St. PETER'S UNIVERSITY

Chennai – 600 054.

B.E. AERONAUTICAL ENGINEERING

3 & 4 SEMESTERS CURRICULUM AND SYLLABI

Regulations – 2008

SEMESTER III

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

Code No.	Course Title	Credit	L	T	P	Marks		
Theory						**CA**	**EA**	**Total**
308AET01	Transforms And Partial Differential Equations	3	3	1	0	25	75	100
308AET02	Mechanics of Machines	3	3	1	0	25	75	100
308AET03	Aero Engineering Thermodynamics	3	3	1	0	25	75	100
308AET04	Fluid Mechanics and Machinery	2	3	1	0	25	75	100
308AET05	Solid Mechanics	2	3	1	0	25	75	100
308AET06	Elements of Aeronautics	2	3	0	0	25	75	100
Practical								
308AEP01	Strength of Materials Lab	1	0	0	3	25	75	100
308AEP02	Fluid Mechanics and Machinery Lab	1	0	0	3	25	75	100
308AEP03	Thermodynamics Lab	1	0	0	3	25	75	100
	Total	**18**	**18**	**5**	**9**	**225**	**675**	**900**

SEMESTER IV

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

Code No.	Course Title	Credit	L	T	P	Marks		
Theory						**CA**	**EA**	**Total**
408AET01	Numerical Methods	3	3	1	0	25	75	100
408AET02	Aerodynamics - I	2	3	0	0	25	75	100
408AET03	Aircraft Systems and Instruments	2	3	0	0	25	75	100
408AET04	Production Technology	2	3	0	0	25	75	100
408AET05	Aircraft Structures - I	3	3	1	0	25	75	100
408AET06	Propulsion-I	2	3	0	0	25	75	100
Practical								
408AEP01	Aircraft Structures Lab - I	1	0	0	3	25	75	100
408AEP02	Aerodynamics Lab	1	0	0	3	25	75	100
408AEP03	Aircraft Component Drawing	1	0	0	4	25	75	100
408AEP04	Manufacturing Technology Lab	1	0	0	3	25	75	100
	Total	**18**	**18**	**2**	**13**	**250**	**750**	**1000**

SEMESTER III

308AET01 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS 3 1 0 4
(*Common to all branches)*

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differtial Equations. 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.

1. FOURIER SERIES 9 + 3

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 identify – Harmonic Analysis.

2. FOURIER TRANSFORMS 9 + 3

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

3. PARTIAL DIFFERENTIAL EQUATIONS 9 +3

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

4. APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

5. Z -TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3

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

Lectures : 45 Tutorials : 15 Total : 60

TEXT BOOKS

1. Grewal, B.S, 'Higher Engineering Mathematics' 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES

1. Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2007).
4. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition-Wiley India (2007).

308AET02 **MECHANICS OF MACHINES** **3 1 0 4**

(Common to Automobile and Aeronautical)

OBJECTIVE

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

1. MECHANISMS **9+3**

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

2. FRICTION **9+3**

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 **9+3**

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 **9+3**

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

5. VIBRATION **9+3**

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, 1979.

308AET03 AERO ENGINEERING THERMODYNAMICS 3 1 0 4

OBJECTIVE

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

1. BASIC THERMODYNAMICS 15+3

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

2. AIR CYCLES 5+3

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

3. THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW 12+3

Application of continuity, momentum and energy equations- Rankine cycle - Isentropic flow of ideal gases through nozzles - Simple jet propulsion system - Thrust rocket motor – Specific impulse.

4. REFRIGERATION AND AIR CONDITIONING 6+3

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

5. AIR COMPRESSORS 7+3

Classification and working principle of compressors (Descriptive Treatment). Isothermal and Isentropic efficiency of air compressors.

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

308AET04 FLUID MECHANICS AND MACHINERY 3 1 0 4

(Common to Aeronautical, Mechanical, Automobile & Production)

OBJECTIVES:

The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated under standing of the transport of mass, momentum and energy.

The applications of the conservation laws to flow though pipes and hydraulics machines are studied

I. INTRODUCTION 12

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

II. FLOW THROUG CIRCULAR CONDUITS 12

Laminar flow though circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darcy – Weisbach equaition. Friction factor and Moody diagram. Commercial pipes. Minor losses. Flow though pipes in series and in parallel.

III. DIMENSIONAL ANALYSIS 9

Dimension and units: Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

IV. ROTO DYNAMIC MACHINES 16

Homologus units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

V. POSITIVE DISPLACEMENT MACHINES 11

Recriprocating pumps, Indicator diagrams, Work saved by air vessels. Rotory pumps. Classification. Working and performance curves.

