Reading: Skimming & Scanning using different texts.
Listening: Listening for general content.
Speaking: Pronunciation and accent.
Writing: Principles of writing, Paragraph writing, Definition, Description.
Suggested Activities: Changing the grammatical function of words using suffixes, Providing different contexts for using tenses, Changing voices (Active to Passive form)Rewriting in impersonal passive form.

UNIT II **12**

Focus on Language: Word formation with prefixes, Framing 'Wh'–questions- Yes-No questions and Question tags, Adjectives, Comparative Adjectives.
Reading: Scanning for specific information and making inferences.
Listening: Note-making
Writing: Comparison and Contrast, Bar charts
Speaking: Conversations- Eliciting information.
Suggested Activities: Changing the grammatical function of words using prefixes, Questions Yes/No types, Question tags, Using appropriate Comparative Adjectives, Role-play activities for eliciting information.

UNIT III **12**

Focus on Language: Tenses- simple past, past perfect, Phrasal verbs, SV concord, Rules of spelling, Compound nouns, Vocabulary.

Reading : Analyzing and interpreting graphics information, Making inferences, Reading comprehension, Organization of information in a paragraph

Listening: Listening comprehension (multiple choice questions)

Writing: Use of discourse markers, Sequencing jumbled sentences, Letter to the editor, Letter of invitation.

Speaking: Debates.

Suggested activities: Providing context for tenses, Fill in the blanks with suitable phrasal verbs, Correction of sentences, Editing, Expansion of Compound nouns, Multiple choice, Gap filling, Conversations, Persuasive speaking, Drawing inferences.

UNIT IV **12**

Focus on Language: Use of imperatives, Prepositions, Adverbs, Use of modals, Tenses- Simple future tense and 'If' conditionals

Reading: Extensive reading- reading general texts.

Listening: Intensive listening, Guessing the main idea based on the contextual meaning, multiple choice,

Writing: Cause and effect, Purpose and function expressions, Instructions and Recommendations

Speaking: Future plans,(career topic oriented).

Suggested activities: Rewriting sentences using imperatives , fill in the blanks with suitable prepositions, adverbs, use of modal verbs in sentences , Using tenses in different contexts, Use of 'If' conditionals, Giving cause & effect statements to be linked with expressions like as, since, because, etc, using expressions of 'purpose &function' &linking sentences, Using expressions related to recommendations & writing recommendations. Students may be asked to read the book suggested for extra reading and submit assignments. Assignments can be in the form of review, criticism, appreciation etc.

UNIT V **12**

Focus on Language: Numerical adjectives, Using vocabulary in different contexts.

Reading – Reading between the lines understanding implied meanings in the context.

Listening -Listening for specific information, taking messages – memos

Writing- Business letters – quotations, placing an order, complaint, check list.

Speaking – Group Discussion – Problems and Solutions Suggested activities: Rewriting sentences as numerical adjectives, Technical vocabulary, Identifying an issue and discussing the solution, Writing formal letters – Calling for quotations, Placing an order, Complaint- Writing recommendations, Instructions- Preparing a check list, Listening to conversations & taking down messages.

TOTAL: 60

TEXT BOOK

1. Department of Humanities & Social Sciences, Anna University, " English For Engineers & Technologists" combined edition (volumes 1 & 2).

Reference Books

1. Andrea J. Rutherford, 'Basic Communication Skills for Technology' second edition. Pearson Education.
2. P.K.Dutt, G. Rajeevan and C.L.N. Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
3. Krishna Mohan and Meera Banerjee, ' Developng Comminication Skills', Macmillan India Ltd., (reprinted 1994-2007)

Extensive Reading

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

Assessment

I Writing
II Listening
Assessment to be done by the Department
III Writing
IV End semester – Writing

PH 101 **PHYSICS-I** **L T P C**
3 0 0 3

(Common to all branches)

OBJECTIVES

- Basic understanding of Crystal Physics, theory of polarization, photo elasticity, ultrasonics
- To impart fundamental knowledge in various engineering subjects and applications.
- Structure identification of engineering materials.
- Non Destructive techniques
- Application of quantum physics to optical and electrical phenomena
- Application of lasers in Engineering.
- Understanding of fiber optics for applications in communication

UNIT 1 CRYSTAL PHYSICS 9

Introduction – Space lattice – unit cell – Bravais lattices – Miller Indices for cubic crystals – Inter planar spacing in cubic lattice – simple crystal structures – SC, BCC, FCC and HCP structures – atomic radius, coordination number, Packing factor calculation – crystal imperfections – point, line and surface defects – Burger vector.

UNIT II QUANTUM PHYSICS 9

Black body radiation – Planck's theory of radiation – deduction of Wien's displacement law and Rayleigh – Jeans law from Planck's theory – Compton effect – Theory and experimental verification – Dual nature of matter – De Broglie's wavelength- physical significance of wave function – Schroedinger wave equation – time independent and time dependent wave equation – particle in one dimensional box.

UNIT III WAVE OPTICS 9

Polarization – double refraction – Theory of plane polarized,circularly polarized and elliptically polarized light – Quarter wave plate, Half wave plate – production and detection of plane, circularly and elliptically polarized lights – photoelasticity – photo elastic effect – stress optic law – effect of stressed model in a plane polariscope – isoclinics and isochromatic fringes –photo elastic bench.

UNIT IV ULTRASONICS AND NDT 9

Ultrasonics – production – magnetostriction and piezo electric methods – properties of ultrasonic waves – Detection of ultrasonic waves – Applications – Acoustical grating – SONAR – depth of sea – measurement of velocity of blood flow – Non Destructive Testing (NDT) methods – Liquid penetrant method – ultrasonic flaw detector – A,B and C scan displays – X – ray radiography and fluoroscopy.

UNIT V LASER AND FIBRE OPTICS 9

Characteristics of laser light – Einstein's A & B coefficients (derivation) – Nd:YAG laser – He -Ne laser – CO_2 laser – homo and hetero junction semiconductor lasers – applications – material processing and holography (construction and reconstruction of hologram) – Optical fibre – principle of propagation of light in optical fibers – Numerical aperture and acceptance angle – single and multimode fibres – step index and graded index fibres – applications – fibre optic communication system (block diagram only)- fibre optic sensors (displacement and pressure sensors (qualitative).

TOTAL: 45

TEXT BOOKS:

1. Avadhanulu M.N., Engineering Physics, 1st Edition, S.Chand & Company Ltd., New Delhi, 2007.
2. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.

REFERENCES:

1. Uma Mukherji, Engineering Physics, Narosa Publishing House, New Delhi, 2007.

CH 101	CHEMISTRY- I	L T P C 3 0 0 3

(Common to all branches)

UNIT I WATER TECHNOLOGY 9

Introduction- Impurities present in water-Hardness-Types of Hardness-Estimation of Hardness (EDTA method)-Alkalinity-Estimation of Alkalinity-Disadvantages of hard water in industries – conditioning methods – external treatment methods – zeolite and ion exchange methods - internal treatment (colloidal, phosphate, calgon, carbonate methods) – drinking water standards (BIS) – treatment of domestic water (screening, sedimentation, coagulation, filtration, disinfection – by chlorination, UV treatment, ozonization).

UNIT II ENGINEERING MATERIALS 9

Abrasives – Moh's scale of hardness – natural abrasives (diamond, corundum, emery, garnets and quartz) – artificial abrasives (silicon carbide, boron carbide) - Refractories : characteristics – classification (acid, basic and natural refractories) – properties (refractoriness, refractoriness under load, dimensional stability, porosity – thermal spalling) - manufacture of refractories (general methods) – preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks only - lubricants and lubrication - functions – classification with examples – properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) – greases (calcium based, sodium based, lithium based only) – solid lubricants – graphite and molybdenumsulphide-Adhesives-Requirements-Classification-Adhesive action-Factors influencing adhesive action

UNIT III ELECTRO CHEMISTRY 9

Galvanic cells – reversible and irreversible cells – emf and its measurements - single electrode potential – standard electrodes (H_2 & calomel electrodes) – electrochemical series – Nernst equation – problems – metal – metal ion electrode – metal – metal insoluble salt electrode – glass electrode – determination of pH using glass electrode – application of emf measurements – problems – concentration cells – applications – problems – ion selective electrodes – Kohlrausch law of independent migration of ions – applications – conductometric titrations – polarization – overvoltage – decomposition potential.

UNIT IV FUELS AND COMBUSTION 9

Classification of fuels (solid, liquid and gaseous) comparison – coal varieties – analysis of coal, proximate (moisture, volatile mater, ash content & carbon content) – significance – ultimate analysis (carbon, hydrogen, nitrogen, ash & oxygen) – significance – coke manufacture (Otto-Hoffman by product coke oven method) – characteristics of metallurgical coke – Petroleum – refining – fractions – composition

and uses – cracking – thermal and catalytic (fixed bed & fluidized bed) - synthetic petrol (polymerization – thermal and catalytic methods) – Fischer – Tropsch method – Bergius process – knocking – octane number – improvement of antiknock characteristics – diesel engine fuel – cetane number – Gaseous fuels – production composition and uses of producer gas, water gas and natural gas - combustion – gross and net calorific values – theoretical calculation of calorific values (Dulong's formula) – calculation of minimum requirement of air (simple calculations) – explosive range, spontaneous ignition temperature – flue gas analysis – Orsat apparatus.

UNIT V SPECTROSCOPY 9

Electromagnetic spectrum – absorption of radiation – electronic transition – vibrational transition – rotational transition – intensities of spectral lines – Beer – Lambert's Law – colorimetric analysis – estimation of concentration of a solution by colorimetry – flame photometry – theory, instrumentation (block diagram only) and application – visible & UV spectroscopy – principles, instrumentation (block diagram only) and simple applications – IR spectroscopy – simple applications only.

TOTAL : 45

TEXT BOOKS:

1. Puri B.R., Sharma L.R. and Madan S. Pathania, Principles of Physical Chemistry,
   Shoban Lal Nagin Chand & Co., Jalandhar, 2000.
2. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai & Sons, New Delhi. 2001.

REFERENCES :

1. Bahl B.S., Tuli G.D., and Arun Bahl, Essentials of Physical Chemistry, S.Chand & Company Ltd., New Delhi, 2004.
2. Kuriacose J.C. & Rajaram J, Chemistry in Engineering & Technology, Vol. 1, Tata McGraw-Hill publishing company, New Delhi, 1996.

GE 101 **ENGINEERING GRAPHICS** **L T P C**
2 0 3 3

(Common to All Branches)

OBJECTIVE

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide an exposure to the appropriate standards for technical drawings
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, pictorial views and free hand drawing
- To introduce computerized drafting

BASICS **3**

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

UNIT I CURVES AND ORTHOGRAPHIC PROJECTION 9

Conic sections : ellipse, parabola, hyperbola
Special curves : Cycloid, epicycloid, hypocycloid, involutes, helix
Orthographic projection – first angle, third angle projections, principle, free hand sketching of 3D to 2D as per first angle projection.

UNIT II PROJECTION OF POINTS, STRAIGHT LINES AND PLANE SURFACES 12

Orthographic projection of points, straight lines in first quadrant – true length and true inclinations – traces. Projection of plane lamina in first quadrant.

UNIT III PROJECTION OF SOLIDS 12

Projection of solids: prism, pyramid, cone, cylinder – auxiliary projection.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape .Solids in simple position and cutting plane inclined to one reference plane only. Development of surfaces of truncated solids: prism, pyramid, cone cylinder – frustum of cone and pyramid.

UNIT V PICTORIAL PROJECTIONS 12

Isomertic scale - Isometeric projection & Isometric view of prism, pyramid, cylinder , cone , frustums and truncated solids. Perspective projection of prism, pyramid, cylinder, frustums – Visual ray method and Vanishing point method. Commands and demonstration of Drafting packages.

TOTAL : 60

TEXT BOOK:

1. N.D. Butt, 'Engineering Drawing' Charotar Publishing house, 46th Edtion, (2003)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai.(2006)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai.(2008)

GE105 FUNDAMENTALS OF COMPUTING L T P C
3 0 0 3

(Common to All Branches)

OBJECTIVE

- To give a broad overview of the computer and accessories.
- To provide background knowledge of Information Technology.
- To develop logical and analytical thinking skills for writing algorithms.
- To expose and train programming concepts in C.

UNIT I BASICS OF COMPUTER AND INFORMATION TECHNOLOGY 9

Digital Computer fundamentals – Block diagram of a computer-Component of a computer system – Hardware and software definitions – Categories of software – Booting – Installing and uninstalling Software – Software piracy – software terminologies – Applications of computers – Role of Information technology – History of Internet – Internet Services.

Types and generation of programming languages – algorithm – flow chart – pseudo code – Top down approach – refinement - one-in one-out control structures - Development of solutions for simple problems using flow charts and pseudo code.

UNIT II BASIC ELEMENTS OF C 9

Introduction to C – Lexical elements of C – types - their representation -Operators and Expressions – Operator precedence – and associatively of operators - Input and Output functions – simple computational problems.

Decision Making:

Control statements – branching, looping, nested control structures, switch, break, continue, goto statements – Problems using control structures.

UNIT III FUNCTIONS AND PROGRAM STRUCTURES 9

Prototypes and Functions – Declaring defining and accessing functions – Parameter passing methods –storage classes – auto, extern, static, and register – Library functions – Programs using functions - recursion.

Arrays:

Defining and processing arrays - Passing arrays to functions – Multi – dimensional arrays – strings and basic operations on strings – enumerated data types – Programs using simple sorting, searching and merging of arrays.

UNIT IV POINTERS , STRUCTURES 9

Pointer concept – Declarations - Accessing variable through pointer - Structures – User defined data types - poniter to structures – passing structures to functions – self-referential structures – linked list.

UNIT V FILE HANDLING 9

Union –Command line arguments – Dynamic memory allocation.

File pointer – Opening and closing of file – Creating, Processing and Updation on files - simple file handling programs.

TOTAL : 45

TEXT BOOKS

1. Jeri R. Hanly and Elliot B. Koffman , “Problem Solving and Program Design in C”, Fifth Edition, Pearson Education (2009)

REFERENCES

1. Brian W. Kernighan and Dennis M. Ritchie, “The C programming Language”, Pearson Education Inc. (2005).
2. Behrouz A. ForouZan and Richard. F. Gilberg, “A structured Programming Approach using C”, II Edition, Brooks-Cole Thomson Learning Publications,2001.
3. V Rajaraman, “Computer Basics and C Programming”, PHI (2008)

CH 102 **CHEMISTRY LABORATORY** **L T P C**
0 0 2 1

(Common to all branches)

I. Weighing and preparation of standard solutions

1. Preparation of molar and normal solutions of the following substances - oxalic acid, sodium carbonate, sodium hydroxide, hydrochloric acid.
2. Preparation of buffer solutions: borate buffer, phosphate buffer using Henderson equation.

II. Water Analysis

3. Determination of total hardness, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content by Winkler's method.
5. Determination of alkalinity in a water sample.
6. Determination of chloride content of water sample by argentometric method.

