ANNA UNIVERSITY CHENNAI :: CHENNAI - 600 025

CURRICULUM 2004

B.E. AERONAUTICAL ENGINEERING

SEMESTER III

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
MA1201	Mathematics - III	3	1	0	100
ME1206	Applied Engineering Mechanics	3	1	0	100
AE1201	Aero Engineering Thermodynamics	3	1	0	100
ME1202	Fluid Mechanics and Machinery	3	1	0	100
AE1202	Solid Mechanics	3	1	0	100
AE1203	Elements of Aeronautics	3	0	0	100
PRACTICAL					
CE1263	Strength of Materials Lab	0	0	3	100
ME1204	Fluid Mechanics and Machinery Lab	0	0	3	100
AE1204	Thermodynamics Lab	0	0	3	100
GE1201	Technical Seminar**	0	0	3	100

SEMESTER IV

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
MA1251	Numerical Methods	3	1	0	100
AE1251	Aerodynamics – I	3	0	0	100
AE1252	Aircraft Systems and Instrumentations	3	0	0	100
AE1253	Mechanics of Machines	3	1	0	100
AE1254	Aircraft Structures – I	3	1	0	100
EE1265	Control Engineering	3	0	0	100
PRACTICAL					
AE1255	Aircraft Structures Lab – I	0	0	3	100
AE1256	Design and Drafting	0	0	3	100
AE1257	Aerodynamics Lab	0	0	3	100
GE1251	Technical Seminar**	0	0	3	100

SEMESTER V

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
CY1201	Environmental Science and Engineering	3	0	0	100
AE1301	Flight Dynamics	3	0	0	100
AE1302	Aircraft Structures – II	3	1	0	100
AE1303	Aerodynamics – II	3	0	0	100
AE1304	Propulsion-I	3	0	0	100
EC1369	Microprocessor and Applications	3	0	0	100
PRACTICAL					
AE1305	Aircraft Structures Lab – II	0	0	3	100
AE1306	Aircraft Structures Repair Lab	0	0	3	100
AE1307	CAD/CAM Lab	0	0	3	100
GE1303	Communication Skills and Technical Seminar**	0	0	3	0

SEMESTER VI

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
MG1351	Principles of Management	3	0	0	100
AE1351	Propulsion-II	3	0	0	100
AE1352	Heat Transfer	3	0	0	100
AE1353	Experimental Stress Analysis	3	0	0	100
AE1354	High Temperature Materials	3	0	0	100
E1****	Elective – I	3	0	0	100
PRACTICAL					
AE1355	Aircraft Design Project – I	0	0	3	100
AE1356	Propulsion Lab	0	0	3	100
AE1357	Aero Engine Repair and Maintenance Lab	0	0	3	100
GE1351	Presentation Skills and Technical Seminar**	0	0	3	0

SEMESTER VII

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
MG1401	Total Quality Management	3	0	0	100
AE1401	Avionics	3	0	0	100
AE1402	Composite Materials and Structures	3	0	0	100
ME1403	Computer Integrated Manufacturing	3	0	0	100
E2****	Elective – II	3	0	0	100
E3****	Elective – III	3	0	0	100

PRACTICAL					
AE1403	Aircraft Design Project – II	0	0	3	100
AE1404	Aircraft Systems Lab	0	0	3	100
AE1405	Avionics Lab	0	0	3	100
AE1406	Identification of Project Work**	0	0	2	0

SEMESTER VIII

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
AE1451	Rocket and Missiles	3	0	0	100
E4****	Elective – IV	3	0	0	100
E5****	Elective – V	3	0	0	100
PRACTICAL					
AE1452	Comprehension & Technical Seminar**	0	0	3	0
AE1453	Project Work	0	0	6	200

LIST OF ELECTIVES FOR

B.E. AERONAUTICAL ENGINEERING

ELECTIVES I AND II FOR VI SEMESTER

Code No.	Course Title	L	T	P	M
AE1001	Theory of Elasticity	3	0	0	100
AE1002	Space Mechanics	3	0	0	100
AE1003	Aircraft General Engineering and Maintenance Practices	3	0	0	100
AE1004	Aircraft Rules and Regulation	3	0	0	100
AE1005	Wind Tunnel Techniques	3	0	0	100
GE1001	Intellectual Property Rights (IPR)	3	0	0	100
GE1002	Indian Constitution and Society	3	0	0	100

