AERONAUTICAL ENGG
B TECH COURSE

THIRD SEMESTER

Subject Code	Name of Subject	Teaching Period			Credit
		L	T	P	C
03BAE101	Fluid Mechanics	3	1	0	4
03BAE102	Mechanics of Solids	3	0	0	3
03BAE103	Aero Engineering Thermodynamics	3	0	0	3
03BAE104	Computing Skills & software Development	3	0	0	3
03BAE105	Properties of Materials	3	0	0	3
03BAE106	Advanced Engineering Mathematics	3	1	0	4
PRACTICAL					
03BAE201	Strength of Materials Lab	0	0	3	2
03BAE202	Thermodynamics Lab	0	0	3	2
03BAE203	Fluid Mechanics Lab	0	0	3	2
03BAE204	Computer Programming lab	0	0	3	2
03BAE301	Discipline and extra curricular activity			4	1
	TOTAL	18	2	16	29

FOURTH SEMESTER

Subject Code	Name of Subject	Teaching Period			Credit
		L	T	P	C
04BAE101	Elements of Aeronautics	3	0	0	3
04BAE102	Aircraft Systems and Instruments	3	1	0	4
04BAE103	Control Engineering	3	1	0	4
04BAE104	Aero Dynamics I	3	0	0	3
04BAE105	Air Craft Structure I	3	0	0	3
04BAE106	Mechanics Of Machines	3	0	0	3
PRACTICAL					
04BAE201	Aero Dynamics Lab	0	0	3	2
04BAE202	Design and Computer aided modeling Lab	0	0	3	2
04BAE203	Aircraft Structure Lab I	0	0	3	2
04BAE204	Control lab	0	0	3	2
4BAE301	Discipline and extra curricular activity	0	0	4	1
	TOTAL	18	2	16	29

FIFTH SEMESTER

Subject Code	Name of Subject	Teaching Period			Credit
		L	T	P	C
05BAE101	Propulsion I	3	0	0	3
05BAE102	Aircraft Structures II	3	0	0	3
05BAE103	Aerodynamics II	3	1	0	4
05BAE104	Flight Dynamics	3	0	0	3
05BAE105	Aircraft General Engineering Practices	3	0	0	3
05BAE106	Micro Processor & Applications	3	0	0	3
PRACTICAL					
05BAE201	Air Craft Structure Lab II	0	0	3	2
05BAE202	Air Craft repair Lab	0	0	3	2
05BAE203	Cad/ Cam Lab	0	0	3	2
05BAE204	Micro processor Lab	0	0	3	2
05BAE301	Discipline and extra curricular activity			4	1
	TOTAL	18	1	16	28

SIXTH SEMESTER

Subject Code	Name of Subject	Teaching Period			Credit
		L	T	P	C
06BAE101	Propulsion II	3	0	0	3
06BAE102	Heat Transfer	3	0	0	3
06BAE103	Composite materials and structures	3	0	0	3
06BAE104	Aircraft engine and instrument system	3	1	0	4
06BAE105	Experimental Stress Analysis	3	0	0	3
06BAE106	Air Craft Stability and Control	3	1	0	4
PRACTICAL					
06BAE201	Propulsion Lab	0	0	3	2
06BAE202	Air Craft Design Project - I	0	0	3	2
06BAE203	Aero Dynamics Lab	0	0	3	2
06BAE204	Technical Seminar	0	0	3	2
06BAE301	Discipline and extra curricular activity	0	0	4	1
	TOTAL	18	2	16	29

SEVENTH SEMESTER

Subject Code	Name of Subject	Teaching Period			Credit
		L	T	P	C
07BAE101	Air transportation and aircraft maintenance management	3	0	0	3
07BAE102	Avionics	3	0	0	3
07BAE103	Rockets and Missiles	3	0	0	3
07BAE104	Principles of Environmental Science and Engineering	3	0	0	3
07BAE105	Air craft General Engineering and Maintenance Practice	3	1	0	4
07BAE106	Air Craft Rules and regulations	3	1	0	4
P7ACTICAL					
07BAE201	Aircraft Engine Repair and Maintenance Lab	0	0	3	2
07BAE202	Aircraft Design Project II	0	0	3	2
07BAE203	Minor Project	0	0	3	2
07BAE204	Avionics lab	0	0	3	2
07BAE301	Discipline and extra curricular activity	0	0	4	1
	TOTAL	18	2	16	29

EIGHTH SEMESTER

Subject Code	Name of Subject	Teaching Period			Credit
		L	T	P	C
8BAE101	Total Quality Management	3	1	0	4
8BAE102	Fuels & propellant Technology	3	0	0	3
8BAE103	Aircraft design	3	0	0	3
8BAE104	Helicopter Aerodynamics	3	0	0	3
PRAT1CAL					
8BAE201	Project Work	0	0	6	5
8BAE202	Computer Added Air Craft Design Lab	0	0	3	2
8BAE203	Seminar	0	0	3	3
8BAE204	Discipline and extra curricular activity			4	1
	TOTAL	12	1	16	24

FLUID MECHANICS
Course/Paper 03BAE 101
BAE Semester III

UNIT - 1
Basic Definitions and Fluid Properties ; Definition of Fluid, Incompressible and compressible fluids, Fluid as a continuum, Mass, Density, specific weight, relative density, specific volume, Bulk modulus, velocity of sound Ideal fluid Viscosity. Newtonian and Non - Newtonian fluid, Kinematics' viscosity, Effect of temperature and pressure on viscosity, surface tension capillarity, vapour pressure and cavitation. Fluid Statics : General differential equation, Hydrostatics Manometry, Fluid forces on submerged surfaces. Curved surfaces, Aerostatics, Isothermal atmosphere, polytropic atmosphere. The international standard atmosphere, static stability The international standard
atmosphere submerged bodies. Floating bodies.

UNIT - 2
Kinematics and conservation of Mass : Flow classifications. Fluid velocity and acceleration, streamlines and the stream function. Pathlines and streak lines. Deformation of a fluid element, verticity and circulation. Irrotational and Rotational flow. Flownet, Laplace equation. Conservation of mass and the continuity equation for three dimensions. Fluid Momentum : The Momentum theorem Applications of the momentum theorem Equation of motion, Euler's equation of motion Integration of Euler's equation of motion. Bernoulli's equation. Applications of Bernoulli's Pitot tube, Equation of motion for Viscous fluid, Navier Stoke's equation.

UNIT - 3
Orifice discharging free, Jet, vena contracts, co-efficient of contraction, velocity and discharge, coefficient of resistance. Orifices and mouthpieces Nozzles and weires. Flow Through Pipes : Reynold's experiment Darcy's Weisback equation. Loss of head due tosudden enlargements, contraction, entrance, exit obstruction, bend, pipe fittings. Total and Hydraulic grandient lines, Flow through pipe line. Pipes in series, parallel Transmission of power through pipes.

UNIT - 4
Laminar Flow: Simple solution of Navier Stokes equations. Hagen – Poiseuille flow. Plans Poiseuille flow and coutte flow. Turbulent Flow; Variation of friction factor with Reynold's number. The Prandt Mixing length hypothesis applied to pipe flow, velocity distribution in smooth pipes, sough pipes. The Universal pipe friction laws, Colebrook. White formula. Dimensional Analysis: Buckingham variables, Model Similitude, Force ratio, Reynolds, Froude's Mach, Weber and Euler numbers and their applications. Undistorted model distorted model scale effect.