III. pH

7. To find out the strength of given hydrochloric acid by sodium hydroxide.

IV. Conductometry

8. Conductometric titration of mixture of acids.
9. Conductometric precipitation titration using $BaCl_2$ – Na_2SO_4.

V. Potentiometry

10. Redox titration – Iron Vs dichromate.

VI. Spectrophotometry

11. To determine the iron content of an unknown solution (1,10–phenanthroline / thiocyanate method)

VII. Flame photometry

12. To determine sodium and potassium in water

VIII Viscometry

13. Determination of molecular weight of a polymer.

TOTAL : 45

REFERENCES :

1. A Text of Quantitative Inorganic Analysis, A.I.Vogel, ELBS, London.
2. Experiments in Physical Chemistry, D.P. Shoemaker and C.W. Garland, McGraw-Hill, London.

PH 102	PHYSICS LABORATORY (Common to all branches)	L T P C 0 0 2 1

LIST OF EXPERIMENTS:

1. Torsional Pendulum – Determination of rigidity modulus of wire and moment of inertia of disc.
2. Non- Uniform Bending – Young modulus determination
3. Viscosity – Determination of co-efficient of Viscosity of liquid by Poiseuilles flow.
4. Lee' disc – Determination of thermal conductivity of a bad conductor.
5. Air wedge – Determination of thickness of a thin wire.
6. Spectrometer – Determination of wavelength of Hg source using Grating
7. (i) Determination of wavelength of Laser using Grating
   (ii) Particle size determination
   (iii) Determination of Numerical Aperture and Acceptance angle of an optical Fiber.
8. Ultrasonic Interferometer – Velocity of Ultrasonic waves in a liquid and compressibility of the liquid.
9. Band gap determination of a semiconductor.
10. Determination of hysteresis loss in a ferromagnetic material.

GE 102 BASIC ENGINEERING PRACTICE LABORATORY L T P C
0 0 3 1

(Common to All Braches)

OBJECTIVE

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

OUTCOME

- Should be able to appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Should be able to attend minor defects especially in items used in day to day life
- Should be aware of the safety aspects involved in using tools and instruments

CIVIL ENGINEERING PRACTICE 9

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints

MECHANICAL ENGINEERING PRACTICE 12

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mould preparation for simple component

ELECTRICAL ENGINEERING PRACTICE 12

1. Basic house hold wiring using switches, fuse, indicator – lamp
2. Study of Tube light wiring, iron box, fan with regulator, emergency lamp and stair case light wiring

ELECTRONIC ENGINEERING PRACTICE 12

1. Soldering simple electronic circuits and checking continuity
2. Assembling and testing of telephone circuit, FM radio on a small PCB

TOTAL : 45

GE 106	COMPUTER PRACTICE LAB	L T P C
	(Common to all branches)	0 0 3 1

LIST OF EXPERIMENTS

OBJECTIVE

- To give an in-depth training on C programming
- To provide hands on experience on basic computer tools
- To develop logical and analytical skills for problem solving.

WORD PROCESSING AND SPREAD SHEET

1. Word Processing
   a. Document creation, Text formatting, Searching.
   b. Table creation, Table formatting.

2 Spread Sheet
   a. Formula - formula editor.
   b. Chart - Line, XY, Bar and Pie.
   c. Inclusion of Picture and graphics
   d. Sorting and Import / Export features.

C PROGRAMMING

3. Data types, Expression Evaluation, Condition Statements.
4. Functions, Recursion and parameter passing mechanisms.
5. Arrays
6. Structures and Unions
7. Pointers and Functions
8. File Processing
9. Dynamic allocation, Linked List

TOTAL : 45

SEMESTER – II

MA 102	MATHEMATICS – II	L T P C
	(Common to all branches except CSE & IT)	3 1 0 4

OBJECTIVE

An aim of the course is to train the students in additional areas of Engineering Mathematics, necessary for grooming them into successful engineers. The topics introduced will serve as basic tools for specialized studies in many engineering fields, significantly in fluid mechanics, field theory and communication engineering.

UNIT I MULTIPLE INTEGRALS **12**

Double integration – Cartesian and Polar coordinates – change of order of integration – area as a double integral – triple integration in Cartesian coordinates – change of variables between Cartesian and polar coordinates and cylindrical, spherical polar coordinates.

UNIT II VECTOR CALCULUS **12**

Gradient, divergence and curl – line, surface and volume integrals – Green's, Gauss Divergence and Stoke's theorems – verification and evaluation of integrals using them.

UNIT III ANALYTIC FUNCTIONS **12**

Function of a complex variable – Analytic function – necessary conditions – Cauchy-Riemann equations in Cartesian coordinates – sufficient condition – properties of analytic function – determination of harmonic conjugate by Milne-Thomson method – conformal mapping ($w= a+z, az, 1/z, z^2$) and bilinear transformation.

UNIT IV COMPLEX INTEGRATION **12**

Statement and application of Cauchy's theorem – Cauchy's integral formula – Taylor and Laurent expansion – singularities classification – residues - Cauchy's residue's theorem – contour integration – unit circle and semi circular contours

UNIT V LAPLACE TRANSFORM **12**

Laplace transform – sufficient condition – transforms of elementary functions- basic properties- inverse transforms –derivatives and integral of transforms- transforms of derivatives and integrals- convolution theorem –transform of periodic functions – application to solution of linear ordinary differential equations – second order with constant coefficients, Simultaneous equations.

TOTAL : 60

REFERENCE:

1. Kreyszig .E., " Advanced Engineering Mathematics " (8th edition), John Wiley and Sons (Asia) Pte Ltd., Singapore, 2001
2. Kandasamy,p., Thilagavathy.k, and Gunavathy.k., "Engineering Mathematics" Volume II (Revised Edition) S.Chand &co , New Delhi, 2000

3. Rajasekaran.S., Chandrasekaran A., “Engineering Mathematics” Volume II (Revised Edition) Dhanam publishers, Chennai
4. Veerarajan.T., “Engineering Mathematics “ Tata Mc Graw Hill Publishing Co. New Delhi
5. Venkataraman. M.K. “Engineering Mathematics – First Year“ National Publishing Company. Chennai.

PH 103 **PHYSICS II** **L T P C**
3 0 0 3

(**Common to Mechanical, Aeronautical, EEE, ICE, Civil and Polymer)**

OBJECTIVES

At the end of the course, the students would be exposed to basic understanding of

- Theory of conducting materials, conductivities and their measurement and applications in engineering field.
- Semi conducting materials and their types, carrier concentration in intrinsic & extrinsic semiconductors and their applications.
- Dielectric materials and their types, dielectric loss, applications of dielectrics in engineering fields.
- Super conducting materials, types, properties and their applications in various engineering fields and also basic knowledge about various new engineering materials.
- Thermal conductivity and its application.

UNIT – I CONDUCTING MATERIALS **9**

Classical free electron theory of metals – Electrical conductivity and thermal conductivity – Widemann Franz law(derivation) – Lorentz number – Drawbacks of classical theory – Quantum free electron theory and its importance – Energy distribution of electrons in metals – Fermi distribution function – Density of energy states and carrier concentration in metals (derivation) – Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory (qualitative).

UNIT – II SEMICONDUCTING MATERIALS **9**

Intrinsic semiconductors – Elemental and compound semiconductors – Drift current and diffusion current – carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – mobility and electrical conductivity – band gap determination – Extrinsic semiconductors – carrier concentration in n-type and p- type semiconductors (derivation) Energy band diagram of n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and Impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

UNIT III DIELECTRIC MATERIALS **9**

Dielectric constant (ϵ_r) – Electric susceptibility (χ) – Different types of dielectric polarization: electronic , ionic, orientational and space charge polarization – frequency and temperature dependence of polarization – Internal field and deduction of Clausius – Mossoti's equation (derivation) – Dielectric loss – Types of dielectric breakdown – uses of dielectric materials (Capacitor and transformer)

UNIT IV SUPERCONDUCTING MATERIALS & NEW ENGINEERING MATERIALS 9

Superconductivity – Meissner effect – Critical magnetic field – type I and II superconductors – High temperature superconductors – Applications of superconductors: SQUID and magnetic levitation – Nonlinear optics – Harmonic generation – Optical mixing – Optical phase conjugation – Solitons – Metallic glasses – properties and application – Shape Memory Alloys – properties and applications – Nano phase materials – properties and applications.

UNIT – V THERMAL PHYSICS 9

Mode of heat transfer, coefficient of Thermal conductivity, Thermal diffusivity, Rectilinear flow of heat along a bar (derivation) – Radial flow of heat, spherical shell method (derivation) – determination of thermal conductivity of Rubber and powder materials – conduction through compound media – Thermal insulation in the buildings – Practical application of heat conduction and convection – conductivity of the earth' crust and age of the earth – Ventilation – Radiators – Central heating – Removal of generated heat in automobiles – gas filled electric lamps.

TOTAL : 45

TEXT BOOKS:

1. Avadhanulu M.N., Engineering Physics, 1st Edition, S.Chand & Company Ltd, New Delhi, 2007.
2. Gaur R.K.and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.
3. Brijlal and Subrahmanyam, N., Heat & Thermodynamics, New edition, S. Chand & Company Ltd., New Delhi, 2007.

REFERENCES:

1. Charles Kittel, Introduction to solid state physics, 7th Edition, John Wiley & sons(ASIA) Pvt., Ltd.
2. Uma Mukherji, Engineering Physics, Narosa Publishing House, New Delhi.

CH 104 **CHEMISTRY II** **L T P C**
3 0 0 3

(Common for Mechanical & Aeronautical Engineering)

UNIT I POLYMER CHEMISTRY 9

Monomers – functionality – polymer – degree of polymerization – classification based on source and applications – effect of polymer structure on properties – addition, condensation, co-polymerization and co-ordination polymerization – mechanism of addition – polymerization (free radical mechanism) thermosetting and thermoplastics resins – preparation, properties and applications of polythene, polypropylene, TEFLON, polystyrene, polyvinyl chloride, PMMA, polyamides, polyesters, bakelite, epoxy resins – vulcanization of rubber – rubber blended plastics – laminated plastics – laminated glass – thermocole.

UNIT II CORROSION AND CORROSION INHIBITION 10

Corrosion – causes of corrosion – principles of chemical corrosion – Pilling – Bedworth rule – principles of electrochemical corrosion – difference between chemical and electrochemical corrosion – factors influencing corrosion – types of corrosion : galvanic corrosion, differential aeration corrosion, stress corrosion, soil (microbial) corrosion, pitting corrosion, water line corrosion - corrosion control: cathodic protection, sacrificial anode, selection of materials and proper designing – corrosion inhibitors, protective coatings.

Paints: constituents – functions – mechanism of drying – varnishes and lacquers – special paints – fire retardant, water repellant, temperature indicating and luminous paints.

UNIT III ENERGY SOURCES AND ENERGY STORING DEVICES 9

Nuclear fission process – characteristics of nuclear fission – chain reactions – nuclear energy – nuclear reactors – light water nuclear power plant.

Batteries – introduction – primary and secondary batteries – dry cells – alkaline batteries, lead acid storage cell, nickel – cadmium cell, lithium battery - fuel cell – hydrogen – oxygen fuel cell – photogalvanic cell.

UNIT IV PHASE RULE AND PHYSICAL METALLURGY 9

Phase rule – statements and explanation of the terms involved – condensed phase rule – construction of phase diagram – thermal analysis – simple eutectic system (Ag-Pb system only) – applications of phase rule - physical metallurgy - powder metallurgy – preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) – mixing and blending – compacting – sintering – uses, advantages and limitations of powder metallurgy.

UNIT V ANALYTICAL TECHNIQUES 8

Gravimetry analysis of Pb, Fe, Al, and Ni - complexometric titrations (using EDTA) – estimation of Ni, Zn, and Mg - redox titrations - estimation of iron by dichrometry and copper by iodometry - atomic absorption spectroscopy - principle – instrumentation (block diagram only) – quantitative estimation of Ni and Cr.

TOTAL : 45

TEXT BOOKS:

1. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi, Edition 2002.
2. Dara S.S., A text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi, 2003.

REFERENCES:

1. Vogel A.I., A text book Quantitative Inorganic Analysis, ELBS, London, 2000.

EE 185 BASIC ELECTRICAL ENGINEERING LT P C
3 0 0 3

(Common for Mechanical & Aeronautical Engineering)

OBJECTIVE

- To study qualitatively about the construction and principle of operation of D.C. machines and to do simple problems.
- To study qualitatively the construction and principle of operation of transformers and three phase induction motors and to do simple problems.
- To study qualitatively the time responses of. 1st and 2nd order system.
- To study qualitatively the Thyristor-Operation and its usage in-Speed control of motors

UNIT I ELECTRIC CIRCUITS 9

Introduction to DC circuits: ohm's law, kirchhoff's laws, resistance connections, defining terms. Introduction to AC circuits: AC, representation techniques, defining terms, series and parallel circuits, 3 phase circuits. Simple problems.

UNIT II DC MACHINES 9

Construction –types- generator- characteristics- motors- characteristics- starting and speed control- testing- curves & efficiency.

UNIT III AC MACHINES 9

Transformers: construction, types, principle of operation, behavior of load, equivalent circuit, voltage regulation of load, equivalent circuit, voltage regulation, efficiency. Three phase Induction motor: construction, types, characteristics, speed control, starting methods. Simple problems.

UNIT IV INTRODUCTION TO CONTROL SYSTEMS 9

Control Systems –Open and Closed Loop –Laplace transforms-transfer function-block diagram reductions-Differential equation of physical systems, time response of 1st and 2nd order systems, errors, simple problems.

UNIT V CONTROL SYSTEM COMPONENTS 9

Components- servo motors- stepper motors- control of such motors - hydraulic & pneumatic systems- analysis- simple problems.

TOTAL : 45

REFERENCES

1. Edward Hughes; Electrical and Electronics Technology, Pearson India, 9th Edition, 2007.
2. Cotton.H; Electrical Technology, Pitman.
3. Nagarath.I.J and M.Gopal; A text book of Control Systems Engineering, New Age International Publishers, First Edition 2010
4. John Bird; Electrical and Electronics Principles and Technology, Newness Publishers (Elsevier Unit).

GE 107 **ENGINEERING MECHANICS** **L T P C**
3 1 0 4

(Common to all Branches)

OBJECTIVE

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

UNIT I BASICS & STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector Algebra and its Physical relevance in Mechanics- Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

UNIT II EQUILIBRIUM OF RIGID BODIES 12

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

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

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

Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

Review of laws of motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

Introduction to vibrations - Single degree of freedom systems – with and without damping

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

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

TOTAL: 60

TEXT BOOK:

1. Beer,F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.

REFERENCES:

1. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000
2. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition – Pearson Education Asia Pvt. Ltd., 2003

ME 105 ENGINEERING DESIGN CONCEPTS L T P C
3 0 0 3

(Common for Mechanical & Aeronautical Engineering)

Course objective:

- To understand design as a central activity in engineering
- To learn the scientific approach to Product Design
- To understand the basic concepts of Engineering Design
- To understand the various domains of Mechanical Engineering and their interconnection through analyzing various products and systems

UNITI INTRODUCTION TO PRODUCT DESIGN 9

Introduction to product design - Design as the core engineering activity – Products and Processes –Product Design Methodology – Concept of Concurrent Engineering – Team Building – Failure Analysis - Case Studies.

UNITII OPPORTUNITY TO ANALYSIS 9

Understanding the opportunity - Product vision – Product Life Cycle- Market opportunity analysis - Customer need analysis – Voice of the Customer – Technical Specifications - Competitive analysis –Case Studies.