ELECTIVES III AND IV FOR VII SEMESTER

Code No.	Course Title	L	T	P	M
AE1006	Vibration and Aero elasticity	3	0	0	100
AE1007	Finite Element Method	3	0	0	100
AE1008	Airframe Maintenance and Repair	3	0	0	100
AE1009	Aero Engine Maintenance and Repair	3	0	0	100
AE1010	Theory of Plates and Shells	3	0	0	100

ELECTIVES V AND VI FOR VIII SEMESTER

Code No.	Course Title	L	T	P	M
ME1011	Computational Fluid Dynamics	3	0	0	100
AE1011	Fatigue and Fracture	3	0	0	100
AE1012	Air transportation and Aircraft Maintenance	3	0	0	100
AE1013	Helicopter Maintenance	3	0	0	100
AE1014	Air Traffic Control and Aerodrome Design	3	0	0	100
ME1020	Entrepreneurship Development	3	0	0	100
GE1301	Professional Ethics and Human Values	3	0	0	100

SEMESTER III

MA1201 MATHEMATICS III 3 1 0 100

(Common to all branches)

OBJECTIVES

The course objective is to impact analytical skills to the students in the areas of boundary value problems and transform techniques. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

1. PARTIAL DIFFERENTIAL EQUATIONS 9

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

2. FOURIER SERIES 9

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

3. BOUNDARY VALUE PROBLEMS 9

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

4. FOURIER TRANSFORM 9

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

5. Z –TRANSFORM AND DIFFERENCE EQUATIONS 9

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

TUTORIALS 15

TOTAL : 60

TEXT BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.
3. Wylie C. Ray and Barrett Louis, C., "Advanced Engineering Mathematics", Sixth Edition, McGraw-Hill, Inc., New York, 1995.

REFERENCES

1. Andrews, L.A., and Shivamoggi B.K., "Integral Transforms for Engineers and Applied Mathematicians," Macmillen , New York ,1988.
2. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
3. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw Hill Book Co., Singapore, 1987.

ME1206 APPLIED ENGINEERING MECHANICS 3 1 0 100

OBJECTIVE :

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

1. BASICS & STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics – Parallelogram and triangular Law of forces – Vectorial representation of forces and moments – Vector operations of forces moments and Couples – Moment of a force about a point and aboutan axis – Vectorial representation of moments and couples – Scalar components of a moments – Varignon's theorem - Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

2. EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

3. PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle areas from integration – T section, I section, Angle section, Hollow section from primary simpler sections – second moments of plane area – Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow sections – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia - Mass moment of inertia – Derivation of mass moment of inertia for, prism, cylinder and sphere from first principle – Relation to area moments of inertia.

4. FRICTION AND DYNAMICS OF PARTICLES 12

Surface Friction – Law of dry friction – Sliding friction – Static and Kinetic friction – Rolling resistance – Belt friction – Rectilinear motion of particles - Relative motion – Curvilinear motion – Newton's law – Energy and momentum Equation of particles – Impulse – Impact of elastic bodies – Motion of connected particles.

5. ELEMENTS OF RIGID BODY DYNAMICS 12

Translation and Rotation of Rigid Bodies – Velocity and acceleration – Plane motion of rigid bodies – Forces and acceleration.

L: 45, T: 15, TOTAL: 60

TEXT BOOK

1. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 1997.

REFERENCES

1. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000
2. Ashok Gupta, Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM), Pearson Education Asia Pvt., Ltd., 2002
3. Palanichamy, M.S., Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw-Hill, 2001.
4. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Pearson Education Asia Pvt. Ltd., 2003
5. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 2000

CY1201 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 100

(Common to all branches)

OBJECTIVES

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

1. INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

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.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

2. ECOSYSTEMS AND BIODIVERSITY 14

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.

Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

3. ENVIRONMENTAL POLLUTION 8

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 7

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 6

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.

TOTAL : 45

TEXT BOOKS

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

REFERENCES

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

AE1201 AERO ENGINEERING THERMODYNAMICS 3 1 0 100

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 12+3

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

2. AIR CYCLES 8+3

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

3. THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW 8+3

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

4. REFRIGERATION AND AIR CONDITIONING 8+3

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

5. AIR COMPRESSORS 9+3

Classification and working principle, work of compression with and without clearance, Isothermal and Isentropic efficiency of reciprocating air compressors, multistage compression and intercooling.