TOTAL 60

TEXT BOOKS:

1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES:

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 1988.
2. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.

308AET05 SOLID MECHANICS 3 1 0 4

OBJECTIVE

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

1. BASICS AND AXIAL LOADING 10+3

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

2. STRESSES IN BEAMS 10+3

Shear force and bending moment diagrams for simply supported and cantilever beams-Bending stresses in straight beams-Shear stresses in bending of beams with rectangular, I & T etc cross sections-beams of uniform strength

3. DEFLECTION OF BEAMS 10+3

Double integration method – McCauley's method - Area moment method – Conjugate beam method-Principle of super position-Castigliano's theorem and its apllication

4. TORSION 5+3

Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts – closely coiled helical springs.

5. BI AXIAL STRESSES 10+3

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

TOTAL : 60

TEXT BOOKS

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

REFERENCES

1. Dym C.L. and Shames I.H. – "Solid Mechanics", 1990.

308AET06 ELEMENTS OF AERONAUTICS 3 0 0 3

OBJECTIVE

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

1. AIRCRAFT CONFIGURATIONS 6

Brief History-Components of an airplane and their functions. Different types of flight vehicles, classifications. Basic instruments for flying,

2. INTRODUCTION TO PRINCIPLES OF FLIGHT 8

Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Different types of drag.

3. INTRODUCTION TO AERODYNAMICS 9

Aerodynanic forces on aircraft – classification of NACA aerofoils, aspect ratio, wing loading, Mach number,centre of pressure and aerodynamic centre-aerofoil characteristics-lift, drag curves.

4. INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS 12

General types of construction, Monocoque, semi-monocoque. 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 10

Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production., Principles of operation of rocket, types of rockets

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.

308AEP01 STRENGTH OF MATERIALS LABORATORY 0 0 3 2

OBJECTIVE

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

LIST OF EXPERIMENTS

Brinell Hardness test
Rockwell Hardness test
Tension test
Torsion test
Izod Impact test
Charpy Impact test
Reverse plate bending Fatigue test
Rotating Beam Fatigue test
Testing of springs
Block Compression Test

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS

(for a batch of 30 students)

Sl.No	Details of Equipments	Qty Required	For Experiments
1.	Hardness Testing Machine	1	1, 2
2.	Universal Testing Machine	1	1, 2, 3, 9, 10
3.	Impact Testing Machine	1	5, 6
4.	Fatigue tester- Rotating Beam	1	8
5.	Fatigue tester –Reverse plate bending	1	7

308AEP02 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 3 2
(Common to Aeronautical, Automobile, Mech & Prod)

OBJECTIVE

To study the flow measurement and the performance of fluid machinery

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

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS

(for a batch of 30 students)

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	Venturimeter setup	1	1,3
2.	Pipe friction set up	1	3
3.	Pitot tube set up	1	2,4
4.	Jet pump	1	6
5.	Submersible pump	1	6
6.	Centrifugal pump	1	6
7.	Reciprocating pump	1	7
8.	Pelton wheel turbine and Francis turbine	1	8,9
9.	Viscosity Meter	1	10
10.	Hele-shaw apparatus	1	5

308AEP03 THERMODYNAMICS LABORATORY 0 0 3 2

OBJECTIVE

To enhance the basic knowledge in applied thermodynamics

LIST OF EXPERIMENTS

Performance test on a 4-stroke engine
Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
Determination of effectiveness of a parallel flow heat exchanger
Determination of effectiveness of a counter flow heat exchanger
Determination of heating value of a fuel
COP test on a vapour compression refrigeration test rig
COP test on a vapour compression air-conditioning test rig
Determination of specific heat of solid
Determination of Thermal Conductivity of solid.
Determination of Thermal Resistance of a Composite wall.

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS

(for a batch of 30 students)

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

SEMESTER IV

408AET01 NUMERICAL METHODS 3 1 0 4
(Common to Civil, Aero & EEE)

AIM

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.

OBJECTIVES

At the end of the course, the students would be acquainted with the basic concepts in numerical methods and their uses are summarized as follows:

The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.

When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.

The numerical differentiation and integration find application when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.

Since many physical laws are couched in terms of rate of change of one/two or more independent variables, most of the engineering problems are characterized in the form of either nonlinear ordinary differential equations or partial differential equations. The methods introduced in the solution of ordinary differential equations and partial differential equations will be useful in attempting any engineering problem.

1. SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Solution of equation –Fixed point iteration: x=g(x) method - Newton's method – Solution of linear system by Gaussian elimination and Gauss-Jordon method– Iterative method - Gauss-Seidel method - Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method and by Jacobi method for symmetric matrix.

2. INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas.

3. NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulae – Double integrals using trapezoidal and Simpsons's rules.

4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

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

5. 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.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. Veerarjan, T and Ramachandran, T. 'Numerical methods with programming in 'C' Second Editiion, Tata McGraw-Hill Publishing.Co.Ltd. (2007).

2. Sankara Rao K, 'Numerical Methods for Scientisits and Engineers' – 3rd editiion Printice Hall of India Private Ltd, New Delhi, (2007).

REFERENCE BOOKS

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.

2. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.

3. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004

408AET02 AERODYNAMICS – I 3 0 0 3

OBJECTIVE

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

1. REVIEW OF BASIC FLUID MECHANICS 4

Continuity, momentum and energy equations.

2. TWO DIMENSIONAL FLOWS 12

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.

3. GENERATION OF LIFT 8

Kutta Joukowski's theorem. Kutta condition. Blasius theorem.

4. AIRFOIL AND WING THEORY 12

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 9

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

TOTAL : 45

TEXT BOOKS

1. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York, 1998.

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

408AET03 AIRCRAFT SYSTEMS AND INSTRUMENTATION 3 0 0 3

OBJECTIVE

To describe the principle and working of aircraft systems and instruments

1. AIRPLANE CONTROL SYSTEMS 10

Conventional Systems - fully powered flight controls - Power actuated systems – Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology,

2. AIRCRAFT SYSTEMS 12

Hydraulic systems - Study of typical workable system - components - Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system - Typical Pneumatic power system - Components, Landing Gear systems - Classification

3. 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.

4. AUXILIARY SYSTEM 8

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

5. 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.

408AET04 **PRODUCTION TECHNOLOGY** **3 0 0 3**

(Common to Aeronautical & Automobile)

OBJECTIVE

The components such a piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, powder metallurgy, etc. hence Engineering students must study this course production technology.

1. CASTING **9**

Casting types, procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes-co_2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

2. WELDING **9**

Classification of welding processes. Principles of Oxyacetylene gas welding. A.C. metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermic welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

3. MACHIINING **9**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines.

General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma are machining, Electron beam machining and Laser beam machining.

4. FORMING AND SHAPING OF PLASTICS **9**

Types of plastics-characteristics of the forming and shaping processes-Moulding of Thermoplastics-working principles and typical applications of Injection moulding-Plunger and screw machines-Blow moulding-Rotational moulding-Film moulding-Extrusion-typical industrial applications-Thermoforming-processing of thermosets-working principles and typical applications-compression moulding-Transfer moulding-Bonding of thermoplastics-Fusion and solvent methods-Induction and Ultrasonic methods.

5. METAL FORMING AND POWDER METALLURGY **9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy-Principal steps involved advantages. Disadvantages and limitations of powder metallurgy.

TOTAL:45

TEXT BOOK:

1. Harija choudry, Elements of workshop Technology, vol. I and II Media promoters and publishers pvt., Ltd., Mumbai, 2001.

REFERENCES:

1. R. K. Jain and S. C. Gupta, production Technology, Khanna Publishers. 16th Edition, 2001.
2. H. M. T. production technology-Hand book, Tata Mc Graw-Hill, 2000.
3. Roy. A. Linberg, process and materials of manufacturing technology, PHI, 2000.
4. M. Adithan and A. B. Cupta, manufacturing technology, New Age, 1996.
5. Serope Kalpajian, Steven R. Schimid, Manuyfacturing Engineering and Technology, Pearson Education, Inc.2002 (second Indian Reprint**)**

408AET05 AIRCRAFT STRUCTURES – I 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.

1. STATICALLY DETERMINATE STRUCTURES 10+3

Analysis of plane Truss-Method of joints-3 D Truss-Plane frames-Composite beam.

2. STATICALLY INDETERMINATE STRUCTURES 10+3

Propped Cantilever- Fixed-Fixed beams-Clapeyron's Three Moment Equation - Moment Distribution Method.

3. ENERGY METHODS 10+4

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

4. COLUMNS 10+4

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 5+1

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

TOTAL : 60

TEXT BOOK

1. Donaldson, B.K., "Analysis of Aircraft Structures – An Introduction", McGraw-Hill, 1993.
2. Bruhn.E.F."Analysis and design of flight vehicle structures" Tri set of offset company, USA,1973.

REFERENCE

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

408AET06 PROPULSION – I 3 0 0 3

OBJECTIVE

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

1. 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.

2. SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES 8

Internal flow and Stall in subsonic inlets – Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and 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 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.

4. 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.