UNITIII CONCEPT DEVELOPMENT 9

Concept Development - Portfolio Planning - Product Teardown – Reverse Engineering - Functional Modeling - Product Architecture and Development - Concept Engineering – Case Studies

UNITIV CONCEPT IMPLEMENTATION 9

Implementation of concept - Embodiment engineering - Physical and Analytical modeling – Material Considerations – Design for Strength – Manufacturing and Assembly - Design for X - QFD and House of Quality - Robust design

UNITV CASE STUDIES 9

Case studies of complete product design - Automotive Sub systems Design – Design of a consumer durable – Toy design – design of engineering systems - Electronic Product Design – Software Design

TOTAL : 45

TEXT BOOKS :

1. Kevin.otto, Kristin wood, “Product design”, (2nd edition), Pearson education, New Delhi 2004.

REFERENCES :

1. D G Ullman, The Mechanical Design Process, McGraw Hill 1997
2. G.Pahl, and W. Beitz, Engineering Design – A Systematic Approach, Springer- Verlag, 1996
3. Ulrich, Karl, and Steven Eppinger, Product Design and Development, (3rd edition) New York-McGraw Hill, 2004. ISBN:9780072471465

EE 186 **ELECTRICAL ENGINEERING LAB** **L T P C**
0 0 3 1

(Common for Mechanical & Aeronautical Engineering)

List of Experiments:

1. Verification of Kirchhoff's law.
2. Study of R.L.C series circuit.
3. O.C.C of a DC generator.
4. Load test on D.C generator.
5. Load test on D.C motors
6. Speed control of D.C shunt motors.
7. Load characteristics of a single phase transformer.
8. Load test on 3 phase induction motor.
9. Transfer function of separately excited DC generator
10. Transfer function of armature and fixed controlled DC motor.
11. Transfer function of AC servo motor.
12. OC and SC test on single phase transformer.

TOTAL : 45

ME 106 **COMPUTATIONAL LAB** **L T P C**
0 0 3 1

(Common for Mechanical & Aeronautical Engineering)

Exercises:

I Programming **(30)**

1. Finding the real roots of polynomials
2. Finding the inverse of a Matrix
3. Finding parameters like mean, median, mode, variance, skew and Kurtosis for a given data file
4. Finding the Eigen value and Eigen Vectors of Matrices
5. Numerical integration
6. Solving set of simultaneous equations
7. Plotting simple curves like circle, ellipse, parabola etc.
8. Plotting any one synthetic curve

II Computer Aided Drafting **(15)**

Students must be taught the fundamentals of any one drafting package. The coverage must include isometric and orthographic drawing of simple components.

TOTAL : 45

ME 107 **DESIGN APPRECIATION LAB** **L T P C**
0 0 3 1

(Common for Mechanical & Aeronautical Engineering)

Exercises:

0. Study of standard components
1. Dismantling and Assembling of work holding devices
2. Dismantling and Assembling of fixed ratio reduction gear box
3. Dismantling and Assembling of automotive gearbox and clutch
4. Dismantling and Assembling of reciprocating pump
5. Dismantling and Assembling of centrifugal pump and submersible pump
6. Dismantling and Assembling of compressor and blower
7. Dismantling and Assembling of two stroke petrol engine
8. Dismantling and Assembling of valves
9. Dismantling and Assembling of differential and rear axle
10. Study of Mechanical components in electronic devices
11. Study of pneumatic devices
12. Dismantling and Assembling of carburetor and fuel feed pump
13. Dismantling and Assembling of steering and front axle
14. Dismantling and Assembling of four cylinder four stroke diesel engine
15. Study of mechanisms in machine tools

TOTAL : 45

EN102 COMMUNICATION SKILLS LABORATORY- I L T P C
0 0 3 1

(COMMON FOR ALL BRANCHES)

OBJECTIVES:

1. To help students interact with people effectively in various academic and Professional situations
2. To prepare students for placement interviews
2. To enable students understand Spoken English in real-life and business situations
4. To develop the writing ability of students by providing them required practice
5. To familiarize students with the words used in both technical and business contexts

UNIT I Use of Language in Business Context 4

Face to face conversations - Greeting friends and strangers, Introducing, etc., Situational conversations - Asking for and giving information, Agreeing and disagreeing, etc., Telephonic conversations - Preparing to make a telephone call, receiving a telephone call, taking and leaving telephone messages, etc., Buying and selling a product, Making arrangement for meetings**.**

Unit II Listening in Context 10

Listening to monologues and short conversations based on a variety of sources including interviews, telephone calls, face-to-face conversations – listening to people, listening for instructions (business related), followed by two forms of multiple choice tasks and note completion tasks-- Listening to texts lasting three minutes which is generally in the form of an interview or a discussion with two or more speakers, Listening to longer texts in order to listen for clues and prompts relating to purpose.

Unit III Speaking in Context 12

Selling a product-- Describing brands and markets- discussing different advertising methods and marketing techniques, Pronunciation – Stress, Word Stress (giving opinion), Sentence Stress (talking about plans, interpretation of meanings), Pitch and Intonation (talking about problems), Role play, Conducting and participating in meetings, Making a telephone call to a supplier, interviewing a company owner, Persuading/Convincing a customer to buy a product.

Unit IV Reading in Context 7

Reading articles from magazines or newspaper- Extracting relevant information, scanning the text for specific information, Cloze passage, Reading mini case studies on corporate situations like launching and marketing a product, customer care, etc.

Unit V Writing in Context 12

Writing emails, Inter-office communication —memos, phone messages, Writing a fax, Writing Letters – to express thanks to a host- to express interest in a product, Business Letters – Making Enquiry about a product, Calling for Quotation, Seeking Clarification, Placing an Order and Making a Complaint, Interpretation of data

TOTAL : 45

REFERENCES.

1. BEC Preliminary, Cambridge University Press, New York. 2002. 2. Bill Mascull . 'Business Vocabulary in Use' Cambridge University Press. Cambridge, 2002.
3. Bill Mascull. 'Business Vocabulary in Use' Advanced. Cambridge University Press. Cambridge, 2004.
4. Comfort, Jeremy. Et.al. 'Speaking Effectively: Developing Speaking Skills for Business English.' Cambridge University Press. Cambridge, 1984.
5. John Seely, 'Oxford Guide to Speaking and Writing'. Oxford University Press, New Delhi, 2004.
6. Leo Jones. 'New International Business English Student's book. Cambridge University Press. 2003.
7. Leo Jones. 'New International Business English' Teachers' book. Cambridge University Press. Cambridge. 2003.
8. Mohan ,Krishna & Meera Bannerji . 'Developing Communication Skills'. Macmillan India Ltd., Chennai. 2001.
9. Norman Whitby, ' Business Benchmark.' Bulat edition. Cambridge University Press, New Delhi. 2006.
10. Richards, Jack.C. 'New Interchange: English for International Communication.' Foundation Books Pvt. Ltd., New Delhi, 2006.
11. Simon Sweeney. 'Communicating in Business' Student's Book. Cambridge University Press. Cambridge , 2003.
12. Simon Sweeney. 'Communicating in Business' Teacher's Book. Cambridge University Press. Cambridge , 2004.

SEMESTER – III

MA 201	MATHEMATICS - III	L T P C
	(Common to all branches)	3 1 0 4

OBJECTIVE

The course aims to develop the skills 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. The 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 – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9

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

UNIT III BOUNDARY VALUE PROBLEMS 12

Classification of second order quasi linear partial differential equations – Solutions of one-dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM 9

Fourier integral theorem – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z –TRANSFORM AND DIFFERENCE EQUATIONS 6

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

TOTAL: 60

REFERENCES :

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.

2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., “Engineering Mathematics Volume III”, S. Chand & Company ltd., New Delhi, 1996.
3. S.Rajasekaran, A.Chandrasekaran “Engineering Mathematics Volume III “ Dhanam Publishers,Chennai
4. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., “Advanced Mathematics for Engineering Students”, Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.

AE 201 MECHANICS OF MACHINES L T P C
3 1 0 4

OBJECTIVE

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

UNIT I MECHANISMS 12

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

UNIT II FRICTION 12

Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

UNIT III GEARING AND CAMS 12

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicylic gear trains - Determination of speed and torque - Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

UNIT IV BALANCING 12

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

UNIT V VIBRATION 12

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

TOTAL : 60

TEXT BOOKS

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

REFERENCES

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

ME 202 FLUID MECHANICS AND MACHINERY L T P C
3 1 0 4

OBJECTIVE

• To understand the structure and the properties of the fluid.
• To understand and appreciate the complexities involved in solving the fluid flow problems.
• To understand the mathematical techniques already in vogue and apply them to the solutions of practical flow problems.
• To understand the energy exchange process in fluid mechanics handling incompressible fluids.

UNIT I BASIC CONCEPTS AND PROPERTIES 6

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

UNIT II FLIUD KINEMATICS AND FLUID DYNAMICS 12

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net – fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications – Venturi meter, Orifice meter, Pitot tube - dimensional analysis - Buckingham's π theorem- applications - similarity laws and models.

UNIT III INCOMPRESSIBLE FLUID FLOW 12

Viscous flow - Navier-Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy -weisback's equation - pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

UNIT IV HYDRAULIC TURBINES 8

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagrams - head and specific work - components of energy transfer - degree of reaction.

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies -performance curve for turbines.

UNIT V HYDRAULIC PUMPS 7

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

TOTAL: 45

TEXT BOOKS:

1. Streeter, V.L., and Wylie, E.B., “Fluid Mechanics”, McGraw-Hill, 1983.
2. Kumar, K.L., “Engineering Fluid Mechanics”, Eurasia Publishing House (P) Ltd, New Delhi (7^{th} edition), 1995.
3. Vasandani, V.P., “Hydraulic Machines - Theory and Design”, Khanna Publishers.1992

REFERENCES*:*

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, (5^{th} edition), Laxmi publications (P) Ltd, New Delhi, 1995
2. White, F.M., “Fluid Mechanics”, Tata McGraw-Hill, 5^{th} Edition, New Delhi, 2003.
3. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1998.
4. Som, S.K., and Biswas, G., “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw-Hill, 2^{nd} Edition, 2004.

AE 202 AERO ENGINEERING THERMODYNAMICS L T P C
3 1 0 4

OBJECTIVE

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

UNIT I BASIC THERMODYNAMICS 15

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

UNIT II AIR CYCLES 11

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

UNIT III THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW 11

Application of Continuity and energy equations- Properties of steam - Rankine cycle - Simple jet propulsion system - Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR CONDITIONING 11

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

UNIT V AIR COMPRESSORS 12

Classification and working principle, work of compression with and without clearance, Isothermal and Isentropic efficiency of reciprocating air compressors, multistage compression and intercooling.Various types of compressors (Descriptive treatment only)

TOTAL : 60

TEXT BOOKS

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

REFERENCES

1. Mayhew, A. and Rogers, B., “Engineering Thermodynamics”, Longman Green & Co. Ltd., London, E.L.B.S. Edition, 1990.

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

AE 203 SOLID MECHANICS L T P C
3 1 0 4

OBJECTIVE

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

UNIT I AXIAL LOADING 12

Stresses and strains – Hooke's law – stress and strain diagrams - elastic constants – statically determinate and indeterminate problems in tension & compression – thermal stresses – impact loading.

UNIT II STRESSES IN BEAMS 10

Shear force & bending moment diagrams – bending stresses – shear stress variation in beams of symmetric sections – beams of uniform strength.

UNIT III DEFLECTION OF BEAMS 12

Double integration method – Macaulay's method – moment area method – conjugate beam method – principle of superposition – Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorems and their applications.

UNIT IV TORSION – SPRINGS – COLUMNS 14

Torsion of solid and hollow circular shafts – shear stress variation – power transmission in shafts – open and closed-coiled helical springs – stresses in helical springs – classification of columns – Euler buckling – columns with different end conditions.

UNIT V BIAXIAL STRESSES 12

Stresses in thin-walled pressure vessels – combined bending, torsion and axial loading of circular shafts – Mohr's circle and its construction – determination of principal stresses.

TOTAL: 60

TEXT BOOK

1. Gere & Timoshenko, 'Mechanics of Materials', McGraw Hill, 1993
2. William Nash, Strength of Materials, Tata McGraw Hill, 2004

REFERENCES:

1. Dym,C.L., and Shames,I.H., 'Solid Mechanics', McGraw Hill, Kogakusha, Tokyo, 1973.
2. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, Third Edition.
3. R.K.Rajput, 'Strength of Materials', S. Chand and Co., 1999.
4. Timoshenko,S. and Young,D.H., Elements of Strength of Materials, T.Van Nostrand Co. Inc., Princeton, N.J., 1977.

AE 204 ELEMENTS OF AERONAUTICS L T P C
3 0 0 3

OBJECTIVE

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

UNIT I HISTORICAL EVALUATION 8

Early airplanes, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

UNIT II AIRCRAFT CONFIGURATIONS 5

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.

UNITN III INTRODUCTION TO PRINCIPLES OF FLIGHT 10

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

UNIT IV INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS 12

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.

UNIT V POWER PLANTS USED IN AIRPLANES 10

Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production. Comparative merits, Principles of operation of rocket, types of rockets and typical applications, Exploration into space.

TOTAL : 45

TEXT BOOKS

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

REFERENCE

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

ME 206 **FLUID MECHANICS** **L T P C**
0 0 3 1

LIST OF EXPERIMENTS

1. Comparison of coefficient of discharge of given Orifice meter and Venturimeter.
2. Calibration of Rotameter
3. Determination of friction factor for the given set of pipes.
4. Performance study of Centrifugal pump / Submersible pump
5. Determination of maximum efficiency for the given Reciprocating pump.
6. Characteristic curves of Gear pump / Vane pump
7. Determination of the maximum power at constant speed / constant load for an Impulse turbine.
8. Performance characteristics of Reaction turbine.
9. Impact of jet on flat and curved vanes
10. Verification of Bernoullis equation
11. Performance test on a jet pump.

TOTAL : 45

AE 205 STRENGTH OF MATERIALS LABORATORY **L T P C**
0 0 3 1

OBJECTIVE

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

LIST OF EXPERIMENTS

1. Hardness test - a)Vickers b)Brinell c) Rockwell d) Shore
2. Tension test
3. Torsion test
4. Impact test – a) Izod b)Charpy
5. Fatigue test - a) Reverse plate bending b) Rotating Beam
6. Testing of springs
7. Block Compression Test

TOTAL : 45

AE206	THERMODYNAMICS LABORATORY	L T P C 0 0 3 1

OBJECTIVE

To enhance the basic knowledge in applied thermodynamics

LIST OF EXPERIMENTS

1. Performance test on a 4-stroke engine
2. Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
3. Determination of effectiveness of a parallel flow heat exchanger
4. Determination of effectiveness of a counter flow heat exchanger
5. Determination of the viscosity coefficient of a given liquid
6. COP test on a vapour compression refrigeration test rig
7. COP test on a vapour compression air-conditioning test rig
8. Study of a Gas Turbine Engine.
9. Determination of Conductive Heat Transfer Coefficient.
10. Determination of Thermal Resistance of a Composite wall.

TOTAL:45

EN201 COMMUNICATION SKILLS LABORATORY-II
(COMMON FOR ALL BRANCHES)

L	T	P	C
0	0	3	1

OBJECTIVES:

1. To prepare students for placement interviews.
2. To acquire Business English qualification at Vantage level
3. To help them develop interpersonal and social skills.
4. To develop their writing skills in order to write reports.
5. To improve their speaking skills so as to converse in their professional and business situations.