Various types of compressors (Descriptive treatment only)

TOTAL : 60

TEXT BOOKS

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

REFERENCES

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

ME1202 FLUID MECHANICS AND MACHINERY 3 1 0 100

(Common To Mechanical, Production, Mechatronics, Automobile and Aeronautical)

OBJECTIVE

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

1. BASIC CONCEPTS AND PROPERTIES 6

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour

pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

2. FLIUD KINEMATICS AND FLUID DYNAMICS 12

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

3. INCOMPRESSIBLE FLUID FLOW 12

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

4. HYDRAULIC TURBINES 8

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

5. HYDRAULIC PUMPS 7

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

TUTORIALS 15

TOTAL : 60

TEXT BOOKS

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

REFERENCES

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

AE1202 SOLID MECHANICS 3 1 0 100

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 - bar with uniform and varying section 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 various cross sections – beams of uniform strength

3. DEFLECTION OF BEAMS 10+3

Double integration method – McCauley's method - Area moment method – Conjugate beam method.

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.

AE1203 ELEMENTS OF AERONAUTICS 3 0 0 100

OBJECTIVE

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

1. HISTORICAL EVALUATION 8

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

2. AIRCRAFT CONFIGURATIONS 5

Components of an airplane and their functions. Different types of flight vehicles, classifications. Conventional control, Powered control, Basic instruments for flying, Typical systems for control actuation.

3. INTRODUCTION TO PRINCIPLES OF FLIGHT 10

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

4. INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS 12

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

5. POWER PLANTS USED IN AIRPLANES 10

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

TOTAL : 45

TEXT BOOKS

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

REFERENCE

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

CE1263 STRENGTH OF MATERIALS LABORATORY 0 0 3 100

OBJECTIVE

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

LIST OF EXPERIMENTS

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

TOTAL : 45

LIST OF EQUIPMENTS
(for a batch of 30 students)

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

ME1204 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 3 100

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

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

AE1204 THERMODYNAMICS LABORATORY 0 0 3 100

OBJECTIVE

To enhance the basic knowledge in applied thermodynamics

LIST OF EXPERIMENTS

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

TOTAL : 60

LIST OF EQUIPMENTS
(for a batch of 30 students)

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	4 stroke twin cylinder diesel engine	1	1
2.	Cut section model of 4 stroke kirloskar diesel engine and cut section model of 2 stroke petrol engine	1	2
3.	Parallel and counter flow heat exchanger test rig	1	3,4
4.	Red wood viscometer	1	5

5.	Vapour compression refrigeration test rig	1	6
6.	Vapour compression air-conditioning test rig	1	7
7.	Gas Turbine Engine	1	8
8.	Conductive Heat Transfer set up	1	9
9.	Composite wall	1	10

GE1201 TECHNICAL SEMINAR 0 0 3 0

(Common to all Branches)

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

SEMESTER IV

MA1251 NUMERICAL METHODS 3 1 0 100

(Common to Mechanical, Production, Automobile, and IV Semester core for Metallurgy Mechatronics and Aeronautical)

OBJECTIVES

With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically. At the end of the course, the students would be acquainted with the basic concepts in numerical methods and their uses.

1. SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

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

2. INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials – Divided difference – Interpolation with a cubic spline – Newton forward and backward difference formulae.

3. NUMERICAL DIFFERENTIATION AND INTEGRATION 9

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

4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

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

5. BOUNDARY VALUE PROBLEMS 9

Finite difference solution for the second order ordinary differential equations. Finite difference solution for one dimensional heat equation by implict and explict methods – one dimensional wave equation and two dimensional Laplace and Poisson equations.

TUTORIAL **15**

TOTAL : 60

TEXT BOOKS

1. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 1999.

REFERENCES

1. Kandasamy, P.Thilakavthy, K and Gunavathy, K.Numerical Methods. S.Chand and Co. New Delhi, 1999
2. Burden, R.L and Faries, T.D., "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
3. Venkatraman M.K, "Numerical Methods" National Pub. Company, Chennai, 1991.
4. Sankara Rao K., "Numerical Methods for Scientists and Engineers", 2nd Ed. Prentice Hall India, 2004.

AE1251 AERODYNAMICS – I **3 0 0 100**

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. Kutta Joukowski's theorem.