UNIT - 5
The Boundary Layer: Description of the boundary layer. Boundary Layer thickness boundary layer separation and control. The Prandtl boundary layer equation. Solution for cominar boundary layer. The momentum equation for the boundary layer. The flat plate in uniform free stream with no pressures gradients. Approximate momentum analysis laminar boundary Aerofoils Theory. Flow round a body ; Drag skin friction drag, pressure drag, combined skin friction & pressure drag (Profile drag) wave drag, lift induced drag. Flow past sphere & Cylinder.

References
1. Engineering Fluid Mechanics : K.L.Kumar, Eurasia Publishing House Pvt Ltd
2. Fluid Mechanics and Machines : F.M. White ,John Wiley & Sons
3. Fluid Mechanics and Machines: A.K. Jain
4. Fluid Mechanics: V.L. Streeter, Mc Graw Hill
5. Fluid Mechanics and Hydraulic Machines: R.K. Bansal, Laxmi Publication New Delhi
6. Fluid Mechanics With Applications : S.K.Gupta V.Gupta, New Age Publications
7. Fluid Mechanics for Chemical engineers : Noel de Nevers ,Mc Graw HillII Edition 1991
8. Fluid mechanics for chemical engineers: James O wikes and Stacy G Bikes, Prentice Hall PTR (International seriesin chemical engineering)1999

MECHANICS OF SOLIDS

Course/Paper 03BAE 102
BAE Semester III
Unit – 1
Stress & strain: Tension, compression, shearing stress & strain; Poisson's ratio: Stress-strain relationship, Hooke's law; equations of static = w for 2D & 3D cars Elastic constants and their relations for a isotropic hookean material, anisotropy & orthotropy, thermal stresses, composite bars; simple elastic, plastic & visco-elastic behavior of common materials in tension and compression test, stress- strain curves. Concept of factor of safety & permissible stress. Conditions for equilibrium. Concept of free body diagram; Introduction to mechanics of deformable bodies.

Unit – 2
Members subjected to flexural loads: Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beams. Bending stresses, Section modulus and transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc.

Unit – 3
Principal planes, stresses & strains: Members subjected to combined axial, bending & Torsional loads, maximum normal & shear stresses; Concept of equivalent bending & equivalent twisting moments:
Mohr's circle of stress & strain.
Theories of Elastic Failures: The necessity for a theory, different theories, significance and comparison, applications.

Unit – 4
Torsion: Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity.
Stability of equilibrium: Instability & elastic stability. Long & short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations.

Unit – 5
Transverse deflection of beams: Relation between deflection, bending moment, shear force and load, Transverse deflection of beams and shaft under static loading, area moment method, direct integration method: method of superposition and conjugate beam method. Variational approach to determine deflection and stresses in beam.
Elastic strain energy: Strain energy due to axial, bending and Torsional loads; stresses due to suddenly applied loads; use of energy theorems to determine deflections of beams and twist of shafts.Castigliano's theorem. Maxwell's theorem of reciprocal deflections.

References
1. Strength of Materials : B.C Poonamia and ramamurtham, Dhanpatrai Publishers Delhi
2. Mechanics of solid : S.H.Crandell, N.C.Dahi and T.J. Lardner, Mc Graw Hill International Edition
3. Strength of Materials: G.H. Ryder, ELBS Publications co ltd
4. Elements of Strength of Material :J.P. Tinnoshnko and G.H.Young, Affiliated East west Press New Delhi
5. Solid Mechanic : GMA Kazmi, Tata Mc-Graw Hill Publishing Ltd., New Delhi Mc Graw Hill Publishing co Ltd New Delhi

AERO ENGINEERING THERMODYNAMICS

Course/Paper 03BAE 103
BAE Semester III
UNIT 1
Basic Concepts of Thermodynamics: Thermodynamics system, control volume, Properties, state, processes and cycle, equality of temperature, Zeroth Law of thermodynamics,

temperature scale, laws of perfect gas, Pure substances, vapour-Liquid –solid-phase equilibrium in a pure substances, thermodynamic surfaces

UNIT 2

Work and heat, Law of conservation of mass and energy, First law of thermodynamics, steady state Processes, Second law of thermodynamics, Heat engine, Carnot cycle, thermodynamic temperature scale, entropy, change of entropy for different processes, equivalence of Kelvin plank and clausius statements, clausius inequality.

UNIT 3

Available and unavailable energy, availability of a non flow and steady flow system, Helmbeltz and Gibb's functions, Thermodynamic Relations: Important mathematical relations, Maxwell relations, Tds Relations, Joule- Thomson coefficient, Clayperon relation.

UNIT 4

Air – standard power cycle, Brayton cycle, Otto cycle, diesel cycle, Dual cycle, Stirling cycle, Ericssion cycle and Atkinson cycle, Mean effective pressure and efficiencies, Four stroke petrol and diesel engine, Two stroke Petrol and diesel engine.

UNIT 5

Properties of steam, phase change process, use of steam table & molier char. Rankine cycle, Reheat cycle, Regenerative cycle, cogeneration vapour compression refrigeration cycle.

References
1. Thermodynamics: P.K.Nag
2. Engg. Thermodynamics : Goyal

COMPUTING SKILLS & SOFTWARE DEVELPOPMENT

Course/Paper 03BAE 104
BAE Semester III

Unit 1

Computer software: Spreadsheets (e.g. Microsoft Excel, including Macros) Engineering Application (e.g. Engineering Evolution solver), a Mathematical Simulation package (e.g. MATLAB).Use of this software in analysis of simple Engineering system

Unit II

System analysis , system elements & characteristics, software development life cycle , software development process models (waterfall model , spiral model)

Unit III

Introduction to data structures, singly linked lists, doubly linked lists, circular list.

Unit IV

Trees- Binary trees, terminology, representation, traversals, graphs – terminology, representation graph traversals (dfs & bfs).

Unit V

Representing stacks and queues in c using arrays and linked lists, infix to post fix conversion, post fix expression evaluation.

References
1. D.S.A : (SCHAUM'S)
2. SOFTWARE ENGINEERING : (SHAHINI PURI)

PROPERTIES OF MATERIALS

Course/Paper 03BAE 105
BAE Semester III

UNIT 1
Atomic structure of Metals: Crystal structure, crystal lattice of (i) Body centred cubic (ii) Face centred cubic (iii) Closed packed hexagonal, crystallographic Notation of atomic planes and Directions (Miller Indices), polymorphism and allotropy, Crystal imperfection.

UNIT 2
Theories of plastic deformation. Phenomenon of slip, twinning and dislocation. Identification of crystallographic possible slip planes and direction in FCC, BCC, HCP. Recovery and recrystallization, preferred orientation causes and effects on the property of metals. Transformation of austentite,martensite,pearlite,troosites. Application of TTT curves.

UNIT 3
Engineering properties and their measurements, Principles and applications of annealing, normalising, hardening, tempering. Recovery and re-crystallization. Hardenability – Brinell,Rockwell,barcol tester. Temper brittleness - its causes and remedies. plain carbon steel, alloy steels, cast iron and Non-ferrous metals and their alloys.
Chemical Heat treatment of steels: Physical principles involved in chemical heat treatment procedure for carburizing, Nitriding, Cyaniding, carbo-nitriding of steel.

UNIT 4
Effects produced by Alloying element on the structures and properties of steel Distribution of alloying elements (Si, Mn, Ni, Cr, Mo, Co, W, Ti, Al) in steel, structural classes of steel. Classification of steels. 18-8 stainless steel and characteristics.