UNIT I Discussion Skills:

Negotiations - Types of Negotiations - Selling and Buying Products, Negotiating face to face and on the Phone - Bargaining and Making Concessions-. Group Discussions.

9 Hrs

UNIT II Presentation Skills

Tips for effective Presentation, Different types of Presentation – Sales Presentation, Project Presentation, etc., Presentation practice.

9 Hrs

UNIT III Business Communication skills

Writing Minutes - Note making - Letter Writing - Applying for Jobs, CV Writing, To invite a candidate for an interview, Job promotion letters.

9 Hrs

UNIT IV Interview Skills

Preparing for Interviews - Etiquette, Body Language, Dress Code etc., Mock Interviews

9 Hrs

UNIT V Managerial and Social Skills

Organizing, Conducting and Participating in Meetings - Interacting with people - Time Management - Writing Business Reports - Language and Style, Reports on Conferences, Meetings.

9 Hrs

TOTAL : 45

REFERENCES

1. BEC Vantage, Cambridge University Press. Edition 2005.
2. Bill Mascull . 'Business Vocabulary in Use. Cambridge University Press. Cambridge, 2002.
3. Bill Mascull. 'Business Vocabulary in Use' Advanced. Cambridge University Press. Cambridge, 2004.
4. Comfort, Jeremy. Et.al. 'Speaking Effectively: Developing Speaking Skills for Business English.' Cambridge University Press. Cambridge, 1984.
5. Gerson, Sharon, Steve M.Gerson. ' Technical Writing: Process and Product' Pearson Education , New Delhi. 2004.

6. Leo Jones. ‘New International Business English’ Students book. Cambridge University Press. 2003.
7. Leo Jones. ‘ New International Business English’ Teachers’ book . Cambridge University Press. Cambridge. 2003.
8. Richards, Jack.C. ‘New Interchange: English for International Communication.’ Foundation Books Pvt. Ltd., New Delhi, 2006
9. Riordan, Pauley. ‘Report Writing Today’ AITBS Publisher, New Delhi. 2000.
10. Rutherford , Andrea. J. ‘ Basic Communication Skills For Technology’ Pearson Education Asia. 2002.
11. Simon Sweeney. ‘ Communicating in Business’ Students’s Book. Cambridge University Press. Cambridge , 2003.
12. Simon Sweeney. ‘ Communicating in Business’ Teacher’s Book. Cambridge University Press. Cambridge , 2004.

Assessment: Continuous Assessment

SEMESTER – IV

MA 205 NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES

With the present development of the 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 occur in engineering numerically.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Linear interpolation methods (method of false position) – Newton's method – Statement of Fixed Point Theorem – Fixed point iteration: x=g(x) method – Solution of linear system by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods- Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method.

UNIT II INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas - Relations between operators (E, ∇ , μ, Δ, Δ)

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL : 60

REFERENCES:

1. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition,

Pearson Education Asia, New Delhi, 2002.
2. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., “Numerical Methods”, S.Chand Co. Ltd., New Delhi, 2003.
3. Burden, R.L and Faires, T.D., “Numerical Analysis”, Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
4. M.K.Venkataraman “Numerical Methods” The National Publishing Co. Chennai.
5. S.S.Sastry “Introductory Methods of Numerical Analysis”, PHI of India (p) Ltd. New Delhi.

AE207 AERODYNAMICS – I L T P C
3 0 0 3

OBJECTIVE

To introduce the concepts of mass, momentum and energy conservation relating to aerodynamics. To make the student understand the concept of vorticity, irrotationality, theory of airfoils and wing sections. To introduce the basics of viscous flow.

UNIT I REVIEW OF BASIC FLUID MECHANICS 10

System and Control volume approach, substantial, local and convective derivative, Continuity, momentum and energy equations, Inviscid flow, Euler equation, incompressible Bernoulli's Equation. Circulation and Vorticity, Green's Lemma and Stoke's Theorem, Barotropic Flow, Kelvin's theorem, Streamline, Stream Function, Irrotational flow, Potential Function, Equipontential Lines, Elementary Flows and their combinations.

UNIT II TWO DIMENSIONAL INVISCID INCOMPRESSIBLE FLOW 8

Ideal Flow over a circular cylinder, D'Alembert's Paradox, Magnus effect, Kutta Jonkowski's Theorem, Starting Vortex, Kutta condition, Real flow over smooth and rough cylinder.

UNIT III AIRFOIL THEORY 9

Cauchy-Riemann relations, Complex Potential, Methodology of Conformal Transformation, Kutta-Joukowski transformation and its applications, Karman Trefftz Profiles, Thin Airfoil theory and its applications.

UNIT IV SUBSONIC WING THEORY 8

Vortex Filament, Biot and Savart Law, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Lifting Line Theory and its limitations.

UNIT V INTRODUCTION TO LAMINAR AND TURBULENT FLOW 10

Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, Energy thickness, Shape parameter, Boundary layer equations for a steady, two dimensional incompressible flow, Boundary Layer growth over a Flat plate, Critical Reynolds Number, Clasius solution, Basics of Turbulent flow, Prandtl's mixing length hypothesis, Free shear layers.

TOTAL:45

TEXT BOOK

1. Houghton, E.L., and Caruthers, N.B., Aerodynamics for Engineering students, Edward Arnold Publishers Ltd., London, 1989.
2. Anderson, J.D., Fundamentals of Aerodynamics, MaGraw Hill Book Co., 1999

REFERENCES

1. Milne Thomson, L.H., Theoretical Aerodynamics, Macmillan, 1985
2. John J Bertin., Aerodynamics for Engineers, Pearson Education Inc, 2002
3. Clancey, L J., Aerodynamics, Pitman, 1986

AE208 AIRCRAFT SYSTEMS AND INSTRUMENTATIONS L T P C
3 0 0 3

OBJECTIVE

To describe the principle and working of aircraft systems and instruments

UNIT I AIRPLANE CONTROL SYSTEMS 15

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

UNIT II AIRCRAFT SYSTEMS 7

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

UNIT III ENGINE SYSTEMS 8

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

UNIT IV AUXILLIARY SYSTEM 8

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

UNIT V AIRCRAFT INSTRUMENTS 7

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

TOTAL : 45

TEXT BOOKS

1. McKinley, J.L., and Bent, R.D., “Aircraft Maintenance & Repair”, McGraw-Hill, 1993.
2. “General Hand Books of Airframe and Powerplant Mechanics”, U.S. Dept. of Transportation, Federal Aviation Administation, The English Book Store, New Delhi1995.

REFERENCES

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

AE 209 AIRCRAFT STRUCTURES – I L T P C
3 1 0 4

OBJECTIVE

To study different types of beams and columns subjected to various types of loading and support conditions with particular emphasis on aircraft structural components.

UNIT I STATICALLY DETERMINATE STRUCTURES 12

Statically determinate frames – plane truss analysis – method of joints – method of sections – 3-D trusses – the landing gear tripod – beams of two materials.

UNIT II STATICALLY INDETERMINATE STRUCTURES 12

Propped cantilevers – fixed-fixed beams – Clapeyron's 3 moment equation – moment distribution method.

UNIT III ENERGY METHODS 12

Strain energy evaluation in structural members – energy theorems – dummy load & unit load methods – Maxwell's reciprocal theorem – energy methods applied to statically determinate and indeterminate beams, frames, rings & trusses.

UNIT IV COLUMNS 12

Euler's column curve – inelastic buckling – effect of initial curvature – the Southwell plot – columns with eccentricity – use of energy methods – theory of beam columns – beam columns with different end conditions – stresses in beam columns.

UNIT V FAILURE THEORIES 12

Ductile and brittle materials – maximum principal stress theory - maximum principal strain theory - maximum shear stress theory - distortion energy theory – octahedral shear stress theory.

TOTAL : 60

TEXT BOOK

1. Timoshenko and Gere, `Mechanics of Materials', Tata McGraw Hill, 1993.
2. Bruhn E F, 'Analysis and Design of Flight Vehicle Structures', Tri-State Off-set Company, USA, 1985

REFERENCES

1. Donaldson, B.K., 'Analysis of Aircraft Structures - An Introduction', McGraw Hill, 1993.
2. Megson T M G, `Aircraft Structures for Engineering students' Edward Arnold Publishers.
3. Peery, D.J., and Azar, J.J., Aircraft Structures, 2nd edition, McGraw – Hill, N.Y., 1999.

AE 211 PROPULSION – I L T P C
3 0 0 3

OBJECTIVE

To understand the principles of operation and design of aircraft power plants

UNIT I FUNDAMENTALS OF GAS TURBINE ENGINES 12

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 SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES 8

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

UNIT III COMBUSTION CHAMBERS 6

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

UNIT IV NOZZLES 6

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

UNIT V COMPRESSORS 13

Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of prewhirl, rotation stall and surge – Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.

TOTAL : 45

TEXT BOOKS

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

REFERENCES

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

GE 201 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C

3 0 0 3

OBJECTIVES

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

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Definition, scope and importance, Need for public awareness.
Natural resources and associated problems - Uses, over exploitation and environmental impacts of (a) Forest resources, (b) Water resources, (c) Mineral resources, (d) Food resources, (e) Land resources, (f) Energy resources -Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources - Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 9

Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a) Terrestrial ecosystems (Forest, Grassland, Desert), (b) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT III BIODIVERSITY AND HUMAN POPULATION 9

Introduction - Definition, genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity - habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Population growth, variation among nations; Population explosion; Family Welfare Programme.

UNIT IV ENVIRONMENT POLLUTION AND ITS CONTROL 9

Definition, Cause, effects and control measures of (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution, (g) Nuclear hazards - Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Disaster management: floods, earthquake, cyclone and landslides.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT **9**

From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns; Environmental ethics: Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

Environment and human health; human rights; value education; hiv/aids; women and child welfare; role of information technology in environment and human health.

TOTAL : 45

TEXT BOOKS

1. Gilbert M.Masters, “Introduction to Environmental Engineering and Science”, pearson education Pvt., Ltd., second edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. jr., “Environmental Science”, Wadsworth publishing co.
3. Townsend C., Harper J and Michael Begon, “Essentials of Ecology”, Blackwell science.
4. Trivedi R.K. and P.K. Goel, “Introduction to air pollution”, techno-science publications.

REFERENCES

1. Bharucha erach, “The Biodiversity of India”, mapin publishing Pvt. Ltd., Ahmedabad India,
2. Trivedi R.K., “Handbook of Environmental Laws”, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, “Environmental Encyclopedia”, Jaico Publ., House, Mumbai, 2001.
4. Wager K.D., “Environmental Management”, W.B. Saunders Co., Philadelphia, USA, 1998.

AE212 AIRCRAFT STRUCTURES LAB –I

L	T	P	C
0	0	3	1

OBJECTIVE

To study experimentally the load deflection characteristics structural materials under different types of loads.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of steel using mechanical extensometers.
2. Determination of Young's modulus of aluminum using electrical extensometers
3. Determination of fracture strength and fracture pattern of ductile materials
4. Determination of fracture strength and fracture pattern of brittle materials
5. Stress Strain curve for various engineering materials.
6. Deflection of beams with various end conditions.
7. Verification of Maxwell's Reciprocal theorem & principle of superposition
8. Column – Testing
9. South – well's plot.
10. Riveted Joints.

TOTAL : 45

AE 213 AIRCRAFT COMPONENT DRAWING L T P C
0 0 3 1

OBJECTIVE

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

LIST OF EXPERIMENTS

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

TOTAL : 45

AE214 AIRCRAFT SYSTEMS LAB

L	T	P	C
0	0	3	1

OBJECTIVE

To train the students to carryout practicals on Aircraft Systems and rectifications

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. “Test of Brake System” and “Bleeding of Brake System”.
8. “Pressure test” procedure on fuel system component.
9. “Break Torque Load Test” on wheel brake units.
10. Maintenance and rectification of snags in hydraulic and fuel systems.

TOTAL : 45

GE 202 CONFIDENCE BUILDING & BEHAVIOURAL SKILLS **L T P C**
0 0 2 1

(Common for all branches)

Note : This course will be offered by Training and Placement faculty supplemented by outsiders.

1. At the end of this training program the participant will be able to, **15**

   - Define self confidence
   - Comprehend the importance of having self confidence
   - Discuss ways to build up self confidence
   - Recognize the importance of the tips and warnings

2. Improving of, **15**

   - Behavioural Patterns and Basic Etiquette
   - Value System
   - Inter Personal Skills
   - Corporate Culture
   - Self Awareness
   - Managing Self and Personality Styles

TOTAL : 30

SEMESTER V

AE 301 FLIGHT DYNAMICS L T P C
3 0 0 3

OBJECTIVE

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

UNIT I DRAG ON THE AIRPLANE 7

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

UNIT II AIRCRAFT PERFORMANCE 10

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

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. Determination of neutral points and maneuver points from flight test.

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 10

Dynamic longitudinal stability: equations of motion - stability derivatives - characteristic equation of stick fixed case - modes and stability criterion - effect of freeing-the stick - brief description of lateral and directional. dynamic stability - spiral, divergence, dutch roll, auto rotation and spin.

TOTAL : 45

TEXT BOOKS

1. Perkins, C.D., and Hage, R.E., “Airplane Performance stability and Control”, John Wiley & Son:, Inc, New York, 2011.

REFERENCES

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

AE302 **AERODYNAMICS – II** **L T P C**
3 1 0 4

OBJECTIVE

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

UNIT I ONE DIMENSIONAL COMPRESSIBLE FLOW **10**

Energy, momentum, continuity and state equations, velocity of sound, adiabatic steady state flow equations, flow through converging, diverging passages, performance under various back pressures.

UNIT II NORMAL, OBLIQUE SHOCKS AND EXPANSION WAVES **16**

Prandtl equation and rankine – hugonoit relation, normal shock equations, pitot static tube, corrections for subsonic and supersonic flows, oblique shocks and corresponding equations, hodograph and pressure turning angle, shock polars, flow past wedges and concave corners, strong, weak and detached shocks, rayleigh and fanno Flow. Flow past convex corners, expansion hodograph, reflection and interaction of shocks and expansion, waves, families of shocks, methods of characteristics, two dimensional supersonic nozzle contours.

UNIT III DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS **13**

Small perturbation potential theory, solutions for supersonic flows, Mach waves and Mach angles, Prandtl-Glauert affine transformation relations for subsonic flows, linearised two dimensional supersonic flow theory, lift, drag pitching moment and center of pressure of supersonic profiles.

UNIT IV AIRFOIL IN HIGH SPEED FLOWS **9**

Lower and upper critical Mach numbers, lift and drag divergence, shock induced separation, characteristics of swept wings, effects of thickness, camber and aspect ratio of wings, transonic area rule, tip effects.

UNIT V HIGH SPEED WIND TUNNELS **12**

Blow down, indraft and induction tunnel layouts and their design features, transonic, supersonic and hypersonic tunnels and their peculiarities, helium and gun tunnels, shock tubes, optical methods of flow visualization.

TOTAL : 60

TEXT BOOKS

1. John D. Anderson, Jr., Fundamentals of Aerodynamics, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2007.
2. Liepmann, H. W and Roshko, A., Elements of Gasdynamics,Dover Publication, 2002.
3. Pope, A. and Goin, L., High Speed Wind Tunnel Testing, John Wiley, 1985

REFERENCES

1. Mc Cormick. B. W., “Aerodynamics, Aeronautics and Flight Mechanics”, John Wiley & Sons, Inc., UK, 1995.

2. Anderson Jr., D., – “Modern compressible flow”, McGraw-Hill Book Co., New York 2003.
3. Rathakrishnan, E., “Gas Dynamics”, Prentice Hall of India, 2003.