3. CONFORMAL TRANSFORMATION **10**

Joukowski transformation and its application to fluid flow problems, 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 **7**

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, 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

AE1252 AIRCRAFT SYSTEMS AND INSTRUMENTATIONS 3 0 0 100

OBJECTIVE

To describe the principle and working of aircraft systems and instruments

1. AIRPLANE CONTROL SYSTEMS 15

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

2. AIRCRAFT SYSTEMS 7

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

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. AUXILLIARY SYSTEM 8

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

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.

AE1253 MECHANICS OF MACHINES 3 1 0 100

(Common to Production Automobile and Aeronautical -IV Semester)

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.

AE1254 AIRCRAFT STRUCTURES – I 3 1 0 100

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

2. STATICALLY INDETERMINATE STRUCTURES 10+3

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

3. ENERGY METHODS 10+4

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 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.

REFERENCE

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

EE1265 CONTROL ENGINEERING 3 0 0 100

OBJECTIVE

To understand the basic concepts of flight control system.

1. INTRODUCTION 6

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 6

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 10

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 15

Necessary and sufficient conditions, Routh – Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.

5. SAMPLED DATA SYSTEMS 8

Introduction to digital control system, Digital Controllers and Digital PID Controllers.

TOTAL : 45

TEXT BOOKS

1. OGATO, "Modern Control Engineering", Prentice – Hall of India Pvt. Ltd. New Delhi, 1998.
2. GOPAL.M. "Control Systems, Principles and design" – Tata McGraw-Hill Publication, New Delhi, 2000.

REFERENCES

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

AE1255 AIRCRAFT STRUCTURES LAB –I 0 0 3 100

OBJECTIVE

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

LIST OF EXPERIMENTS

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

TOTAL : 60

LIST OF EQUIPMENTS
(for a batch of 30 students)

Sl. No.	Equipments	Qty	Experiments No.
1.	Universal Testing Machine	1	1,2,3,4,5,10
2.	Mechanical Extensometer	1	1
3.	Electrical stain gauge	10	2
4.	Stain indicator	1	2
5.	Dial Gauges	12	3,4
6.	Beam Test set up with various end conditions	2	3,4
7.	Weight 1 Kg	10	3,4
8.	Weight 2 Kg	10	3,4
9.	Weight Pans	6	3,4
10.	Column Test Apparatus	1	5,6
11.	Rivet	30	10

AE1256 DESIGN AND DRAFTING 0 0 3 100

OBJECTIVE

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

LIST OF EXERCISES

1. Design of riveted joints (Lap joint).
2. Design of riveted joints (Butt joint with single and double straps).
3. Design of welded joints.

4. Layout of typical wing structure.
5. Layout of typical fuselage structure.
6. Computer aided modeling of typical aircraft wing.
7. Computer aided modeling of typical fuselage structure.
8. Computer aided modeling of landing gear
9. Three view diagram of a typical aircraft
10. Layout of control systems

TOTAL : 60

LIST OF EQUIPMENT
(for a batch of 30 students)

Sl.No	Equipments	Quantity	Experiments No.
1	Drawing Boards, Drafting machines	30	1, 5
2	Computer and modeling software	Pentium IV PC's, - 30 Nos. License of Software – 30	6, 7

AE1257 AERODYNAMICS LABORATORY 0 0 3 100

OBJECTIVE

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

LIST OF EXPERIMENTS

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

TOTAL : 60

LIST OF EQUIPMENT
(for a batch of 30 students)

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

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

GE1251 TECHNICAL SEMINAR 0 0 3 0

(Common to all Branches)

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering / technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

SEMESTER V

GE1301 PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 100

(Common to all branches)

OBJECTIVE

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

1. HUMAN VALUES 10

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

2. ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

3. ENGINEERING AS SOCIAL EXPERIMENTATION 9

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

4. SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies.
Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

5. GLOBAL ISSUES 8

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

TOTAL : 45

TEXT BOOKS

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

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available).
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

AE1301 FLIGHT DYNAMICS 3 0 0 100

OBJECTIVE

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

1. DRAG ON THE AIRPLANE 7

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

2. AIRCRAFT PERFORMANCE 10

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

3. STATIC LONGITUDINAL STABILITY 10

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes - Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral

points-Symmetric maneuvers - Stick force gradients - Stick _ force per 'g' - Aerodynamic balancing. Determination of neutral points and maneuver points from flight test.