UNIT 5
Corrosion- effects-removal in aircraft prones areas ,anodizing , alodising thermosetting plastics and thermoplastics,tempered glass and its use in windshields and windows in aircraft.

References:-
1) AIRCRAFT MATERIALS AND PROCESSES:-J.TITTERTON
2) MATERIAL SCIENCE :- R.K. GOYAL

ADVANCED ENGINEERING MATHEMATICS

Course/Paper 03BAE 106
BAE Semester III

UNIT 1
Fourier series: Fourier series, Half-range series, Harmonic analysis. Integral Transforms: Fourier integral theorem, Fourier transforms, Convolution theorems, Inversion theorem for Fourier and Laplace transforms, Simple applications of these transforms to one-dimensional problems.

UNIT 2
Method of separation of variables - applications to the solution of wave equation in one dimension, laplace's equation in two dimensions, Diffusion equation in one dimension. Transform calculus : Laplace transform with its simple properties, applications to the solutions of ordinary and partial differential equations having constant co-efficient with special reference to wave and diffusion equation.

UNIT 3
Complex Variable: Functions of a complex variable; Exponential, trigonometric, hyperbolic and logarithmic functions; Differentiation, Analytic functions, Cauchy-Riemann equations,

conjugate functions; Application to two dimensional potential problems; Conformal transformations, Schwartz- Christoffel transformation; Cauchy's Integral theorem. Taylor's and Laurent's expansions; Branch points, zeros, poles and residues; Simple problems on contour integration

UNIT 4

Boundary Value Problems: Equations for vibrations of strings, heat flow and electrical transmission lines; Laplace's equation in Cartesian, cylindrical polar and spherical polar coordinates; Solution by separation of variables. Solution in Series: Differentiation and integration of infinite series, Series solution of differential equations; Bessel and Legendre equations, their series solution, elementary properties of Bessel functions and Legendre polynomials

UNIT 5

Numerical Methods: Difference operators: forward, backward, central shift and average operators and relations between them.

Newton Backward and Interpolation; Lagrange's interpolation and the error formula for interpolation.Numerical differentiation and integration. Trapezoidal rule and Simpson's one-third rule including error formula

References
1.MATHEMATICS III : (GOKHUROO)
2. MATHEMATICS III : (ASHIRWAD)

STRENGTH OF MATERIALS LAB
Course/Paper 03BAE 201
BAE Semester III

LIST OF EXPERIMENTS

1. Izod Impact testing.
2. Rockwell Hardness Testing.
3. Spring Testing
4. Column Testing for buckling
5. Torsion Testing
6. Tensile Testing
7. Compression Testing
8. Shear Testing
9. Brinell Hardness Testing
10. Bending Test on UTM.
11. Study of Fatigue Testing Machine.

THERMODYNAMICS LABORATORY
Course/Paper 03BAE 202
BAE Semester III

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.

FLUID MECHANICS AND MACHINERY LABORATORY
Course/Paper 03BAE 203
BAE Semester III

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

COMPUTER PROGRAMMING LAB
Course/Paper 03BAE 201
BAE Semester III

List of programs in C:
1. Program for revising control statements, arrays and functions.
2. Program using string handling and various functions described in string.h, ctype.h.
3. Program using structures and sorting algorithm (Insertion, Selection, Quick, Heap sort) and
functions described in math.
4. Program using file handling and related functions defined in stdio.h, io.h.
5. Program using pointers, array and pointers, pointers to structures, dynamic memory allocation.

List of Programs in C++
6. Program using basic I/O and control statements.
7. Program using class, objects, objects as function parameters.
8. Program using functions and passing reference to a function, inline functions. Program using
Inheritance and virtual base class.
9. Program using pointers, arrays, dynamic arrays. Program using functions defined in ctype.h and string.h.
10. Program using constructors, destructors. Program using function and operator over loading
List of program in C++ implementing Data Structures
11. Creating and managing (add, delete, print, insert) nodes of a Linked list.
12. Creating and managing (create, pop, push etc.) stacks and queues.

ELEMENTS OF AERONAUTICS

Course/Paper 04BAE 101
BAE Semester IV

1.   HISTORICAL EVALUATION

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

2. AIRCRAFT CONFIGURATIONS

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.

3. INTRODUCTION TO PRINCIPLES OF FLIGHT

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

4. INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS

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.

5. POWER PLANTS USED IN AIRPLANES

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.

References
1.   Anderson, J.D., "Introduction to Flight", McGraw-Hill, 1995.
        REFERENCE
1.   Kermode, A.C., "Flight without Formulae", McGraw-Hill, 1997.

AIRCRAFT SYSTEMS AND INSTRUMENTATIONS

Course/Paper 04BAE 102
BAE Semester IV

1. AIRPLANE CONTROL SYSTEMS

Flight control system-hydraulic operated controls-cables guides-mechanical linkage-torques tubes-stops-control snubbers and locking devices.-Aircraft Rigging and checks.-push pull rod and fairleads-Application of aircraft cables tensiometer- Modern flight actuated control surfaces-Autopilot system-digital fly by wire systems.

2. AIRCRAFT SYSTEMS

Hydraulic fluids-characteristics-types, Hydraulic system,types aircraft systems pumps,pneumatic system,landing gear-parts-types-bleeding-maintenance,brakes system-single,multi disc brakes-expander types,retraction mechanism, steering system,bogie landing gear,tyres and it maintenances.

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ENGINE SYSTEMS

3. Fuel systems for Piston and jet engines, - lubricating systems for piston and jet engines - Starting and Ignition systems.

4. AUXILLIARY SYSTEM

Oxygen systems - Fire protection systems, Deicing and anti icing systems,rain repellant system, vapour cycle process,

5. AIRCRAFT INSTRUMENTS

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.

References:-
1.FAA-15A,airframe and powerplant handbook,airfame mechanics
2.FAA-12A, airframe and powerplant handbook,powerplant mechanics

CONTROL ENGINEERING
Course/Paper 04BAE 103
BAE Semester IV

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

3.   CHARACTERISTIC EQUATION AND FUNCTIONS
Lap lace transformation, Response of systems to different inputs viz., Step input, impulse, ramp, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.
4.   CONCEPT OF STABILITY
Necessary and sufficient conditions, Routh – Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.
5.   SAMPLED DATA SYSTEMS
Introduction to digital control system, Digital Controllers and Digital PID Controllers.
References

1. OGATO, "Modern Control Engineering", Prentice – Hall of India Pvt. Ltd. New Delhi, 1998.
2. GOPAL.M. "Control Systems, Principles and design" – Tata McGraw-Hill Publication, New Delhi, 2000.
3. Azzo, J.J.D. and C.H. Houpis, "Feed back control system analysis and synthesis", McGraw – Hill International, 3rd Edition, 1998.
4. Kuo, B.C., "Automatic control systems", Prentice – Hall of India Pvt. Ltd., New Delhi, 1998.
5. Houpis, C.H. and Lamont, G.B., "Digital Control Systems", McGraw-Hill Book Co. New York, USA 1995.
6. Naresh K. Sinha, "Control Systems", New Age International Publishers, New Delhi

AERODYNAMICS – I
Course/Paper 04BAE 104
BAE Semester IV
1.   REVIEW OF BASIC FLUID MECHANICS
Continuity, momentum and energy equations.
2.   TWO DIMENSIONAL FLOWS
Basic flows   – Source, Sink, Free and Forced vortex, uniform parallel flow. Their combinations, Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows. Kutta Joukowski's theorem.
3.   CONFORMAL TRANSFORMATION

Joukowski transformation and its application to fluid flow problems, Kutta condition, Blasius theorem.