AE303	AIRCRAFT STRUCTURES – II	L T P C 3 1 0 4

OBJECTIVE

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

UNIT- I UNSYMMETRICAL BENDING **11**

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

UNIT-II SHEAR FLOW IN OPEN SECTIONS **13**

Thin walled beams, concept of shear flow, shear centre, elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT-III SHEAR FLOW IN CLOSED SECTIONS **13**

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

UNIT-IV BUCKLING OF PLATES **13**

Rectangular sheets under compression, local buckling stress of thin walled sections, crippling stresses by Needham's and Gerard's methods, thin walled column strength. Sheet stiffener panels. Effective width, inter rivet and sheet wrinkling failures.

UNIT-V STRESS ANALYSIS IN WING AND FUSELAGE **10**

Procedure – Shear and bending moment distribution for semi cantilever and other types of wings and fuselage, thin webbed beam. With parallel and non parallel flanges, Shear resistant web beams, Tension field web beams (Wagner's).

TOTAL : 60

TEXT BOOKS

1. Megson, T.M.G.,"Aircraft Structures for Engineering Students", 4th edition, Elsevier Ltd., 2010.

REFEENCES

1. Peery, D.J., and Azar, J.J.,"Aircraft Structures",Dover Publications, 2011.
2. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Jacobs Pub., 1973.
3. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, 1993.

AE 304 **PROPULSION – II** **L T P C**
3 1 0 4

OBJECTIVE

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

UNIT I AIRCRAFT GAS TURBINES **14**

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

UNIT II SUPERSONIC INLETS AND NOZZLES **12**

Supersonic inlets – starting problem on supersonic inlets – shock swallowing by area variation – external declaration – models of inlet operation. Convergent nozzles and choking – over expanded and under – expanded nozzles – ejector and variable area nozzles – interaction of nozzle flow with adjacent surfaces – thrust reversal

UNIT III RAMJET PROPULSION **12**

Operating principle – sub critical, critical and supercritical operation – combustion in ramjet engine – ramjet performance – sample ramjet design calculations – introduction to scramjet – preliminary concepts in supersonic combustion – integral ram- rocket- numerical problems**.**

UNIT IV FUNDAMENTALS OF ROCKET PROPULSION **14**

Operating principle – specific impulse of a rocket – internal ballistics- rocket nozzle classification – rocket performance considerations solid propellant rockets – selection criteria of solid propellants – important hardware components of solid rockets – propellant grain design considerations – liquid propellant rockets – selection of liquid propellants – thrust control in liquid rockets – cooling in liquid rockets – limitations of hybrid rockets – relative advantages of liquid rockets over solid rockets- numerical problems.

UNIT V ADVANCED PROPULSION **8**

Electric rocket propulsion – ion propulsion techniques – nuclear rocket – types – solar sail- preliminary concepts in nozzleless propulsion**.**

TOTAL : 60

TEXT BOOKS

1. Sutton, G.P., Oscar biblarz“Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 8th Edn., 2010.

REFERENCES

1. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., “Gas Turbine Theory”, Pearson Education Ltd., 2009.

2. Gordon, C.O., Aerothermodynamics of Gas Turbine and Rocket Propulsion, 3rd Edtion AIAA Education Series, New York, 1998.

3. Seddon, J., Goldsmith, E.L. Intake Aerodynamics, 2nd Edn., AIAA Education series, 1999.
4. Hill, P.G. & Peterson, C.R. Mechanics & Thermodynamics of Propulsion, Pearson Education Inc., 2010.

AE 312	THEORY OF ELASTICITY	L T P C
		3 0 0 3

OBJECTIVE

To understand the theoretical concepts of material behaviour with particular emphasis on their elastic property

UNIT I ASSUMPTIONS IN ELASTICITY **8**

Definitions- notations and sign conventions for stress and strain, equations of equilibrium.

UNIT II BASIC EQUATIONS OF ELASTICITY **17**

Strain – displacement relations, stress – strain relations, Lame's constant – cubical dilation, compressibility of material, bulk modulus, shear modulus, compatibility equations for stresses and strains, principal stresses and principal strains, Mohr's circle, Saint Venant's principle.

UNIT III PLANE STRESS AND PLANE STRAIN PROBLEMS **13**

Airy's stress function, bi-harmonic equations, polynomial solutions, simple two-dimensional problems in cartesian coordinates like bending of cantilever and simply supported beams, etc.

UNIT IV POLAR COORDINATES **12**

Equations of equilibrium, strain displacement relations, stress – strain relations, axi – symmetric problems, Kirsch, Michell's and Boussinesque problems.

UNIT V TORSION **10**

Navier's theory, St. Venant's theory, Prandtl's theory on torsion, the semi- inverse method and applications to shafts of circular, elliptical, equilateral triangular and rectangular sections.

TOTAL : 45

TEXT BOOK

1. Timoshenko, S., and Goodier, T.N., Theory of Elasticity, Tata McGraw–Hill , 2010

REFERENCES

1. Enrico Volterra & J.H. Caines, Advanced Strength of Materials, Prentice Hall, New Jersey, 1991.
2. Wang, C.T., Applied Elasticity, McGraw–Hill Co., New York, 1993.
3. Atkin, R. J., & Fox, N., An Introduction to the theory of Elasticity, Dover publication, 2005.

EI 382 BASIC ELECTRONICS AND CONTROL SYSTEMS L T P C
3 0 0 3

OBJECTIVE

- To acquaint students to semi conductor devices and their applications
- To keep the students abreast of the latest digital technology and expose them to application oriented programming
- To give basic knowledge of control system in Flight Control System and Flight Deck.

UNIT I SEMI CONDUCTOR DEVICES 10

Introduction to semi conductor – PN junction diode – Zener diode – tunnel diode – transistor – FET and MOSFET – silicon controlled rectifier, diac and triac – half wave and full wave rectifier – filter – ripple factor – regulators – principle and types of transistor amplifiers.

UNIT II LINEAR AND DIGITAL ICS 10

Number representation – binary, octal and hexadecimal number systems – logic families and logic gates – half and full adder – multiplexers – demultiplexers – decoders – encoders – flip-flops – registers – counters

IC Technology – fabrication of linear and digital IC's – D/A and A/D converters – comparison between analog and digital systems

UNIT III 8085 MICROPROESSOR 10

Introduction to Microprocessor - block diagram of 8085 microprocessor – architecture of intel 8085 – addressing modes – instruction format – instruction set for 8085 – simple arithmetic and logical programs

UNIT IVSYSTEM AND THEIR REPRESENTATION 7

Basic elements of control system – open and closed loop system – mathematical model of physical systems: thermal, pneumatic, hydraulic, flight control system – transfer function – block diagram reduction

UNIT VTIME REPSONSE AND FREQUENCY RESPONSE 8

Time response – test signals– response of first and second order systems for unit step input – time domain specification – frequency response: bode plot, specification: gain margin – phase margin

TOTAL: 45

TEXT BOOKS

1. V.K. Mehta, "Principles of Electronics", S. Chand & Co., New Delhi 2nd edition, 2002.
2. Goankar R.S, "Microprocessors, Programming to Architecture 8085", Penram International publishing Pvt. Ltd., New Delhi, 5th edition 2002.
3. Ogata, Modern Control Engineering, Prentice Hall of India Pvt. Ltd., New Delhi, 1998.
4. M.M. Mano, "Digital Design", 3rd Edition, Prentice Hall of India, 2001.
5. Nagrath & Gopal, Control System Engineering, 3rd Edition, New Age International Edition, 2002.

REFERENCE

1. Douglas, Hall, "Microprocessors and Interfacing", Tata Mcgraw-Hill, Revised edition, 1990.
2. Jacob Millman & Christos C. Halkias, "Electronic Devices and Circuits" Tata McGraw-Hill, 1991.

AE 306	AERODYNAMICS LABORATORIES	L	T	P	C
		0	0	3	1

OBJECTIVE

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

LIST OF EXPERIMENTS

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

TOTAL : 45

AE 307	AIRCRAFT STRUCTURES LAB – II	L T P C 0 0 3 1

OBJECTIVE

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

LIST OF EXPERIMENTS

1. Unsymmetrical bending of beams
2. Shear centre location for open sections
3. Shear centre location for asymmetric closed sections
4. Constant strength beam
5.
6. Beam with combined loading
7. Calibration of Photo- elastic materials
8. Stresses in circular discs and beams using photoelastic techniques
9. Vibrations of beams
10. Wagner beam – Tension field beam

TOTAL : 45

AE 308 PROPULSION AND AERO ENGINE MAINTENANCE LAB L T P C
0 0 3 1

LIST OF EXPERIMENTS

1. Study of aircraft piston engine. (includes study of assembly of sub systems, various components, their functions and operating principles)
2. Stripping of piston engine, visual inspection, NDT checks and assembly
3. Study of an aircraft jet engine (includes study of assembly of sub systems, various components, their functions and operating principles)
4. Stripping of Jet engine, visual inspection, NDT checks and assembly
5. Study of performance of a propeller
6. Study of forced convective heat transfer over a flat plate
7. Study of free convective heat transfer over a flat plate
8. Determination of heat of combustion of aviation fuel.
9. Study of free jet
10. Study of wall jet

TOTAL : 45

GE301	CAREER BUILDING & PEOPLE SKILLS	L T P C 0 0 2 1

(Common for all branches)

The course content will include

1. creation of awareness of the top companies / different verticals / courses for improving skill set matrix
2. industry expectations to enable them to prepare for their career
3. Group discussions : Do's and Don'ts - handling of Group discussions – What evaluators look for.
4. Development of positive frame of mind - avoiding inhibitions - Creation of selfawareness - Overcoming of inferiority / superiority complex.
5. Interview - awareness of facing questions - Do's and Don'ts of personal interview.
6. selection of appropriate field vis-à-vis personality / interest.
7. Preparation of Curriculum Vitae - Objectives, profiles vis-a-vis companies.
8. Enabling students prepare for different procedures / levels to enter into anycompany - books / websites to help for further preparation.
9. Technical interview - how to prepare to face it.
10. Entrepreneurship development - preparation for tests prior to the interview - Qualities and pre-requisites for launching a firm.
11. Interpersonal relationships - with colleagues - clients - understanding one'sown behaviour - perception by others.
12. How to work with persons whose background, culture, language / workstyledifferent from one's.

TOTAL : 30

SEMESTER VI

AE 309	HEAT TRANSFER	L	T	P	C
		3	0	0	3

OBJECTIVE

To study the heat transfer mechanism involved in different applications.

UNIT I FUNDAMENTALS AND HEAT CONDUCTION 10

Modes of heat transfer: conduction – convection – radiation Steady and unsteady state heat conduction in solids - effect of variation of thermal conductivity on heat transfer in solids – conduction with heat generation – heat transfer problems in infinite and semi infinite solids – critical radius *of* insulation- extended surfaces - application of numerical techniques.

UNIT II FREE FORCED CONVECTION 8

Convection fundamentals: Basic equations, boundary layer concept, dimensional analysis

Free Convention: Laminar boundary layer equation-free convection in atmosphere free convection on a vertical flat plate – integral method-empirical relation in free convection –external flows.

UNIT III FORCED CONVECTION 7

Forced convection: Forced convection - laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. empirical relations - numerical techniques in problem solving.

UNIT IV RADIATIVE HEAT TRANSFER AND HEAT EXCHANGERS 12

Concept of black body-Intensity of radiation-Laws of black body radiation-radiation from non black surfaces- real surfaces – radiation between surfaces-Radiation shape factors-radiation shields.

HEAT EXCHANGERS: Types-overall heat transfer coefficient- LMTD- NTU method of heat exchanger analysis.

UNIT V HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING 8

Heat transfer problems in gas turbine combustion chambers - rocket thrust chambers - aerodynamic heating - ablative heat transfer.

TOTAL : 45

TEXT BOOKS

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

REFERENCES

1. Lienhard, J.H., “A Heat Transfer Text Book”, Dover publication, 2011.

2. Holman, J.P. “Heat Transfer”, McGraw-Hill Book Co., Inc., New York, 6th Edn., 1991.
3. Sachdeva, R.C., “Fundamentals of Engineering Heat & Mass Transfer”, New Age International, New Delhi, 2011.

AE310 INTRODUCTION TO CFD L T P C
3 1 0 4

OBJECTIVE

To study the flow of dynamic fluids by computational methods

UNIT I GRID GENERATION 11

Introduction to grid generation in computational fluid dynamics - structured grid generation techniques – algebraic methods, conformal mapping and methods using partial differential equations - basic ideas in numerical grid generation and mapping - boundary value problem of numerical grid generation- grid control functions- branch cut - the boundary conditions of first kind – orthogonality of grid lines- boundary point grid control - introduction to adaptive grids.

UNIT II SOLUTION OF BOUNDARY LAYER EQUATIONS 11

Introduction to boundary layer equations and their solution - description of Prandtl's boundary layer equations and the hierarchy of the boundary layer equations - transformation of boundary layer equations and the numerical solution method - choice of discretization model and the generalized Crank-Nicholson scheme - discretization of the boundary layer equations and illustration of solution of a tridiagonal system of linear algebraic equations.

UNIT III EXPLICIT TIME DEPENDENT METHODS 13

Introduction to time dependent methods - explicit time dependent methods – Euler, backward Euler, one step trapezoidal, backward differencing, two-step trapezoidal, Leap Frog and Adams-Bashforth Methods - description of Lax-Wendroff Scheme and Mac Cormack's two step predictor – corrector method - description of time split methods and approximate factorization Schemes

UNIT IV IMPLICIT TIME DEPENDENT METHODS 12

Introduction to implicit methods and respective stability properties of explicit and implicit methods - stiff problems- absolute stability and stability of numerical methods for the integration of partial differential equations - construction of implicit methods for time dependent problems - linearization, choice of explicit operator and numerical dissipation aspects - choice of the linear system solution strategy – one dimensional and two-dimensional problems by implicit methods.

UNIT V FINITE VOLUME METHOD 13

Introduction to Finite volume Method - different flux evaluation schemes, central, upwind, exponential and hybrid schemes - staggered grid approach - pressure-velocity coupling - SIMPLE, SIMPLER algorithms- pressure correction equation (both incompressible and compressible forms) - application of Finite Volume Method for 1-D and 2-D problems.

TOTAL: 60

TEXT BOOKS:

1. C.A.J. Fletcher, Computational Techniques for Fluid Dynamics Vol. 1, 2nd Edn., Springer, 2003.
Verlag,1995.
2. C.A.J. Fletcher, "Computational Techniques for Fluid Dynamics Vol. 2, 2nd Edn., Springer, 2003.

REFERENCES

1. H.K. Versteeg and W. Malalsekera “An Introduction to Computational Fluid Dynamics, The Finite Volume Method”, Longman Scientific & Technical, 1995.
2. T. J. Chung, “Computational Fluid Dynamics”, Cambridge University Press, 2002.
3. C. Hirch, “Numerical Computation of Internal and External Flows” Volume-2, John Wiley and Sons, 1994.
4. John D. Anderson, Jr., Computational Fluid Dynamics, McGraw-Hill, Inc., 1995.

AE 311	FINITE ELEMENT METHODS	L	T	P	C
		3	1	0	4

OBJECTIVE

To introduce the concept of finite element analysis of structural components

UNIT I INTRODUCTION **11**

Review of various approximate methods – Raleigh Ritz's, Galerkin and finite difference methods- governing equation and convergence criteria of finite element method.