4. LATERAL AND DIRECTIONAL STABILITY 8

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

5. DYNAMIC STABILITY 10

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

TOTAL : 45

TEXT BOOK

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

REFERENCES

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

AE1302 AIRCRAFT STRUCTURES – II 3 1 0 100

OBJECTIVE

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

1. UNSYMMETRICAL BENDING 8+3

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

2. SHEAR FLOW IN OPEN SECTIONS 10+3

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

3. SHEAR FLOW IN CLOSED SECTIONS 10+3

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

4. BUCKLING OF PLATES 10+3

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

5. STRESS ANALYSIS IN WING AND FUSELAGE 7+3

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

TOTAL : 60

TEXT BOOK

1. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2nd edition, McGraw–Hill, N.Y., 1993.

REFEENCES

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

AE1303 AERODYNAMICS – II 3 0 0 100

OBJECTIVE

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

1. ONE DIMENSIONAL COMPRESSIBLE FLOW 7

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 15

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. DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS 9

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

4. AIRFOIL IN HIGH SPEED FLOWS 6

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 8

Blow down, indraft and induction tunnel layouts and their design features, Transonic, supersonic and hypersonic tunnels and their peculiarities, Helium and gun tunnels, Shock tubes, Optical methods of flow visualization.

TOTAL : 45

TEXT BOOK

1. Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2003.

REFERENCES

1. Shapiro, A.H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronold Press, 1982.
2. Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1989.
3. Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, New York, 1979.
4. Anderson Jr., D., – "Modern compressible flows", McGraw-Hill Book Co., New York 1999.

AE1304 PROPULSION – I 3 0 0 100

OBJECTIVE

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

1. FUNDAMENTALS OF GAS TURBINE ENGINES 8

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 8

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

4. NOZZLES 8

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

5. COMPRESSORS 13

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

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.

EC1269 MICROPROCESSORS AND APPLICATIONS 3 0 0 100

OBJECTIVE

To give the principle and applications of microprocessor to the students

1. SEMICONDUCTOR DEVICES 12

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 10

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 10

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 8

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 5

Microprocessor Applications in aerospace – Case study.

TOTAL : 45

TEXT BOOKS

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

REFERENCES

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

AE1305 AIRCRAFT STRUCTURES LAB – II 0 0 3 100

OBJECTIVE

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

LIST OF EXPERIMENTS

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

TOTAL : 60

LIST OF EQUIPMENT

(for a batch of 30 students)

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

AE1306 AIRCRAFT STRUCTURES REPAIR LAB 0 0 3 100

OBJECTIVE

To give training on riveting, patchwork, welding and carpentry

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.

TOTAL : 60

LIST OF EQUIPMENT
(for a batch of 30 students)

Sl.No.	Name of the Equipment	Quantity	Experiment No.
1	Shear cutter pedestal type	1	4,6
2	Drilling Machine	1	4,5,6
3	Bench Vices	1	1,5,6
4	Radius Bend bars	1	2,3
5	Pipe Flaring Tools	1	9
6	Carbide Gas Plant	1	4
7	MIG Weld Plant	1	3
8	TIG Weld Plant	1	2

AE1307 CAD / CAM LABORATORY 0 0 3 100

OBJECTIVE

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

LIST OF EXPERIMENTS

1. Scaling, rotation, translation, editing, dimensioning – Typical CAD command structure.
2. Wire frame modeling – surface modeling
3. Solid Modeling
4. 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

TOTAL : 60

LIST OF EQUIPMENT

(for a batch of 30 students)

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

GE1303 COMMUNICATION SKILLS AND TECHNICAL SEMINAR 0 0 3 0

(Common to all branches)

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

SEMESTER VI

MG1351 PRINCIPLES OF MANAGEMENT 3 0 0 100

(Common to all Branches)

OBJECTIVE

Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations. After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling. Students will also gain some basic knowledge on international aspect of management.

1. HISTORICAL DEVELOPMENT 9

Definition of Management – Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.

2. PLANNING 9

Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making.

3. ORGANISING 9

Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness.

4. DIRECTING 9

Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.

5. CONTROLLING 9

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

TOTAL : 45

TEXT BOOKS

1. Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata McGraw-Hill, 1998
2. Joseph L Massie "Essentials of Management", Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCES

1 Tripathy PC And Reddy PN, "Principles of Management", Tata McGraw-Hill, 1999.
2. Decenzo David, Robbin Stephen A, "Personnel and Human Reasons Management", Prentice Hall of India, 1996
3. JAF Stomer, Freeman R. E and Daniel R Gilbert, "Management", Pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, "Engineering Management", Addison Wesley, 2000.