4. AIRFOIL AND WING THEORY

Joukowski, Karman - Trefftz, Profiles - Thin aerofoil theory and its applications. Vortex line, Horse shoe vortex, Biot and Savart law, Lifting line theory and its limitations.

5. VISCOUS FLOW

Newton's law of viscosity, Boundary Layer, Navier-Stokes equation, displacement, Momentum thickness, Flow over a flat plate, Blasins solution.

References
1.   Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York, 1985.
       REFERENCES
1.   Houghton, E.L., and Carruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, 1989.
2.   Milne Thomson, L.H., "Theoretical aerodynamics", Macmillan, 1985.
3.   Clancey, L.J., "Aerodynamics", Pitman, 1986

AIRCRAFT STRUCTURES – I
Course/Paper 04BAE 105
BAE Semester IV

1. STATICALLY DETERMINATE STRUCTURES

Analysis of plane truss – Method of joints – 3 D Truss - Plane frames

2. STATICALLY INDETERMINATE STRUCTURES

Composite beam - Clapeyron's Three Moment Equation - Moment Distribution Method.

3. ENERGY METHODS

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

4. COLUMNS

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

5. FAILURE THEORY

Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.

References
1.   Donaldson, B.K., "Analysis of Aircraft Structures – An Introduction", McGraw-Hill, 1993.

2.   Timoshenko, S., "Strength of Materials", Vol. I and II, Princeton D. Von Nostrand Co, 1990.

MECHANICS OF MACHINES
Course/Paper 04BAE 106
BAE Semester IV

1. MECHANISMS

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

2. FRICTION

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

3. GEARING AND CAMS

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

4. BALANCING

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

5. VIBRATION

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.

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

AERODYNAMICS LABORATORY
Course/Paper 04BAE 201
BAE Semester IV
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.

DESIGN AND COMPUTER AIDED MODELING LAB
Course/Paper 04BAE 202
BAE Semester IV

. **LIST OF EXERCISES**
1. Design of riveted joints (Lap joint).
2. Design of riveted joints (Butt joint with single and double straps).
3. Design of welded joints.
4. Layout of typical wing structure.
5. Layout of typical fuselage structure.

6.   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

AIRCRAFT STRUCTURES LAB –I
Course/Paper 04BAE 203
BAE Semester IV

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.

CONTROL LABORATORY
Course/Paper 04BAE 204
BAE Semester IV

List of Experiments

1.   Block diagram reduction technique
2.   Block diagram formation for Control Systems.
3.   Step Response of 2nd order transfer function
4.   Root Locus Plot
5.   Bode Plot
6.   Laplace & inverse laplace
7.   Polar plot & Nyquist Stability Criterion
8.   Hydraulic System
9.   Convert Transfer function to State Space & Vice Versa
10. Calculate Observability & Controlability

PROPULSION – I
Course/Paper 05BAE 101
BAE Semester V
1.   FUNDAMENTALS OF GAS TURBINE ENGINES
Illustration of working of gas turbine engine – The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet – Performance characteristics.
2.   SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES
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.
3.   COMBUSTION CHAMBERS

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

4.   NOZZLES

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

5.   COMPRESSORS

Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of prewhirl – Rotation stall – 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.

References

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

AIRCRAFT STRUCTURES – II
Course/Paper 05BAE 102
BAE Semester V

UNIT-1
INTRODUCTION TO STRUCTURE DESIGN

- Steps in structural design
- Applied loads and temperture
- Actual stressband deflections
- Airworthiness and Airframe loads

UNIT-2
SHEAR FLOW IN OPEN SECTION

- Bending of thin plates
- Torsion of thin open walls
- Moment equation for thin plates under stress

UNIT-3
UNSYMMETRICAL AND SYMMETRICAL BENDING

- Difference between unsymmetrical and symmetrical bending
- Bending stress of beams section,cricular section,rectangular section

UNIT-4
STRESS AND STRAIN

- Definition and Notations
- Equations of Equilibrium using stress
- Tensile test explantion

- Compression and shear tests

UNIT-5
COLUMNS AND STRUTS

- Classification of columns
- Bucking of axillay loads compression member
- Eulers theory for long columns
- factors of safty

SHEAR STRESS DISTRIBUTION

- Derivation of shear stress equation
- Shear stress distribution of Rectangular section
- shear stress distribution of circular section
- shear stress distribution of I section

BOOK NAME :1)MECHANICS OF SOLIDS
                DR.ASHISH DUTT SHARMA
                SANJEEV SIPANI
                LADELY MOHAN VERMA

        2) THEORY AND ANALYSIS OF FLIGHT STRUCTURES
                ROBERT .M.RIVELLO

AERODYNAMICS – II
Course/Paper 05BAE 103
BAE Semester V
1.   ONE DIMENSIONAL COMPRESSIBLE FLOW
Energy, Momentum, continuity and state equations, velocity of sound, Adiabatic steady state flow equations, Flow through converging, diverging passages, Performance under various back pressures.

2.   NORMAL, OBLIQUE SHOCKS AND EXPANSION WAVES
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.

3.   STEADY SUPERSONIC TWO DIMENSIONAL FLOW
Two dimensional equations-conservative farm,mach waves,small distance theory,supersonic flow overairfoi-general curved airfoil,transonic transitions,flat plate at angle of attack,diamond shaped airfoil,linearized flow-formulation,flow over a wavy wall

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

5. **HIGH SPEED WIND TUNNELS**
Blow down, in draft 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*.*

References
1. *Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2003.*
2. *Aerodynamics II –Prof.Joseph m.powers*
3. *Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1989.*
4. *Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, New York, 1979.*
5. *Anderson Jr., D., – "Modern compressible flows", McGraw-Hill Book Co., New York 1999.*

FLIGHT DYNAMICS
Course/Paper 05BAE 104
BAE Semester V
1. DRAG ON THE AIRPLANE
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.

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

3. STATIC LONGITUDINAL STABILITY
Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric maneuvers - Stick force gradients - Stick _ force per 'g' - Aerodynamic balancing. Determination of neutral points and maneuver points from flight test.

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

5. DYNAMIC STABILITY
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.

References

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, New York, 1988.
2. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.
3. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
4. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
5. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998.
6.

AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE PRACTICES

Course/Paper 05BAE 105
BAE Semester V
UNIT 1
Mooring, jacking, leveling and towing operations - Preparation - Equipment and precautions - Engine starting procedures - Piston engine, turboprops and turbojets - Engine fire extinguishing - Ground power units.
UNIT 2
Air conditioning and pressurization - Oxygen and oil systems - Ground units and their maintenance. Shop safety - Environmental cleanliness - Precautions. Process - Purpose - Types - Inspection intervals - Techniques - Checklist - Special inspection - Publications,
bulletins, various manuals - FAR Air worthiness directives - Type certificate Data Sheets - ATA specifications.
UNIT 3
Hand tools - Precision instruments - Special tools and equipments in an airplane maintenance shop - Identification terminology - Specification and correct use of various instruments. Nuts-Screw-Rivets-Bolts-Washer-Gasket-Wipers. American and British systems of specifications - Threads, gears, bearings, etc. - Drills, tapes & reamers - identification of all types of fluid line fittings. Materials, metallic and non-metallic.
UNIT 4
Cables - Swaging procedures, tests, Advantages of swaging over splicing.Plumbing Connecters,Painting techniques in aircraft.Dopes and its application.