UNIT II DISCRETE ELEMENTS **13**

Bar elements, uniform section, mechanical and thermal loading, varying section, truss analysis. Beam element - problems for various loadings and boundary conditions - longitudinal and lateral vibration. Use of local and natural coordinates.

UNIT III CONTINUUM ELEMENTS **11**

Plane stress, plane strain and axisymmetric problems, constant and linear strain, triangular elements, stiffness matrix, axisymmetric load vector,

UNIT IV ISOPARAMETRIC ELEMENTS **13**

Definitions, shape function for 4, 8 and 9 nodal quadrilateral elements, stiffness matrix and consistent load vector, Gaussian integration

UNIT V FIELD PROBLEM **12**

Heat transfer problems, steady state fin problems, derivation of element matrices for two dimensional problems, torsion problems

TOTAL: 60

TEXT BOOKS

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu, Introduction to Finite Elements in Engineering Printice Hall India, 3rd Edition, 2003.
2. Reddy J.N. – An Introduction to Finite Element Method , McGraw Hill , 3rd Edn., 2005.

REFERENCES

1. Rao. S.S., Finite Element Methods in Engineering, Butterworth and Heinemann, 2001
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Robert D Cook, David S Malkus, Michael E Plesha, 'Concepts and Applications of Finite Element Analysis', 4th edition, John Wiley and Sons, Inc., 2003.
4. Larry J Segerlind, 'Applied Finite Element Analysis', Second Edition, John Wiley and Sons, Inc. 1984.

AE312 THEORY OF VIBRATION L T P C
3 0 0 3

OBJECTIVE

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

UNIT I INTRODUCTION

Free and forced vibrations, degrees of freedom, simple harmonic motion, spring mass system, torsional vibration, Equation of motion, D'Alembert's Principle, conservation of energy.

UNIT IISINGLE DEGREE OF FREEDOM SYSTEMS 8

free vibrations –damped vibrations – forced Vibrations, with and without damping – support excitation – vibration measuring instruments.

UNIT III MULTI DEGREES OF FREEDOM SYSTEMS 10

Two degrees of freedom systems - static and dynamic couplings - vibration absorber- principal co-ordinates - principal modes and orthogonal condition - Eigen value problems - Hamilton's principle - Lagrangean equations and application.

UNIT IV CONTINUOUS SYSTEMS 8

Vibration of elastic bodies - vibration of strings - longitudinal - lateral and torsional vibrations

UNIT V APPROXIMATE METHODS 9

Approximate methods - Rayleigh's method - Dunkerlay's method – Rayleigh-Ritz method, matrix Iteration method.

UNIT VI ELEMENTS OF AEROELASTICITY 10

Vibration due to coupling of bending and torsion - aeroelastic problems - collars triangle - wing Divergence - aileron control reversal – flutter – buffeting.

TOTAL : 45

TEXT BOOKS

1. Timoshenko S., Vibration Problems in Engineering, Wolfender press, New York, 2008.
2. Fung Y.C., An Introduction to the Theory of Aeroelasticity , Dover Publications, 2008.

REFERENCES

1. Bisplinghoff R.L., Ashely H and Hogman R.L., Aeroelasticity, Dover Publications, 1996.
2. Tse. F.S., Morse, I.F., Hunkle, R.T., Mechanical Vibrations Theory and Applications, Allyn and Bacon, 1978
3. Benson H.Tongue, "Principles of Vibration", Oxford University Press, 2000.

AE 313	AIRCRAFT MATERIALS	L T P C
		3 0 0 3

OBJECTIVE

UNIT I INTRODUCTION TO AIRCRAFT MATERIALS 07

General properties of materials, definition of terms, requirements of aircraft materials, testing of aircraft materials, inspection methods, application and trends in usage in aircraft structures and engines, introduction to smart materials and nanomaterials; selection of materials for use in aircraft.

UNIT II AIRCRAFT METAL ALLOYS AND SUPERALLOYS 12

Aluminum alloys, magnesium alloys, titanium alloys, plain carbon and low carbon steels, corrosion and heat resistant steels, maraging steels, copper alloys,producibility and surface treatments aspects for each of the above; general introduction to superalloys, nickel based superalloys, cobalt based superalloys,and iron based superalloys, manufacturing processes associated with superalloys, heat treatment and surface treatment of superalloys. Knowledge of the various methods used for removal of corrosion from common aircraft metals and methods employed to prevent corrosion.

UNIT III COMPOSITE MATERIALS 8

Definition and comparison of composites with conventional monolithic materials, reinforcing fibers and matrix materials, fabrication of composites and quality control aspects, carbon-carbon composites production, properties and applications, inter metallic matrix composites, ablative composites based on polymers, ceramic matrix, metal matrix composites based on aluminum, magnesium, titanium and nickel based composites for engines.

UNIT IV POLYMERS, POLYMERIC MATERIALS & PLASTICS AND CERAMICS & GLASS 8

Knowledge and identification of physical characteristics of commonly used polymeric material: plastics and its categories, properties and applications; commonly used ceramic, glass and transparent plastics, properties and applications, adhesives and sealants and their applications in aircraft.

UNIT V AIRCRAFT WOOD, RUBBER, FABRICS & DOPE AND PAINT 10

Classification and properties of wood, seasoning of wood, aircraft woods, their properties and applications, joining processes for wood, plywood; characteristics and definition of terminologies pertaining to aircraft fabrics and their applications, purpose of doping and commonly used dopes; purpose of painting, types of aircraft paints, aircraft painting process.

TEXT BOOK

1. Charles E. Dole, Fundamentals of Aircraft Material Factors, 2nd Edn., Jeppesen, 1993.
2. Hull, D., Clyne, T. W., Introduction to Composite Materials, 2nd Edn., Cambridge University Press, 1996.

REFERENCE

1. Polmear, I.J., Light Alloys, Butterworth_Heinemann, 2006.
2. Brooks, C. R., Non Ferrous Alloys, American Society for Metals, Ohio, 1982.
3. Titterton, G.F., Aircraft material and Processes, 5th Edn., Sterling Book House, 1998.

AE 314	AIRCRAFT DESIGN PROJECT – I	L T P C 1 0 3 2

OBJECTIVE

To introduce and develop the basic concept of aircraft design.

Each student is assigned with the design of an Airplane (or Helicopter or any other flight vehicle), for given preliminary specifications. The following are the sequence to be carried out:

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

TOTAL : 45

AE315	AIRCRAFT STRUCTURES REPAIR LAB	L T P C 0 0 3 1

OBJECTIVE

To give training on riveting, patchwork, welding and carpentry

LIST OF EXPERIMENTS

1. Aircraft wood gluing
2. Welded patch repair by TIG.
3. Welded patch repair by MIG
4. Welded patch repair by plasma Arc
5. Fabric Patch repair
6. Riveted patch repairs.
7. Repair of composites
8. Repair of Sandwich panels.
9. Sheet metal forming.
10. Control cable inspection and Validation.

TOTAL : 45

AE316	CAD / CAM LABORATORY	L T P C 0 0 3 1

OBJECTIVE

To give hands on exposure on the fundamentals of computer aided design and manufacturing

A. COMPUTER AIDED DESIGN 24

- Analysis of simple structures like axially loaded members, trusses and beams
- Analysis of plates loaded axially and laterally
- Stress analysis of circular shafts subjected to torsion
- Stress analysis of brackets and housings
- Structural analysis of a Aircraft component
- Post processing of analysis results

B. COMPUTER AIDED MANUFACTURING 21

- Manual Part Programming and machining in CNC Turning Center
- Manual Part Programming and machining in a CNC Milling Center
- Generating CNC codes for turning and milling parts using a CAM software
- Integration of CAM software and CNC machines

TOTAL : 45

SEMESTER VII

AE 401 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVE

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

UNIT I INTRODUCTION 9

Definition of quality, dimensions of quality, quality planning, quality costs - analysis techniques for quality costs, basic concepts of total quality management, historical review, principles of TQM, leadership – concepts, role of senior management, quality council, quality statements, strategic planning, deming philosophy, barriers to TQM implementation.

UNIT II TQM PRINCIPLES 9

Customer satisfaction – customer perception of quality, customer complaints, service quality, customer retention, employee involvement – motivation, empowerment, teams, recognition and reward, performance appraisal, benefits, continuous process improvement – juran trilogy, PDSA Cycle, 5S, Kaizen, supplier partnership – partnering, sourcing, supplier selection, supplier rating, relationship development, performance measures – basic concepts, strategy, performance measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, statistical fundamentals – measures of central tendency and dispersion, population and sample, normal curve, control charts for variables and attributes, process capability, concept of six sigma, new seven management tools.

UNIT IV TQM TOOLS 9

Benchmarking – reasons to benchmark, benchmarking process, quality function deployment (QFD) – house of quality, QFD process, benefits, Taguchi quality loss function, total productive maintenance (TPM) – concept, improvement needs, FMEA – stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and other quality systems, ISO 9000:2000 quality system – elements, implementation of quality system, documentation, quality auditing, TS 16949, ISO 14000 – concept, requirements and benefits.

TOTAL : 45

TEXT BOOKS

1. Dale H.Besterfiled, et al., Total Quality Management, 3rd Edn., Pearson Education, Inc. 2008.

REFERENCES

1. James R.Evans & William M.Lidsay, The Management and Control of Quality, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V. Total Quality Management, McGraw-Hill, 1991.
3. Oakland.J.S. Total Quality Management, Butterworth Heinemann Ltd., Oxford, 1995.
4. Narayana V. and Sreenivasan, N.S. Quality Management Concepts and Tasks, New Age International 1996.
5. Zeiri. Total Quality Management for Engineers, Wood Head Publishers, 1991.

AE 402	AVIONICS	L T P C
		3 0 0 3

OBJECTIVE

To introduce the basic concepts of navigation & communication systems of aircraft

UNIT I INTRODUCTION TO AVIONICS **7**

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies.

UNIT II PRINCIPLE OF DIGITAL SYSTEMS **8**

Digital computer – microprocessors – memories.

UNIT III DIGITAL AVIONICS ARCHITECTURE: **8**

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

UNIT IV FLIGHT DECKS AND COCKPITS: **5**

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 V INTODUCTION TO AVIONICS SYSTEMS: **12**

Communications systems- Navigation systems – flight control systems – radar – electronic warfare – utility systems reliability and maintainability –certification.

TOTAL: 45

TEXT BOOKS

1. Middleton, D.H., Ed., Avionics systems, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
2. Spitzer, C.R. Digital Avionics Systems, Mc Graw---Hill,1993.

REFERENCES

1. Malvino, A.P. and Leach, D.P. Digital Principles and Applications, McGraw Hill, 2001.
2. Gaokar, R.S. Microprocessors Architecture-Programming and Applications, Wiley and Sons Ltd., New Delhi, 1990.

AE 403 COMPOSITE MATERIALS AND STRUCTURES L T P C
3 0 0 3

OBJECTIVE
To understand the fabrication, analysis and design of composite materials & structures.

UNIT I MICROMECHANICS 10
Introduction - advantages and application of composite materials – reinforcements and matrices - micro mechanics – mechanics of materials approach, elasticity approach to determine material properties – fibre volume ratio – mass fraction – effect of voids, hygro thermal effects on a lamina.

UNIT II MACROMECHANICS 10
Generalized Hooke's Law - elastic constants for anisotropic, orthotropic and isotropic materials - macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis – determination of material properties - experimental characterization of lamina.

UNIT III LAMINATED PLATES 10
Governing differential equation for a unidirectional lamina and general laminate, angle ply and cross ply laminate, failure criteria for composites.

UNIT IV FABRICATION PROCESS 8
Various open and closed mould processes, manufacture of fibers, types of resins, properties and applications, netting analysis-Autoclave-Vacuum bag moulding-Filament winding-Pultrusions- Resintransfer moulding

UNIT V SANDWICH CONSTRUCTIONS 7
Basic design concepts of sandwich construction - materials used for sandwich construction - failure modes of sandwich panels.

TOTAL: 45

TEXT BOOKS
1. Jones, R.M., Mechanics of Composite Materials, Taylor & Francis, 2nd Edition, 2000.
2. Madhuji Mukhapadhyay, Mechanics of Composite Materials and Structures, University Press, 2004

REFERENCES
1. Agarwal, B.D., and Broutman, L.J., Analysis and Performance of Fibre Composites, John Wiley and sons. Inc., New York, 1995.
2. Lubin, G., Handbook on Advanced Plastics and Fibre Glass, Von Nostrand Reinhold Co., New York, 1989.
3. Autar K Kaw, Mechanics of Composite Materials, CRC Press, 1997.
4. Calcote, L R. The Analysis of laminated Composite Structures, Von –Nostrand Reinhold Company, New York 1998
5. Allen Baker, Composite Materials for Aircraft Structures, AIAA Series, II Edition, 1999.

AE 404 ROCKETS AND MISSILES L T P C
3 0 0 3

OBJECTIVE
To introduce basic concepts of design and trajectory estimation of rocket and missiles

UNIT I ROCKET SYSTEMS **10**

Ignition system in rockets – types of igniters and igniter design considerations – injection system and propellant feed systems of liquid rockets and their design considerations – design considerations of liquid rocket thrust chambers – combustion mechanisms of liquid and solid propellants.

UNIT II AERODYNAMICS OF ROCKETS AND MISSILES **10**

Airframe components of rockets and missiles – forces acting on a missile while passing through atmosphere – classification of missiles – slender body aerodynamics- method of describing forces and moments – lift force and lateral moment –lateral aerodynamic damping moment – longitudinal moment – drag estimation – body upwash and body downwash in missiles – rocket dispersion.

UNIT III ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD **10**

One dimensional and two-dimensional rocket motions in free space and homogeneous gravitational fields – description of vertical, inclined and gravity turn trajectories – determination of range and altitude – simple approximations to burn out velocity and altitude – estimation of culmination time and altitude.

UNIT IV STAGING AND CONTROL OF ROCKETS AND MISSILES **9**

Design philosophy behind multistaging of launch vehicles and ballistic missiles – multistage vehicle optimization – stage separation techniques in atmosphere and in space – stage separation dynamics and lateral separation characteristics – various types of thrust vector control methods including secondary injection thrust vector control – numerical problems on stage separation and multistaging.

UNIT V MATERIALS FOR ROCKET AND MISSILE APPLICATIONS **6**

Selection criteria of materials for rockets and missiles – materials for various airframe components and engine parts – materials for thrust control devices – various adverse conditions faced by aerospace vehicles and the requirement of materials to perform under these conditions.

TOTAL: 45

TEXT BOOKS

1. Cornelisse, J.W., “Rocket Propulsion and Space Dynamics”, J.W. Freeman & Co., Ltd, London, 1979
2. Sutton, G.P., “Rocket Propulsion Elements”, John Wiley & Sons, 2000.
3. Chin, S. S., Missile configuration Design, McGraw-Hill, 1961.
4. Parker, E.R., “Material for Missiles and Spacecraft”, McGraw Hill Book Co. Inc.,1982.

REFERENCES

1. Barrere et al, Rocket propulsion, Elsevier publisher Co., 1960.
2. Martin J. L. Turner, Rocket and Spacecraft propulsion: Principles, Practice & New Developments, Springer Praxis, 2004.
3. J. N. Nielsen, Missile Aerodynamics,Mountain View, Near, Inc., 1998.