AE1351 PROPULSION – II 3 0 0 100

OBJECTIVE

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

1. AIRCRAFT GAS TURBINES 12

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

2. RAMJET PROPULSION: 10

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

3. FUNDAMENTALS OF ROCKET PROPULSION 8

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

4. CHEMICAL ROCKETS 10

Solid propellant rockets – Selection criteria of solid propellants – Important hardware components of solid rockets – Propellant grain design considerations – Liquid propellant rockets – 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 5

Electric rocket propulsion – Ion propulsion techniques – Nuclear rocket – Types – Solar sail- Preliminary Concepts in nozzleless propulsion.

TOTAL : 45

TEXT BOOKS

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.

REFERENCES

1. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., "Gas Turbine Theory", Longman Co., ELBS Ed., 1989.
2. Gorden, C.V., "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1989.
3. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988.

AE1352 HEAT TRANSFER 3 0 0 100

OBJECTIVE

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

1. HEAT CONDUCTION 11

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

2. CONVECTIVE HEAT TRANSFER 10

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

3. RADIATIVE HEAT TRANSFER 8

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

4. HEAT EXCHANGERS 8

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

5. HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING 8

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

TOTAL : 45

TEXT BOOKS

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

REFERENCES

1. Lienhard, J.H., "A Heat Transfer Text Book", Prentice Hall Inc., 1981.
2. Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6th Edn., 1991.

3. Sachdeva, S.C., “Fundamentals of Engineering Heat & Mass Transfer”, Wiley Eastern Ltd., New Delhi, 1981.
4. Mathur, M. and Sharma, R.P. “Gas Turbine and Jet and Rocket Propulsion”, Standard Publishers, New Delhi 1988.

AE1353 EXPERIMENTAL STRESS ANALYSIS 3 0 0 100

OBJECTIVE

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

1. MEASUREMENTS 4

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

2. EXTENSOMETERS 6

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

3. ELECTRICAL RESISTANCE STRAIN GAUGES 10

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 10

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.

5. NON – DESTRUCTIVE TESTING 15

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.

TOTAL : 45

TEXT BOOKS

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.

REFERENCES

1. Dally, J.W., and Riley, W.F., “Experimental Stress Analysis”, McGraw-Hill Inc., New York, 1998.
2. Hetyenyi, M., “Hand book of Experimental Stress Analysis”, John Wiley and Sons Inc., New York, 1972.
3. Pollock A.A., “Acoustic Emission in Acoustics and Vibration Progress”, Ed. Stephens R.W.B., Chapman and Hall, 1993.

AE1354 HIGH TEMPERATURE MATERIALS 3 0 0 100

OBJECTIVE

To learn damage mechanism and failure of components of elevated temperatures

1. CREEP **9**

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

2. DESIGN FOR CREEP RESISTANCE **9**

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

3. FRACTURE **9**

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

4. OXIDATION AND HOT CORROSION **9**

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

5. SUPERALLOYS AND OTHER MATERIALS **9**

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

TOTAL : 45

TEXT BOOKS

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

REFERENCES

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

AE1355 AIRCRAFT DESIGN PROJECT – I **0 0 3 100**

OBJECTIVE

To introduce and develop the basic concept of aircraft design.

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

EXPERIMENTS

1. Comparative configuration study of different types of airplanes
2. Comparative study on specification and performance details of aircraft
3. Preparation of comparative data sheets
4. Work sheet layout procedures
5. Comparative graphs preparation and selection of main parameters for the design
6. Preliminary weight estimations, selection of main parameters,

7. Power plant selection, Aerofoil selection, Wing tail and control surfaces
8. Preparation of layouts of balance diagram and three view drawings
9. Drag estimation
10. Detailed performance calculations and stability estimates

TOTAL : 60 PERIODS

LIST OF EQUIPMENTS
(for a batch of 30 students)

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

AE1356 PROPULSION LABORATORY 0 0 3 100

OBJECTIVE

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

LIST OF EXPERIMENTS

1. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
2. Study of an aircraft jet engine (Includes study of assembly of sub systems, various components, their functions and operating principles)
3. 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.

TOTAL : 60

LIST OF EQUIPMENTS
(for a batch of 30 students)

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

AE1357 AERO ENGINE REPAIR AND MAINTENANCE LABORATORY 0 0 3 100

OBJECTIVE

To introduce the knowledge of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.

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.