References:-
1.FAA-9A, airframe and powerplant mechanics,general handbook
2.Shop theory- tatro

MICROPROCESSORS AND APPLICATIONS
Course/Paper 05BAE 106
BAE Semester V

1. SEMICONDUCTOR DEVICES
PN Junction diodes – Zenor Diodes – Tunnels Diodes- Thermistors – Transistors – FET and MOSFET – Silicon Controlled Rectifiers And Triacs – Their Applications – Half Wave and Full Wave Rectifiers – Filters – Ripple Factor – Zenor Regulators and AC Voltage Regulators – Principles and Types of Transistor Amplifers – RC Coupled, Transformer Coupled, Direct Coupled – Multistage, FET and Power Amplifers.
2. LINEAR AND DIGITAL ICS
IC Technology – Elements of Fabrication of Linear and Digital IC's – D/A and A/D Converters – Comparison Between Analog and Digital Systems – Number Representation – Binary, Octal and

Hexadecimal Number Systems – Logic Families and Logic Gates – Flip – Flops – Multi Vibrations Using IC's – Half and full Adder – Registers – Counters – Multiplexers- Demultiplexers – Decoders – Encoders.

3. MICROPROCESSORS

Block Diagram of Microprocessors – Architecture of Intel 8085 – Importance of Data, Address and Control Buses – Instruction Formats – Addressing Modes and Types of Intel 8085 – Instruction Set For 8085 – Development of Simple Language Assembly Programs – Architecture and Functioning of Processors like Z80, M6800 and Intel Family of 80 X86 Processors.

4. MICROPROCESSOR MEMORY DEVICES

RAM, ROM, EPROM – magnetic Bubble Memory – Floppy and Hard Disc – Interfacing of Memory Chips – CRT Terminals – Printers, Keyboards and their Interfacing – Parallel and Series Communication – Synchronous and Asynchronous Data Transfer – DMA Data Transfer.

5. APPLICATIONS

Microprocessor Applications in aerospace – Case study.

References
1. "Computer principles of architecture", Tata McGraw-Hill, New Delhi. 4th Edition 2002.
2. Goankar. R.S., "Microprocessors, Programming to Architecture 8085", Penram International publishing PVT Ltd, New Delhi. 5th Edition 2002
3. V.K. Mehta, "Principles of Electronics", S. Chand & Co, New Delhi, 2nd Edition 2002

4. Malvino A.P. Leach, D.P., "Digital Principles & Applications", Tata McGraw– Hill, 1990.
5. Goankar R.S., "Microprocessors Architecture. Programming and Applications", Wiley Eastern, 1992.
6. Ajit Pal., "Microprocessors", Tata McGraw-Hill, Revised Edition 1995.
7. Douglas, Hall, "Microprocessors and Interfacing", Tata McGraw–Hill, Revised Edition 1990.
8. Mathur A.P., "Introduction to Microprocessors", Tata McGraw–Hill, Revised Edition 1995.

AIRCRAFT STRUCTURES LAB – II
Course/Paper 05BAE 201
BAE Semester V
LIST OF EXPERIMENTS
1. Unsymmetrical bending of beams
2. Shear centre location for open sections
3. Shear centre location for closed sections
4. Constant strength beam
5. Flexibility matrix for cantilever beam
6. Beam with combined loading
7. Calibration of Photo- elastic materials
8. Stresses in circular discs and beams using photoelastic techniques
9. Vibrations of beams
10. *Wagner beam – Tension field beam*

AIRCRAFT STRUCTURES REPAIR LAB
Course/Paper 05BAE 202
BAE Semester V

LIST OF EXPERIMENTS
1. Aircraft wood gluing
2. Welded patch repair by TIG, MIG, PLASMA ARC.
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 repair.

CAD / CAM LABORATORY
Course/Paper 05BAE 203
BAE Semester V

LIST OF EXPERIMENTS
1.   Scaling, rotation, translation, editing, dimensioning – Typical CAD command
        structure.
2.   Wire frame modeling – surface modeling
3.   Solid Modeling
4.   Taper Turning – Straight Interpolation
5.   Taper Turning – Circular Interpolation
6.   Incremental programme G 90 operation.
7.   Mirroring.
8.   Incremental Programme G 91 operation
9.   Absolute Programme G 90 operation
10.   Absolute Programme G 91 operation

Electronics & Microprocessor Lab

Course/Paper 05BAE 204
BAE Semester V

LIST OF EXPERIMENTS
1. Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, reverse
   Saturation current and static & dynamic resistances.
2. Plot V-I characteristic of zener diode and study of zener diode as voltage regulator.
   Observe the effect of load changes and determine load limits of the voltage regulator.
3. Plot frequency response curve for single stage amplifier and to determine gain bandwidth
product.
4. Study all types of rectifier and measure the effect of filter network on D.C. voltage output
& ripple factor.
5. Op-Amp in inverting and non-inverting modes.
6. Op-Amp as scalar, summer and voltage follower.
7..Design LPF and HPF using Op-Amp 741
8. Design Oscillators using Op-Amp (i) RC phase shift (ii) Hartley (iii) Colpitts
USING MICROCONTROLLER
9.   Programme to multiply two 8-bit numbers.
10. Programme to generate and sum 15 fibanocci numbers.
11. Transfer of a block of data in memory to another place in memory in the direct and
    reverse order.
12. Searching a number in an array and finding its parity.

PROPULSION – II
Course/Paper 06BAE 101
BAE Semester VI

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

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

3. **FUNDAMENTALS OF ROCKET PROPULSION**
Operating principle – Specific impulse of a rocket – internal ballistics- Rocket nozzle classification – Rocket performance considerations – Numerical Problems.

4. **CHEMICAL ROCKETS**
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.

5. **ADVANTAGES OF PROPULSION TECHNIQUES**
Electric rocket propulsion – Ion propulsion techniques – Nuclear rocket – Types – Solar sail- Preliminary Concepts in nozzleless propulsion*.*

References
1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edn., 1993.
2. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 1999.
3. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., "Gas Turbine Theory", Longman Co., ELBS Ed., 1989.
4. Gorden, C.V., "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1989.
5. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988.

HEAT TRANSFER
Course/Paper 06BAE 102
BAE Semester VI

1. **HEAT CONDUCTION**
Basic Modes of Heat Transfer – One dimensional steady state heat conduction: Composite Medium – Critical thickness – Effect of variation of thermal Conductivity – Extended Surfaces – Unsteady state.
Heat Conduction: Lumped System Analysis – Heat Transfer in Semi infinite and infinite solids – Use of Transient – Temperature charts – Application of numerical techniques.

2. **CONVECTIVE HEAT TRANSFER**
Introduction – Free convection in atmosphere free convection on a vertical flat plate – Empirical relation in free convection – Forced convection – Laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations, application of numerical techniques in problem solving.

3. RADIATIVE HEAT TRANSFER

Introduction to Physical mechanism – Radiation properties – Radiation shape factors – Heat exchange between non – black bodies – Radiation shields.

4. HEAT EXCHANGERS

Classification – Temperature Distribution – Overall heat transfer coefficient, Heat Exchange Analysis – LMTD Method and E-NTU Method.

5. HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING

High-Speed flow Heat Transfer, Heat Transfer problems in gas turbine combustion chambers – Rocket thrust chambers – Aerodynamic heating – Ablative heat transfer.