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AE 405	AIRCRAFT DESIGN PROJECT – II	L	T	P	C
		1	0	3	2

OBJECTIVE

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

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

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

TOTAL : 45

AE406 CFD- STRUCTURAL SIMULATION LAB L T P C
0 0 3 1

OBJECTIVE

- To familiarize the application of CFD/ CSM codes to aeronautical applications
- To understand the flow features and stress distribution over aircraft components

LIST OF EXPERIMENTS

CFD simulation of

(i) Flow over an airfoil
(ii) Flow over a cone cylinder fuselage configuration
(iii) Free jet flow

Computational Structural Analysis of

(i) Wing spar
(ii) Fuselage bulkhead

TOTAL:45

AE 407	AVIONICS LABORATORY	L T P C
		0 0 3 1

OBJECTIVE

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

LIST OF EXPERIMENTS

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

ELECTIVES

AEX 001 WIND TUNNEL TECHNIQUES L T P C
3 0 0 3

OBJECTIVE
To introduce the basic concepts of measurement of forces and moments on models during the wind tunnel testing.

UNIT I PRINCIPLES OF MODEL TESTING 6
Buckingham theorem – non dimensional numbers – scale effect – geometric kinematic and dynamic similarities.

UNIT II WIND TUNNELS 8
Classification – special problems of testing in subsonic, transonic, supersonic and hypersonic speed regions – layouts – sizing and design parameters.

UNIT III CALIBRATION OF WIND TUNNELS 10
Test section speed – horizontal buoyancy – flow angularities – turbulence measurements – associated instrumentation – calibration of supersonic tunnels.

UNIT IV WIND TUNNEL MEASUREMENTS: 12
Steady and unsteady pressure and velocity measurements – force measurements – three component and six component balances – internal balances – principles of hotwire anemometer.

UNIT V FLOW VISUALIZAITON 9
Smoke and tuft grid techniques – dye injection special techniques – optical methods of flow visualization.

TOTAL: 45

TEXT BOOKS
1. Rae, W.H., Barlow, Jewel, B. and Pope, A., Low Speed Wind Tunnel Testing, 3rd Edn., John Wiley & Sons,1999.

REFERENCES
1. Pope, A., and Goin, L., High Speed Wind Tunnel Testing, John Wiley, 1985.
2. Bradshaw,P., Experimental Fluid Mechanics.

AEX 002 **VISCOUS FLOW** **L T P C**
3 0 0 3

OBJECTIVE

- A basic understanding of boundary layer theory and physics.
- The basic ability to analyze practical viscous fluid mechanics problems drawn from aerospace engineering applications.
- The ability to estimate viscous drag forces on basic aerodynamic (lifting) shapes

UNIT I DERIVATION OF THE EQUATIONS OF MOTION **12**

Review of cartesian tensor notation. Review of thermodynamics. Heat transfer. derivation of the full compressible viscous Newtonian equations (conservation of mass, momentum, energy). Vorticity and entropy equations. Kelvin's theorem.

UNIT II LAMINAR INCOMPRESSIBLE VISCOUS FLOW **12**

Exact solutions: stagnation point flow, Jeffrey-Hamel flow, stokes problems. low reynolds number flow. Introduction to perturbation theory. boundary layer theory. effects of pressure gradient and curvature. boundary layer integral equations, Thwaites method. Laminar separation, separation bubbles.

UNIT III LAMINAR COMPRESSIBLE VISCOUS FLOW **10**

Exact solutions: compressible Couette flow, flow through a shock wave. Compressible boundary layers. introduction to shock-boundary layer interaction and hypersonic effects (dissociation, heating, and non-equilibrium thermodynamics).

UNIT IV TRANSITION TO TURBULENCE **6**

Linear transition theory. Introduction to nonlinear theory and numerical methods. Introduction to experimental results in bounded and free shear flows, both incompressible and compressible. Effects of roughness, turbulence, vibration, noise, curvature, etc. Transition-separation interactions in boundary layers.

UNIT V INTRODUCTION TO TURBULENT FLOW **5**

Reynolds averaged equations of motion. Introduction to statistics and correlations. The Kolmogorov scale. The 5/3 law for inertial range self-similarity. Law of the wall in the turbulent boundary layer. Introduction to experimental results for various fundamental turbulent flows - bluff bodies, internal flows, free shear flows. Introduction to far field self-similarity theories.

TOTAL: 45

TEXT BOOKS

1. F. M. White's book, Viscous Fluid Flow, 3rd edition, 2006.

REFERENCES

1. Anderson, Hypersonic and High Temperature Gasdynamics.
2. Rosenhead, Laminar Boundary Layers
3. Schlichting & Gersten, Boundary-Layer Theory

AEX 003 **AIRFRAME MAINTENANCE AND REPAIR PRACTICE** **L T P C**
3 0 0 3

OBJECTIVE

To make the students to understand the Airframe components and the tools used to maintain the components. Defect investigation, methods to carry out investigation and the detailed maintenance and practice procedures.

UNIT I WELDING IN AIRCRAFT STRUCTURAL COMPONENTS 9

Equipments used in welding shop and their maintenance - ensuring quality welds - welding jigs and fixtures - soldering and brazing.sheet metal repair and maintenance: selection of materials; repair schemes; fabrication of replacement patches; tools: power/hand; repair techniques; close tolerance fasteners; sealing compounds; forming/shaping; calculation of weight of completed repair; effect of weight change on surrounding structure. Sheet metal inspection - N.D.T. Testing.

UNIT II PLASTICS AND COMPOSITES IN AIRCRAFT 9

PLASTICS IN AIRCRAFT

Review of types of plastics used in airplanes -maintenance and repair of plastic components - repair of cracks, holes etc.,various repairs schemes - scopes.

ADVANCED COMPOSITES IN AIRCRAFT

Cleaning of fibre reinforced plastic (FRP) materials prior to repair; break test; repair schemes; FRP/honeycomb sandwich materials; laminated FRP structural members and skin panels; tools/equipment; vacuum-bag process. special precautions - Autoclaves.

UNIT III AIRCRAFT JACKING, ASSEMBLY AND RIGGING 9

Airplane jacking and weighing and C.G. location. Balancing of control surfaces - inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

UNIT IV REVIEW OF hydraulic and pneumatic system 12

trouble shooting and maintenance practices - service and inspection – inspection and maintenance of landing gear systems. - inspection and maintenance of conditioning and pressurization system, water and waste system. installation and maintenance of instruments - handling - testing - inspection. inspection and maintenance of auxiliary systems - fire protection systems - ice protection system - rain removal system -position and warning system - auxiliary power units (APUs).

UNIT V SAFETY PRACTICES: 8

Hazardous materials storage and handling, aircraft furnishing practices -equipments. Trouble shooting.Theory and practices.

TOTAL: 45

REFERENCES:

1. Larry Reithmeir, " Aircraft Repair Manual ", Palamar Books, Marquette, 1992.
2. Brimm D.J. Bogges H.E., " Aircraft Maintenance ", Pitman Publishing corp., New York, 1940.
3. Kroes, Watkins, Delp, " Aircraft Maintenance and Repair ", McGraw Hill, New York, 1992.

AEX 004 HYPERSONIC AERODYNAMICS L T P C

3 0 0 3

OBJECTIVE

Develop an understanding of inviscid hypersonic flows, viscous hypersonic flows and high temperature effects as they apply to hypersonic aerodynamics.

UNIT I FUNDAMENTALS OF HYPERSONIC AERODYNAMICS 9

Introduction to hypersonic aerodynamics – differences between hypersonic aerodynamics and supersonic aerodynamics - concept of thin shock layers and entropy layers – hypersonic flight paths – hypersonic similarity parameters – shock wave and expansion wave relations of inviscid hypersonic flows.

UNIT II SIMPLE SOLUTION METHODS FOR HYPERSONIC INVISCID FLOWS 9

Local surface inclination methods – Newtonian theory – modified Newtonian law – tangent wedge and tangent cone and shock expansion methods – approximate methods - hypersonic small disturbance theory – thin shock layer theory.

UNIT III VISCOUS HYPERSONIC FLOW THEORY 9

Boundary layer equations for hypersonic flow – hypersonic boundary layers – self similar and non self similar boundary layers – solution methods for non self similar boundary layers – aerodynamic heating.

UNIT IV VISCOUS INTERACTIONS IN HYPERSONIC FLOWS 9

Introduction to the concept of viscous interaction in hypersonic flows - strong and weak viscous interactions - hypersonic viscous interaction similarity parameter – introduction to shock wave boundary layer interactions.

UNIT V INTRODUCTION TO HIGH TEMPERATURE EFFECTS 9

Nature of high temperature flows – chemical effects in air – real and perfect gases – Gibb's free energy and entropy - chemically reacting mixtures – recombination and dissociation.

TOTAL: 45

TEXT BOOKS

1. John D. Anderson. Jr., "Hypersonic and High Temperature Gas Dynamics", McGraw Hill Series, New York, 1996.

REFERENCES

1. John D. Anderson. Jr., "Modern Compressible flow with historical Perspective", McGraw Hill Publishing Company, New York, 1996.
2. John T. Bertin, "Hypersonic Aerothermodynamics", published by AIAA Inc., Washington. D.C., 1994.

AEX 005	HELICOPTER AERODYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVE

To introduce the concepts of ideal rotor theory and ground effect machines. To make the student understand the theory behind hovercrafts and VTOL and STOL aircrafts.

UNIT I ELEMENTS OF HELICOPTER AERODYNAMICS **8**

Configurations based on torque reaction – jet rotors and compound helicopters – methods of control, rotor blade pitch control, –collective pitch and and cyclic pitch –lead – lag and flapping hinges

UNIT II IDEAL ROTOR THEORY **12**

Hovering performance – momentum and simple blade element theories – figure of merit – profile and induced power estimation – constant chord and ideal twist rotors.

UNIT III POWER estimates **10**

induced, profile and parasite power requirements in forward flight – performance curves with effects of altitude – preliminary ideas on helicopter stability.

UNIT IV LIFT, PROPULSION AND CONTROL OF V/STOL AIRCRAFT **8**

Various configurations – propeller, rotor, ducted fan and jet lift – tilt wing and vectored thrust –performance of VTOL and STOL aircraft in hover, transition and forward motion.

UNIT V GROUND EFFECT MACHINES **7**

Types – hover height, lift augmentation and power calculations for plenum chamber and peripheral jet machines – drag of hovercraft on land and water –applications of overcraft.

TOTAL: 45

TEXT BOOKS

1. Gessow, A.and Myers, G. C., Aerodynamics of Helicopter, MacMillan & Co., 1987.
2. Gupta, L., Helicopter Engineering, Himalayan Books, 1996.

REFERENCES

1. Johnson, W., Helicopter Theory, Princeton University Press, 1980.
2. MacCromick, B. W., Aerodynamics of V/STOL Flight, Academic Press, 1987.

AEX 006 **COMBUSTION** **L T P C**
3 0 0 3

OBJECTIVE

- To review and confirm the basic principles of combustion thermodynamics
- To teach how to compute the adiabatic flame temperature when there is dissociation of the chemical products

UNIT I FUNDAMENTAL CONCEPTS IN COMBUSTION, CHEMICAL KINETICS AND FLAMES **9**

Thermo chemical equations – heat of reaction- first, second and third order reactions – premixed flames – diffusion flames – measurement of burning velocity – various methods – effect of various parameters on burning velocity – flame stability – deflagration – detonation – Rankine-Hugoniot curves – radiation by flames

UNIT II COMBUSTION IN AIRCRAFT PISTON ENGINES **8**

Introduction to combustion in aircraft piston engines – various factors affecting the combustion efficiency - fuels used for combustion in aircraft piston engines and their selection – detonation in piston engine combustion and the methods to prevent the detonation

UNIT III COMBUSTION IN GAS TURBINE AND RAMJET ENGINES **10**

Combustion in gas turbine combustion chambers - recirculation – combustion efficiency, factors affecting combustion efficiency, fuels used for gas turbine combustion chambers – combustion stability – ramjet combustion – differences between the design of ramjet combustion chambers and gas turbine combustion chambers- flame holders types – numerical problems.

UNIT IV SUPERSONIC COMBUSTION **9**

Introduction to supersonic combustion – need for supersonic combustion for hypersonic airbreathing propulsion- supersonic combustion controlled by diffusion, mixing and heat convection – analysis of reactions and mixing processes - supersonic burning with detonation shocks - various types of supersonic combustors.

UNIT V COMBUSTION IN SOLID, LIQUID AND HYBRID ROCKETS **9**

Solid propellant combustion - double and composite propellant combustion – various combustion models – combustion in liquid rocket engines – single fuel droplet combustion model – combustion hybrid rockets

TOTAL: 45

TEXT BOOKS

1. Sharma, S.P., and Chandra Mohan, “Fuels and Combustion”, Tata Mc. Graw Hill Publishing Co., Ltd., New Delhi, 1987.
2. Mathur, M.L., and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers and Distributors, Delhi, 1988.

REFERENCES

1. Loh, W.H.T., “Jet, Rocket, Nuclear, Ion and Electric Propulsion: Theory and Design”, Springer Verlag, New York, 1982.

2. Beer, J.M., and Chiger, N.A. “Combustion Aerodynamics”, Applied Science Publishers Ltd., London, 1981.
3. Sutton, G.P., “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York,5th Edition, 1993.

AEX 007 BHAVIOUR OF MATERIAL AT HIGH TEMPERATURE L T P C
3 0 0 3

OBJECTIVE

To learn damage mechanism and failure of components of elevated temperatures

UNIT I CREEP **9**

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate.

UNIT II DESIGN FOR CREEP RESISTANCE **9**

Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.

UNIT II FRACTURE **9**

Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides.

UNIT IV OXIDATION AND HOT CORROSION **9**

Oxidation, pilling, bedworth ratio, kinetic laws of oxidation- defect structure and control of oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of combat hot corrosion.

UNIT V OBLATION MATERIALS **9**

Iron base, nickel base and cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, intermetallics, high temperature ceramics.

TOTAL : 45

TEXT BOOKS

1. Raj. R., “Flow and Fracture at Elevated Temperatures”, American Society for Metals, USA, 1985.
2. Hertzberg R. W., “Deformation and Fracture Mechanics of Engineering materials”, 4th Edition, John Wiley, USA, 1996.
3. Courtney T.H, “Mechanical Behavior of Materials”, McGraw-Hill, USA, 1990.

REFERENCES

1. Boyle J.T, Spencer J, “Stress Analysis for Creep”, Butterworths, UK, 1983.
2. Bressers. J., “Creep and Fatigue in High Temperature Alloys”, Applied Science, 1981.
3. McLean D., “Directionally Solidified Materials for High Temperature Service”, The Metals Society, USA, 1985.

AEX 008 **EXPERIMENTAL STRESS ANALYSIS** **L T P C**
3 0 0 3

OBJECTIVE
To bring awareness on experimental method of finding the response of the structure to different types of load.

UNIT I EXTENSOMETERS **8**
Principles of measurements, accuracy, sensitivity and range of measurements, mechanical, optical, acoustical and electrical extensometers and their uses, advantages and disadvantages**.**

UNIT II ELECTRICAL RESISTANCE STRAIN GAUGES **12**
Principle of operation and requirements, types and their uses, materials for strain gauge, calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheastone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT III PHOTOELASTICITY **12**
Two dimensional photo elasticity, Photo elastic materials, Concept of light - photoelastic effects, stress optic law, transmission and reflection polariscopes, interpretation of fringe pattern, compensation and separation techniques, introduction to three dimensional photo elasticity.