5. 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.

408AEP01 AIRCRAFT STRUCTURES LAB –I 0 0 3 2

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 and brittle materials
4. Determination of forces in statically indeterminate force system.
5. Deflection of beams with various end conditions.
6. Verification of Maxwell's Reciprocal theorem & principle of superposition
7. Column – Testing
8. South – well's plot.
9. Testing of Riveted Joints.
10. Determination of membrane stresses in a thin cylinder under internal pressure.

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS

(for a batch of 30 students)

Sl. No.	Equipments	Qty	Experiments No.
1.	Universal Testing Machine	1	1,2,3, 9
2.	Mechanical Extensometer	1	1
3.	Electrical strain gauge	10	2, 4, 10
4.	Hinged bar suspended by two wires of different materials.	1	4
5.	Strain indicator	1	2, 4, 10
6.	Dial Gauges	12	5, 6
7.	Beam Test set up with various end conditions	2	5, 6
8.	Column Test Apparatus	1	7, 8
9.	Thin walled pressure vessel	1	10

408AEP02 AERODYNAMICS LABORATORY 0 0 3 2

OBJECTIVE

To familiarize the students in basic aerodynamics and use of wind tunnels.

LIST OF EXPERIMENTS

1. Generation of lift and tip vortices.
2. Flow visualization in water flow channel
3. Flow visualization in smoke tunnel
4. Plot of RPM Vs test section velocity in a subsonic wind tunnel.
5. Pressure distribution over circular cylinder.
6. Pressure distribution over airfoil and estimation of C_L and $C_{D.}$
7. Force measurement using wind tunnel balance.
8. Mach number distribution in nozzle of supersonic wind tunnel.
9. Use of Schlieren system to visualize shock.
10. Use of Shadow graph system to visualize shock.

TOTAL : 45 PERIODS

LIST OF EQUIPMENT

(for a batch of 30 students)

Sl. No.	Items	Quantity	Experiment No.
1.	Blower, Balance, and small aspect ratio model	1 each.	1
2.	Water flow channel & models	1 set	2
3.	Subsonic wind tunnel	1 No.	3, 4,5,6,7
4.	Smoke apparatus and rake	1 each.	3
5.	Manometer, Pitot-Static tube	1 No.	4,5,6
6.	Circular cylinder and Aerofoil pressure distribution models	1 each	5,6
7.	Wind tunnel strain gauge balance	1 No.	7
8.	Supersonic wind tunnel, Mercury manometer	1 No.	8,9,10
9.	Schlieren system and Shadow graph system	1 No.	9,10
10.	Sharp nosed and Blunt nosed models	1 No. each	9,10

408AEP03 AIRCRAFT COMPONENT DRAWING 0 0 4 2

OBJECTIVE

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

LIST OF EXERCISES

Design and Drafting of riveted joints
Design and Drafting of welded joints.
Design and Drafting Control Components Cam
Design and Drafting Control Components Bell Crank
Design and Drafting Control Components Gear
Design and Drafting Control Components Push-pull rod
Three view diagram of a typical aircraft
Layout of typical wing structure.
Layout of typical fuselage structure.
Layout of Control System

TOTAL : 60 PERIODS

LIST OF EQUIPMENT

(for a batch of 30 students)

Sl.No	Equipments	Quantity	Experiments No.
1	Drawing Boards, Drafting machines	30	1, 5

408AEP04 MANUFACTURING TECHNOLOGY LABORATORY 0 0 3 2

(Common to Aeronautical & Automobile)

LIST OF EXPERIMENTS

1. LATHE

1.1. Facing, plain turning and step turning
1.2. Taper turning using compound rest.
1.3. Taper turning using taper turning attachment
1.4. Single start V thread, cutting and knurling
1.5. Boring and internal thread cutting.

2. SHAPER AND SLOTTER

2.1. Machining a V- block (in a Shaper)
2.2. Machining hexagonal shape (in a Shaper)
2.3. Machining internal key-way (in a slotter)

3. DRILLING

3.1 Drilling 4 or 6 holes at a given pitch circle on a plate
3.2. Drilling, reaming and tapping

4. MILLING

4.1. Plain Milling Exercise
4.2. Gear Milling Exercise

5. GRINDING

Cylindrical Grinding Exercise

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS*(For A Batch Of 30 Students)*

1.	Centre Lathe with accessories	5No.
2.	Shaping Machine	2 No.
3.	Slotting Machine	1 No.
4.	Radial Drilling Machine	2No.
5.	Upright Drilling Machine	2No.
6.	Milling Machine	2No.
7.	Cylindrical Grinding Machine	1 No.