References

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

COMPOSITE MATERIALS AND STRUCTURES
Course/Paper 06BAE 103
BAE Semester VI

UNIT 1

Advantages and applications of composite materials, reinforced fibres-types,Matrix Material.Basic design of composite structures pre peg structures.

UNIT 2

Micromechanics - Macromechanics - Netting analysis
Governing differential equation for a general laminate - Angle ply and cross ply laminates, Failure criteria for composites.

UNIT 3

Basic design concepts of sandwich construction - Materials used for sandwich construction - Failure modes of sandwich panels.

UNIT 4

Open and closed mould processes. Filament winding and on-line production method. Manufacture of fibers and properties.

References:-

1.Advanced composites material-cindy foreman
2. Jones, R.M., " Mechanics of Composite Materials ", McGraw Hill Kogakusha Ltd., Tokyo, 1985

AIRCRAFT ENGINE AND INSTRUMENT SYSTEM
Course/Paper 06BAE 104
BAE Semester VI

UNIT 1

Ignition and starting - Fuels and their characteristics for IC engines, contamination of fuels and prevention - Instruments for reciprocating engines.

UNIT 2

Fuels - Characteristics - Fuel Systems - Lubricant and Lubricant systems - Ignition and starting systems - Electronic Engine controls - Full Authority Digital Engine Control (FADEC)

- engine Indicating, warning and control systems - Instruments for gas turbine engine - Fire warning systems - Aircraft Instruments systems.

UNIT 3

Location, visibility and grouping of Instrument, Panels, Basic Instrument elements and Mechanism, Instrument Panels - Displays - Layouts - Grouping details of:

i) Pitot instrument & systems.

ii) Primary flight instruments.

iii) Heading indicating instruments.

iv) Remote indicating systems.

v) Synchronous data transmission systems.

vi) Flight director & Flight data recording systems.

vii) ECAM/EICAS/EFIS - Their concepts, detailed description maintenance and practices.

ECAM - Electronic Central Aircraft Monitor.

EICAS - Engine Indicator Crew Alert Systems.

EFIS - Electronic Flight Instruments Systems.

UNIT 4

Basic Principles - Equipment - Power Sources - Airborne Navigational Equipment - VHF - ILS - DME - ADF - Radar & Doppler Navigation - Inertial Navigation, VOR, MLS (Microwave Landing System) Cockpit Voice Recorder (CVR), ELT (Emergency Locator Transmitter).

UNIT 5

Source of power - DC and AC generators - Inverters, rectifiers, transformers, batteries - Airplane lighting - Power utilisation in airplanes.

References

1. Bent R.D. Mickinely, " Aircraft Maintenance and Repair ", 2nd Edition - McGraw Hill Inc., New York, 1978.
2. Casamassa J.V. & Bent R., " Jet Aircraft Power Systems ", McGraw Hill Book Co., New York, 1975.
3. Adams H.W., " Aircraft Hydraulic ", McGraw Hill Book Co. Inc., New York, 1943

EXPERIMENTAL STRESS ANALYSIS

Course/Paper 06BAE 105
BAE Semester VI

1. **MEASUREMENTS**

   Principles of measurements, Accuracy, Sensitivity and range of measurements.

   1. **EXTENSOMETERS**

      Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

   2. **ELECTRICAL RESISTANCE STRAIN GAUGES**

      Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheastone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

4. **PHOTOELASTICITY**

   Two dimensional photo elasticity, Concept of light – photoelastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

   1. **NON – DESTRUCTIVE TESTING**

      Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Introduction to Moiré techniques, Holography, ultrasonic C- Scan, Thermograph, Fiber – optic Sensors.

References

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

3) Hetyenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1972.
4) Pollock A.A., "Acoustic Emission in Acoustics and Vibration Progress", Ed. Stephens R.W.B., Chapman and Hall, 1993.

AIRCRAFT STABILITY AND CONTROL
Course/Paper 06BAE 106
BAE Semester VI

Unit 1

Degrees of freedom of a system, Static and dynamic stability, Need for stability in an airplane, Purpose of controls, Inherently and marginally stable airplanes.

Unit 2

Stick Fixed:Basic equations of equilibrium, Stability criterion, Wing and tail moments, Effects of fuselage and nacelles, Effects of c.g.location, Power effects, Stabiliser setting and c.g.location, Elevator effects, Stick fixed neutral point. Stick Free: Hinge moment coefficients, Stick free neutral point symmetric maneuvers, Stick force gradients and stick force per g.Aerodynamic balancing of control surfaces.

Unit 3

Dihedral effect, Coupling between rolling moment and yawing moment, Adverse yaw, Aileron power, Aileron reversal.

UNIT 4

Weathercocking effect, Rudder requirements. One engine inoperative conditions, Rudder lock.

Unit 5

Equations of motion, Stability derivatives, Routh's discriminant, solving the stability quartic, Phugoid motion, Factors affecting the period and damping.
Dutch roll and spiral instability Auto rotation and spin, Two control airplane.

REFERENCES:
1. Perkins C.D., & Hage, R.E. " Airplane perofrmance, stability and control ", Wiley Toppan 1974.
2. Babister, A.W. " Aircraft stability and response ", Pergamon Press, 1980.
3. McCormic, B.W., " Aerodynamic, Aeronautics and Flight Mechanics ", John Wiely, 1995.
4. Nelson, R.C. " Fligh Stability & Automatic Contro ", McGraw Hill, 1989.

PROPULSION LABORATORY
Course/Paper 06BAE 201
BAE Semester VI

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

AIRCRAFT DESIGN PROJECT – I
Course/Paper 06BAE 202
BAE Semester VI

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

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

AERODYNAMICS LABORATORY
Course/Paper 06BAE 203
BAE Semester VI

1. Fluid flow studies using a blower
2. Drags of different bodies
3. Lift of flat and curved plates and wings
4. Experiments in a small low speed wind tunnel
5. Pressure distribution studies on two-dimensional models.
6. Pressure distribution studies in Swept wings.
7. Calibration of subsonic wind tunnel

INDUSTRIAL SEMINAR
Course/Paper 06BAE 204
BAE Semester VI

The objective of 'Comprehension' is to provide opportunity for the student to apply the knowledge acquired during the academic programme to real-life problems which he/she may have to face in future as an engineer.

Three period per week shall be allotted in the time table for this activity and this time shall be utilised by the students to receive guidance from the members of faculty on solving real-life problems, practice solving these problems and on group discussions, seminar presentations, library reading as assigned by the faculty member incharge.

For internal assessment, there will be 3 or 4 written tests covering all the courses studied in previous semesters.

The written tests may be of objective type of questions, short answer questions, etc.

AIR TRANSPORTATIONS AND AIRCRAFT MAINTENANCE MANAGEMENT

Course/Paper 07BAE 101
BAE Semester VII
UNIT 1

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

UNIT 2

Forecasting - Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. - Passenger fare and traiffs - Infuence of geographical, economic & political factors on routes and route selection.

UNIT 3

FLEET PLANNING: The aircraft selection process - Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition - Valuation & Depreciation - Budgeting, Cost planning - Aircrew evaluation - Route analysis - Aircraft evaluation. Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations equipments and types of schedule - hub & spoke scheduling, advantages / disadvantages & preparing flight plans

UNIT 4

Aircraft scheduling in line with aircraft maintenance practices.
Aircraft reliability - The maintenance schedule & its determinations - Condition monitoring maintenance - Extended range operations (EROPS) & ETOPS - Ageing aircraft maintenance production.