UNIT IV BRITTLE COATING AND MOIRE METHODS **5**
Introduction to Moiré techniques, brittle coating methods and holography

UNIT V NON – DESTRUCTIVE TESTING **8**
Fundamentals of NDT, radiography, ultrasonics, Eddy current testing, fluorescent penetrant testing, acoustic emission technique,

TOTAL: 45

TEXT BOOKS
1. Dally, J.W., and Riley, W.F., Experimental Stress Analysis, McGraw Hill Inc., New York 1998.
2. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., Experimental Stress Analysis, Tata McGraw Hill, New Delhi, 1984.

REFERENCES
1. Hetenyi, M., Hand book of Experimental Stress Analysis, John Wiley and Sons Inc., New York, 1972.
2. Pollock A.A., Acoustic Emission in Acoustics and Vibration Progress, Ed. Stephens R.W.B., Chapman and Hall,1993.
3. Max Mark Frocht, Photo Elasticity, John Wiley and Sons Inc., New York, 1968
4. A.J.Durelli, Applied Stress Analysis, Prentice Hall of India Pvt Ltd., New Delhi,

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AEX 009 **THEORY OF PLATES AND SHELLS** **L T P C**
3 0 0 3

OBJECTIVE

To study the behaviour of the plates and shells with different geometry under various types of loads.

UNIT I CLASSICAL PLATE THEORY **8**

Classical plate theory – assumptions – differential equations – boundary conditions – axi-symmetric loading

UNIT II PLATES OF VARIOUS SHADES **10**

Navier's method of solution for simply supported rectangular plates – Levy's method of solution for rectangular plates under different boundary conditions –annular plates – plates of other shapes.

UNIT III SHELLS **8**

Basic concepts of shell type of structures – membrane and bending theories for circular cylindrical, spherical, conical shells.

UNIT IV EIGEN VALUE ANALYSIS **10**

Stability and free vibration analysis of rectangular plates, circular cylindrical, conical shells.

UNIT V APPROXIMATE METHODS **9**

Rayleigh – Ritz, Galerkin Methods– Finite Difference Method – Application to Rectangular Plates, circular cylindrical, conical shells for Static condition.

TOTAL : 45

TEXT BOOK

1. Timoshenko, S.P. Winowsky. S., and Kreger, Theory of Plates and Shells, McGraw Hill Book Co., 1990.
2. Varadhan.T.K. & Bhaskar.K., "Analysis of Plates – Theory and Problems", Narosa Publishing House, 2000

REFERENCES:

1. Flugge, W. Stresses in Shells, Springer – Verlag, 1985.
2. Timoshenko, S.P. and Gere, J.M., Theory of Elastic Stability, McGraw Hill Book Co.1986.
3. Harry Kraus, 'Thin Elastic Shells', John Wiley and Sons, 1987.
4. Llyod Hamilton Donald, "Beams, Plates and Shells", McGraw Hill, 1976.
5. Ansel Ugural, Stresses in Plates & Shells, McGraw Hill, 1981
6. Reddy.J.N., "Theory & Analysis of Elastic Plates", CRC, I Edition 1999

AEX 010 INDUSTRIAL AERODYNAMICS L T P C
3 0 0 3

OBJECTIVE

- To develop a working knowledge of experimental test facilities, techniques and equipment commonly used in the field of experimental aerodynamics.
- To develop a basic proficiency in digital data acquisition and analysis techniques.
- To apply statistical, regression and uncertainty analysis techniques to reduce, assess, quantify and validate data sets from experiments.
- To refine report writing and data presentation skills.

UNIT I ATMOSPHERE 9

Types of winds, causes of variation of winds, atmospheric boundary layer, effect of terrain on gradient height, structure of turbulent flows.

UNIT II WIND ENERGY COLLECTORS 9

Horizontal axis and vertical axis machines, power coefficient, betz coefficient by momentum theory.

UNIT III VEHICLE AERODYNAMICS 9

Power requirements and drag coefficients of automobiles, effects of cut back angle, aerodynamics of trains and hovercraft.

UNIT IV BUILDING AERODYNAMICS 9

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

UNIT V FLOW INDUCED VIBRATIONS 9

Effects of reynolds number on wake formation of bluff shapes, vortex induced vibrations, galloping and stall flutter.

TOTAL : 45

TEXT BOOKS

1. M.Sovran (Ed), “Aerodynamics and drag mechanisms of bluff bodies and road vehicles”, Plenum press, New York, 1978.
2. P. Sachs, “Winds forces in engineering”, Pergamon Press, 1978.

REFERENCES

1. R.D. Blevins, “Flow induced vibrations”, Van Nostrand, 1990.
2. N.G. Calvent, “Wind Power Principles”, Charles Griffin & Co., London, 1979.

AEX 011 AIR TRAFFIC CONTROL AND AERODROME DESIGN L T P C
3 0 0 3

OBJECTIVE: To study the procedure of the formation of aerodrome and its design and air traffic control.

UNIT I BASIC CONCEPTS 9

Objectives of ATS - parts of ATC service – scope and provision of ATCs – VFR & IFR operations – classification of ATS air spaces – varies kinds of separation – altimeter setting procedures – establishment, designation and identification of units providing ATS – division of responsibility of control.

UNIT II AIR TRAFFIC SERVICES 9

Area control service, assignment of cruising levels minimum flight altitude ATS routes and significant points – RNAV and RNP – vertical, lateral and longitudinal separations based on time / distance –ATC clearances – flight plans – position report

UNIT III FLIGHT INFORMATION ALERTING SERVICES, COORDINATION, EMERGENCY PROCEDURES AND RULES OF THE AIR 10

Radar service, basic radar terminology – identification procedures using primary / secondary radar – performance checks – use of radar in area and approach control services – assurance control and co-ordination between radar / non radar control – emergencies – flight information and advisory service – alerting service – co-ordination and emergency procedures – rules of the air.

UNIT IV AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION 9

Aerodrome data - basic terminology – aerodrome reference code – aerodrome reference point – aerodrome elevation – aerodrome reference temperature – instrument runway, physical characteristics; length of primary / secondary runway – width of runways – minimum distance between parallel runways etc. – obstacles restriction.

UNIT V VISUAL AIDS FOR NAVIGATION, VISUAL AIDS FOR DENOTING OBSTACLES EMERGENCY AND OTHER SERVICES 8

Visual aids for navigation wind direction indicator – landing direction indicator – location and characteristics of signal area – markings, general requirements – various markings – lights, general requirements – aerodrome beacon, identification beacon – simple approach lighting system and various lighting systems – VASI & PAPI - visual aids for denoting obstacles; object to be marked and lighter – emergency and other services.

TOTAL : 45

TEXT BOOKS

1. AIP (India) Vol. I & II, “The English Book Store”, 17-1, Connaught Circus, New Delhi.

REFERENCES

1. “Aircraft Manual (India) Volume I”, latest Edition – The English Book Store, 17-1, Connaught Circus, New Delhi.
2. “PANS – RAC – ICAO DOC 4444”, Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.

AEX 012 FATIGUE AND FRACTURE MECHANICS L T P C
3 0 0 3

OBJECTIVE

To study the concepts of estimation of the endurance and failure mechanism of components

UNIT I FATIGUE OF STRUCTURES 7

S.N. curves - endurance limits - effect of mean stress, goodman, gerber and soderberg relations and diagrams - notches and stress concentrations - neuber's stress concentration factors - plastic stress concentration factors - notched S.N. curves.

UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR 10

Low cycle and high cycle fatigue - Coffin - Manson's relation - transition life – cyclic strain hardening and softening - analysis of load histories - cycle counting techniques - cumulative damage - Miner's theory - other theories.

UNIT III PHYSICAL ASPECTS OF FATIGUE 10

Phase in fatigue life - crack initiation - crack growth - final fracture -dislocations -fatigue fracture surfaces.

UNIT IV FRACTURE MECHANICS 10

Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin - Orwin extension of Griffith's theory to ductile materials - stress analysis of "cracked bodies - effect of thickness on fracture toughness - stress intensity factors for typical 'geometries.

UNIT V FATIGUE DESIGN AND TESTINIG 8

Safe life and fail-safe design philosophies - importance of fracture mechanics in aerospace structures - application to composite materials and structures.

TOTAL: 45

TEXT BOOK

1. Prasanth Kumar – Elements of fracture mechanics – Wheeter publication, 1999.
2. Barrois W, Ripely, E.L., "Fatigue of aircraft structure," _ Pergamon press. Oxford, 1983.

REFERENCES:

1. Sih C.G., "Mechanics of fracture." Vol - I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1989.
2. Knott, J.F., "Fundamentals of Fracture Mechanics," - Buterworth & Co., Ltd., London, 1983.
3. Kare Hellan ,'Introduction to Fracture Mechanics', McGraw Hill, Singapore,1985

AEX 013 COMPUTER INTEGRATED MANUFACTURING **L T P C**
3 0 0 3

OBJECTIVE

- To gain knowledge on how computers are integrated at various levels of planning and manufacturing.
- To understand the flexible manufacturing system and to handle the product data and various software used for manufacturing

UNIT I INTRODUCTION **8**

The meaning and origin of CIM- the changing manufacturing and management scene - external communication - islands of automation and software-dedicated and open systems-manufacturing automation protocol - product related activities of a company-marketing engineering - production planning - plant operations - physical distribution-business and financial management.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

History of group technology- role of G.T. in CAD/CAM integration - part families - classification and coding - DCLASS and MICLASS and OPITZ coding systems-facility design using G.T. - benefits of G.T. - cellular manufacturing.

Process planning - role of process planning in CAD/CAM integration - approaches to computer aided process planning - variant approach and generative approaches - CAPP and CMPP process planning systems.

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS **9**

Shop floor control-phases -factory data collection system -automatic identification methods- Bar code technology-automated data collection system.

FMS-components of FMS - types -FMS workstation -material handling and storage systems- FMS layout -computer control systems-application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION **10**

CIM and company strategy - system modeling tools -IDEF models - activity cycle diagram CIM open system architecture (CIMOSA)- manufacturing enterprise wheel-CIM architecture- Product data management-CIM implementation software.

Communication fundamentals- local area networks -topology -LAN implementations - network management and installations.

UNIT V OPEN SYSTEM AND DATABASE FOR CIM **8**

Open systems-open system inter connection - manufacturing automations protocol and technical office protocol (MAP /TOP)

Development of databases -database terminology- architecture of database systems-data modeling and data associations -relational data bases - database operators - advantages of data base and relational database.

TOTAL : 45

TEXT BOOK

1. Mikell.P.Groover “Automation, Production Systems and computer integrated manufacturing”, Pearson Education 2001.

REFERENCES

1. Yorem koren, “Computer Integrated Manufacturing System”, McGraw-Hill, 1983.
2. Ranky, Paul G., “Computer Integrated Manufacturing”, Prentice Hall

International, 1986.
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe “Computer Integrated Design and Manufacturing”, McGraw-Hill Inc.
4. Roger Hanman “Computer Intergrated Manufacturing”, Addison – Wesley, 1997.
5. Mikell.P.Groover and Emory Zimmers Jr., “CAD/CAM”, Prentice Hall of India Pvt. Ltd., New Delhi-1, 1998.
6. Kant Vajpayee S, “Principles of Computer Integrated Manufacturing”, Prentice Hall India, 2003.
7. Radhakrishnan P, Subramanyan S.and Raju V., “CAD/CAM/CIM”, 2nd Edition New Age International (P) Ltd., New Delhi, 2000.

AEX 014 AIRCRAFT RULES AND REGULATION L T P C
3 0 0 3

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

UNIT I C.A.R SERIES 'A' - PROCEDURE FOR CIVIL AIR WORTHINESS REQUIRMENTS AND RESPONSIBILITY OPERATORS VIS-À-VIS AIR WORTHINESS DIRECTORATE: 8
Responsibilities of operators / owners; procedure of CAR issue, amendments etc.,
objectives and targets of airworthiness directorate; airworthiness regulations and safety oversight of engineering activities of operators. C.A.R. SERIES 'B' - ISSUE APPROVAL OF COCKPIT CHECK LIST, MEL, CDL: Deficiency list (MEL & CDL); preparation and use of cockpit check list and emergency list.

UNIT II C.A.R. SERIES 'C' - DEFECT RECORDING, MONITORING, INVESTIGATION AND REPORTING 7
Defect recording, reporting, investigation, rectification and analysis; flight report;
reporting and rectification of defects observed on aircraft; analytical study of in-fight readings & recordings; maintenance control by reliability method. **C.A.R. SERIES 'D' - AND AIRCRAFT MAINTENANCE PROGRAMMES:** reliability programme (engines); aircraft maintenance programme & their approval; on condition maintenance of reciprocating engines; TBO - revision programme; maintenance of fuel and oil uplift and consumption records - light aircraft engines; fixing routine maintenance periods and component tbos - initial & revisions.

UNIT III C.A.R. SERIES 'E' - APPROVAL OF ORGANISATIONS: 10
Approval of organizations in categories A, B, C, D, E, F, & G; requirements of infrastructure at stations other than parent base. C.A.R. SERIES 'F' - **AIR WORTHINESS AND CONTINUED AIR WORTHINESS:** Procedure relating to registration of aircraft; procedure for issue / revalidation of type certificate of aircraft and its engines / propeller; issue / revalidation of certificate of airworthiness; requirements for renewal of certificate of airworthiness.

UNIT IV C.A.R. SERIES 'L' - AIRCRAFT MAINTENANCE ENGINEER -LICENSING
8
Issue of AME licence, its classification and experience requirements, complete Series 'L'. **C.A.R. SERIES 'M' MANDATORY MODIFICATIONS AND INSPECTIONS:** mandatory modifications / inspections.

UNIT V C.A.R. SERIES 'T' - FLIGHT TESTING OF AIRCRAFT 12
Flight testing of (series) aircraft for issue of C of A; fight testing of aircraft for which C or A had been previously issued. C.A.R. SERIES 'X' - ISCELLANEOUS
REQUIREMENTS: Registration Markings of aircraft; weight and balance control of an aircraft; provision of first aid kits & physician's kit in an aircraft; use furnishing materials in an aircraft; concessions; aircraft log books; document to be carried on board on indian registered aircraft; procedure for issue of taxy permit; procedure for issue of type approval of aircraft components and equipment including instruments.

TOTAL: 45

REFERENCES
1. " Aircraft Manual (India) ", Volume - Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.
2. " Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness) ", Published by DGCA, The English Book Store, 17-1, Connaught Circus, New Delhi.
3. " Aeronautical Information Circulars (relating to Airworthiness) ", from DGCA.
4. " Advisory Circulars ", form DGCA. as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sam ple Cod e of Conduct

AEX 015 PROFESSIONAL ETHICS IN ENGINEERING **L T P C**
3 0 0 3

OBJECTIVE

- 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 **10**

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 issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – models of professional roles - theories about right action - self-interest - customs and religion - uses of ethical theories.

UNIT 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 **8**

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

TOTAL: 45

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.

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APPLICATION FOR PERMISSION (FOR TEACHING/NON-TEACHING STAFF)

Name :

Designation :

Department :

Date of Permission & Hour : On _____ From _____ To _____

Reason : :

Date _____ Signature of Applicant

Signature of HOD

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