UNIT 5

Airlines scheduling (with reference to engineering) - Product support and spares - Maintenance sharing - Equipments and tools for aircraft maintenance - Aircraft weight control - Budgetary control. On board maintenance systems - Engine monitoring - Turbine engine oil maintenance - Turbine engine vibration monitoring in aircraft - Life usage monitoring - Current capabilities of NDT - Helicopter maintenance - Future of aircraft maintenance.

References:
1. Fedric J.H., " Airport Management ", English Book House, New Delhi-I.
2. Gene Krope, " Airline Procedures ", English Book House, New Delhi-I.
3. Wilson & Bryon, " Air Transportation ", English Book House, New Delhi-I.
4. Philip Lockin D, " Economics of Transporation ", English Book House, New Delhi-I.
5. " Indian Aircraft manual ", Published by DGGA, English Book House, New Delhi-I.
6. Alexander T Wells, " Air Transporation ", Wadsworth Publishing Company, California, 1993.
7. C.H. Friend, " Aircraft Maintenance Management ", English Book House, New Delhi-I.

AVIONICS

Course/Paper 07BAE 102
BAE Semester VII

1. INTRODUCTION TO AVIONICS

Need for Avionics in civil and military aircraft and space systems – Integrated Avionics and Weapon system – Typical avionics sub systems – Design and Technologies.

2. PRINCIPLES OF DIGITAL SYSTEMS

Digital Computers – Microprocessors – Memories

3. DIGITAL AVIONICS ARCHITECTURE

Avionics system architecture–Data buses MIL–STD 1553 B–ARINC 429–ARINC 629.

4. FLIGHT DECK AND COCKPITS

Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) - Civil cockpit and military cockpit : MFDS, HUD, MFK, HOTAS

5. INTRODUCTION TO AVIONICS SYSTEMS

Communication Systems - Navigation systems - Flight control systems - Radar electronic warfare - Utility systems Reliability and maintainability - Certification.

References
1. Malcrno A.P. and Leach, D.P., "Digital Principles and Application", Tata McGraw-Hill, 1990.

2. Gaonkar, R.S., "Microprocessors Architecture – Programming and Application", Wiley and Sons Ltd., New Delhi, 1990.
3. Middleton, D.H., Ed., "Avionics Systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
4. Spitzer, C.R., "Digital Avionic Systems", Prentice Hall, Englewood Cliffs, N.J., USA., 1987.
5. Brain Kendal, "Manual of Avionics", The English Book HOuse, 3rd Edition, New Delhi, 1993.

ROCKETS AND MISSILES

Course/Paper 07BAE 103
BAE Semester VII

1. ROCKETS SYSTEM

Ignition System in rockets – types of Igniters – Igniter Design Considerations – Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems – Propellant Slash and Propellant Hammer – Elimination of Geysering Effect in Missiles – Combustion System of Solid Rockets.

2. AERODYNAMICS OF ROCKETS AND MISSILES

Airframe Components of Rockets and Missiles – Forces Acting on a Missile While Passing Through Atmosphere – Classification of Missiles – methods of Describing Aerodynamic Forces and Moments – Lateral Aerodynamic Moment – Lateral Damping Moment and Longitudinal Moment of a Rocket – lift and Drag Forces – Drag Estimation – Body Upwash and Downwash in Missiles – Rocket Dispersion – Numerical Problems.

3. ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD

One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields – description of Vertical, Inclined and Gravity Turn Trajectories – Determination of range and Altitude Simple Approximations to Burnout Velocity.

4. STAGING AND CONTROL OF ROCKETS AND MISSILES

Rocket Vector Control – Methods – Thrust determination – SITVC – Multistaging of rockets – Vehicle Optimization – Stage Separation Dynamics – Separation Techniques.

5. MATERIALS FOR ROCKETS AND MISSILES

Selection of Materials – Special Requirements of Materials to Perform under Adverse Conditions.

References
1. Sutton, G.P., et al., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 1993.
2. Mathur, M., and Sharma, R.P., " Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1998.
3. Cornelisse, J.W., " Rocket Propulsion and Space Dynamics", J.W., Freeman & Co. Ltd., London, 1982.
4. Parket, E.R., " Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1982.
5.

ENVIRONMENTAL SCIENCE AND ENGINEERING

Course/Paper 07BAE 104
BAE Semester VII

1. INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems – mineral resources: use effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land

resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.

.2. ECOSYSTEMS AND BIODIVERSITY

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 (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical 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.

3. ENVIRONMENTAL POLLUTION

Definition – causes, 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 – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – urban / rural / industrial / agricultural

4. SOCIAL ISSUES AND THE ENVIRONMENT

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, case studies – environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies – 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

5. HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – case studies.

References

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

AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE PRACTICES

Course/Paper 07BAE 105
BAE Semester VII
UNIT 1. Aircraft Maintenance Practices:

General knowledge of procedure of jacking, leveling and mooring of aircraft

Knowledge of maintenance and handling of equipments used in the maintenance of aircraft.

Knowledge of safety and fire precautions to be observed during maintenance, refueling and defueling of aircraft

Knowledge of colour coding ,symbols or other markings to identify fluid systems pipelines, rubber parts and other aircraft systems of aircraft .

Knowledge of various Aircraft manuals, ATA system of classi-fication, inspection schedules, time limit.

UNIT2. Workshop Practices:-

Knowledge of material, parts and use of hand tools , simple machine tools and precision measuring instruments

Detailed knowledge of identification, terminology, correct use and inspection of aircraft bolts, nuts, rivets, screws and locking devices of British and American systems

Detailed knowledge of the interpretation of engineering drawings including symbols

Detailed knowledge of various types of gears and bearings, their use and common defects.

Knowledge of various forms of threads used in British and American system.

Knowledge of various types of threads, drills, taps, reamers .

Knowledge of hardness testing machines and various types of hardness numbers.

Knowledge of various types of Aircraft cables and swaging procedures used.

References
1. KROES WATKINS DELP, "Aircraft Maintenance and Repair" – McGraw-Hill, New York 1993.
2. A & P MECHANICS, "Aircraft hand Book" – F. A. A. Himalayan Book House, New Delhi, 1996.
3. A & P MECHANICS, "General hand Book" – F. A. A. Himalayan Book House, New Delhi, 1996

AIRCRAFT RULES AND REGULATIONS

Course/Paper 07BAE 106
BAE Semester VII

UNIT 1

Knowledge of Aircraft Rules as far as they relate to airworthiness and safety of aircraft.

Knowledge of Privileges and responsibilities of the various categories of AME Licence and approved persons.

Knowledge of "Civil Airworthiness Requirements", "Aeronautical Information Circulars (relating to airworthiness)", "Advisory Circulars" and AME Notices issued by DGCA.

UNIT 2

Knowledge of various mandatory documents like Certificate of Registration, Certificate of Airworthiness , Flight Manual, Export Certificate of Airworthiness.

Method of identifying approved material on Aircraft.

Knowledge of various documents/ certificates issued to establish airworthiness of Aircraft parts.

Various logbooks required to be maintained for Aircraft. Method of maintaining the logbook. Procedure for making entries in logbooks; Journey logbook, Technical logbook etc.

Use of schedules, its certification, preservation.

UNIT 3

Stores: Bonded and Quarantine stores, storage of various aeronautical products including rubber goods, various

fluids.

Knowledge of various terms such as Certificate of Flight Release, Certificate of Maintenance, Approved Certificates.

Condition under which Aircraft is required to be test flown; Certificate to be issued by AME for test flight.

Circumstances under which C of A is suspended.

Ferry Flight, MEL, CDL.

UNIT 4

Minimum equipments, instruments required for various types of operation.

Modification, concession, Airworthiness Directive, Service Bulletins.

Approval of Organisation.
Documents required to be carried on board.
Issue of Type Approval.
Registration markings.

Human performance and limitations relevant to the duties of an aircraft maintenance engineer licence holder.

References
1. "Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness)" – Published by DGCA, The English Book Store, 17-1, Connaught Circus, New Delhi 2000.
2. Aeronautical Information Circulars (relating to Airworthiness) from DGCA 2000.
3. "Aircraft Manual (India) Volume" – Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.
4. Advisory Circulars from DGCA 2003.

AERO ENGINE REPAIR AND MAINTENANCE
Course/Paper 07BAE 201
BAE Semester VII

1. Stripping of a piston engine
2. Engine (Piston Engine) - cleaning, visual inspection, NDT checks.
3. Piston Engine Components - dimensional checks.
4. Piston – Engine reassembly.
5. Propeller Pitch Setting
6. Stripping of a jet engine
7. Jet Engine – identification of components & defects.
8. Jet Engine – NDT checks and dimensional checks
9. Jet Engine – reassembly.
10. Engine starting procedures.

AIRCRAFT DESIGN PROJECT – II

Course/Paper 07BAE 202
BAE Semester VII

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

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

MINOR PROJECT WORK
Course/Paper 07BAE 203
BAE Semester VII

OBJECTIVE
The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. .
Each student shall finally produce a comprehensive report covering back round information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

AVIONICS LABORATORY
Course/Paper 07BAE 204
BAE Semester VII

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 QUALITY MANAGEMENT
Course/Paper 08BAE 101
BAE Semester VIII
1.   INTRODUCTION

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

2.   TQM PRINCIPLES

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.

3.   STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

4.   TQM TOOLS

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.

5.   QUALITY SYSTEMS

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.

TEXT BOOK
1.   Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES
1.   James R.Evans & William M.Lidsay, "The Management and Control of Quality", (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2.   Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
3.   Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., Oxford, 1989.
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.

FUELS AND PROPELLANT TECHNOLOGY
Course/Paper 08BAE 102
BAE Semester VIII
UNIT 1

Properties and tests for petroleum products - Motor gasoline - Aviation gasoline - Aviation turbine fuels - Requirements of aviation turbine fuels of Kerosene type and high flash point type - Requirements for fuel oils Single base propellants - Double base propellants -

composite propellants - CMDB propellants – Metalized composite Propellants - Brief introduction to combustion theory of composite and double base propellants

UNIT 2

Various liquid propellants and their properties - Monopropellant and bipropellant systems - Concept of ullage - Ignition studies of liquid propellants - Propellant loading tolerances - Inventory-Volume versus mass loading - Loading measurement and control - Outage control

UNIT 3

Introduction to cryogenic propellants - Liquid Hydrogen, liquid Oxygen, Liquid nitrogen and liquid helium - Theory behind the production of low temperature - Expansion Engine - Cascade process - Joule Thompson Effect - Magnetic effect - Ortho and Para H2 - Hilium4 and Helium3 - Ideal cycles and Efficiency of cryo systems - Storing of cryogenic propellants - Cryogenic loading problems

UNIT 4

Laboratory testing - Arc Image Furnace - Ignitability studies - Differential Thermal Analysis - Thermo gravimetric analysis - Particle size measurement Micro-merograph - Strand burner tests Impulse Bomb - Performance estimation

References

1. Sutton, G.P., rocket Propulsion Elements, John Wiley, 1993.
2. Sharma,S.P. and Mohan.C., Fuels and Combustion, Tata McGraw Hill Publishing Co.,Ltd.,1984
3. Mathur,M. ,and Sharma.R.P., Gas Turbines and Jet and Rocket Propulsion, Standard Publishers,New Delhi,12988
4. Cornelisse, J.W., Rocket propulsion and space dynamics, W.H. Freeman & Co., Ltd., London, 1980.
5. Parner S.F.. Propellant Chemistry, Reinhold Publishing Corpn.,NewYork 1985

AIRCRAFT DESIGN
Course/Paper 08BAE 103
BAE Semester VIII

UNIT 1

State of the art in airplane design, Classification of airplanes based on purpose and configuration, Factors affecting configuration, Merits of different airplane layouts

UNIT 2

Principal features, Aerodynamic consideration, Lift, Drag and Interference effects, Weights and Strength considerations, Peculiarities in layout, Designing for manufacturability, Maintenance, Operational costs, Interactive design

UNIT 3

Data collection and 3-View drawings, their purpose, weight estimation, choice of wing loading and thrust loading. choices available, Comparative merits, Location of power plants, Functions dictating the locations.

a) Wing design:

Airworthiness requirements, V-n diagram, loads, Elements of wing design, Structural features.

b) Fuselage design:

Loads on fuselage, Elements of fuselage design, Determination of tail surface areas, Structural features.

c) Landing gear design:

Loads or Landing gear, Preliminary landing gear design

d) Elements of computer Aided Design:

References

1. Torenbeek,E., " Synthesis of Subsonic Airplane Design " , Delft University Press,U.K.1986
2. Kuechemann,D., " Aerodynamic Design of Aircraft ", Pergamon Press,1978
3. Raymer,D.P., " Aircraft Conceptual Design " , AIAA Series,1989

HELICOPTER AERODYNAMICS
Course/Paper 08BAE 104
BAE Semester VIII

UNIT 1

Configurations based on torque reaction-Jet rotors and compound helicopters- Methods of control – Collective and cyclic pitch changes - Lead - Lag and flapping hinges.

UNIT 2

Hovering performance - Momentum and simple blade element theories - Figure of merit - Profile and induced power estimation - Constant chord and ideal twist rotors.

UNIT 3

Induced, profile and parasite power requirements in forward flight-Performance curves with effects of altitude- Preliminary ideas on helicopter stability

UNIT 4

Various configuration - Properller, rotor, ducted fan and jet lift - Tilt wing and vectored thrust - Performance of VTOL and STOL aircraft in hover, transition and forward motion.

UNIT 5

Types - Hover hieight, lift augmentation and power calculations for plenum chamber and peripheral jet machine - Drag of hovercraft on land and water. Applications of hovercraft.

References

1. Gessow, A., and Myers, G.C., " Aerodynamicsof Helicopter " , MacMillan & Co., N.Y. 1987.

2. McCormick, B.W., " Aerodynamics of V/STOL Flight ", Academic Press, 1987.

3. Johnson, W., " Helicopter Theory ", Princeton university Press, 1980.

4. McCormick, B.W., " Aerodynamics, Aeronautics & Flight Mechanics " John Wiley, 1995.

5. Gupta, L., " Helicopter Engineering " , Himalayan Books, 1996.

PROJECT WORK

Course/Paper 08BAE 201
BAE Semester VIII

OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. .

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

COMPUTER ADDED AIRCRAFT DESIGN LAB

Course/Paper 08BAE 201
BAE Semester VIII

As Per Subject

SEMINAR

Course/Paper 08BAE 202
BAE Semester VIII
OBJECTIVE

The students are to select one technical topic related its branch for seminar. The student is to submit the synopsis for assessment and approval. Progress for preparation of the seminar

topic would be continuously assessed from time to time. Students have to give a final presentation for 15 minutes on his topic.