TOTAL : 60

LIST OF EQUIPMENTS

(for a batch of 30 students)

Sl.No	Equipments	Qty	Experiments No.
1	Piston Engines	2	1,2,3,4
2	Jet Aero Engines	2	6,7,8,9
3	Propeller pitch setting stand	1	5
4	Aircraft with serviceable stand	1	1 to 10
5	Precision instruments (Vernier Caliper, Micro meter, Cylinder bore gauge, depth gauge, Bevel Protector and DTI	2 each	3,5,8
6	NDT Equipments (Defectoscope, Dyepenetrant method, Hot oil Chalk Method	1 each	2,8

GE1351 PRESENTATION SKILLS AND TECHNICAL SEMINAR 0 0 3 0

(Common to all Branches)

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for aduration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

SEMESTER VI

MG1401 TOTAL QUALITY MANAGEMENT 3 0 0 100

(Common to all branches)

OBJECTIVE

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

1. INTRODUCTION 9

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

2. TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

3. STATISTICAL PROCESS CONTROL (SPC) 9

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

4. TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

5. QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

TOTAL : 45

TEXT 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.

AE1401 AVIONICS 3 0 0 100

OBJECTIVE

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

1. INTRODUCTION TO AVIONICS 6

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 10

Digital Computers – Microprocessors – Memories

3. DIGITAL AVIONICS ARCHITECTURE 6

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

4. FLIGHT DECK AND COCKPITS 8

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 15

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

TOTAL : 45

TEXT BOOKS

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.

REFERENCES

1. Middleton, D.H., Ed., "Avionics Systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
2. Spitzer, C.R., "Digital Avionic Systems", Prentice Hall, Englewood Cliffs, N.J., USA., 1987.
3. Brain Kendal, "Manual of Avionics", The English Book HOuse, 3rd Edition, New Delhi, 1993.

AE1402 COMPOSITE MATERIALS AND STRUCTURES 3 0 0 100

OBJECTIVE

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

1. STRESS STRAIN RELATION 6

Introduction- Advantages and application of composite materials, reinforcements and matrices – Generalised Hooke's Law – Elastic constants for anisotropic, orthotropic and isotropic materials.

2. METHODS OF ANALYSIS 12

Micro mechanics – Mechanics of materials approach, elasticity approach to determine material properties – Macro Mechanics – Stress-strain relations with respect to natural axis, arbitrary axis – Determination of material properties. Experimental characterization of lamina.

3. LAMINATED PLATES 12

Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.

4. SANDWICH CONSTRUCTIONS 8

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

5. FABRICATION PROCESS 7

Various Open and closed mould processes. Manufacture of fibers – Types of resins and properties and applications – Netting analysis.

TOTAL : 45

TEXT BOOKS

1. Calcote, L R. "The Analysis of laminated Composite Structures", Von – Noastrand Reinhold Company, New York 1998.
2. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 1985.

REFERENCES

1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.
2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.

ME1403 COMPUTER INTEGRATED MANUFACTURING 3 0 0 100

(Common to Mechanical, Production, Mechatronics and Aeronautical)

OBJECTIVE

This course will enable the student

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

1. INTRODUCTION 8

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

2. GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

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

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

3. SHOP FLOOR CONTROL AND INTRODUCTION OF FMS 9

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

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

4. CIM IMPLEMENTATION AND DATA COMMUNICATION 10

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

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

5. OPEN SYSTEM AND DATABASE FOR CIM 8

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

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

TOTAL : 45

TEXT BOOK

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

REFERENCES

1. Yorem koren, "Computer Integrated Manufacturing System", McGraw-Hill, 1983.
2. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International, 1986.
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe "Computer Integrated Design and Manufacturing", McGraw-Hill Inc.
4. Roger Hanman "Computer Intergrated Manufacturing", Addison – Wesley, 1997.
5. Mikell.P.Groover and Emory Zimmers Jr., "CAD/CAM", Prentice Hall of India Pvt. Ltd., New Delhi-1, 1998.
6. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
7. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition New Age International (P) Ltd., New Delhi, 2000.

AE1403 AIRCRAFT DESIGN PROJECT – II 0 0 3 100

OBJECTIVE

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

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

LIST OF EXPERIMENTS

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

TOTAL : 60

LIST OF EQUIPMENTS

(for a batch of 30 students)

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

AE1404 AIRCRAFT SYSTEM LABORATORY 0 0 3 100

OBJECTIVE

To train the students "ON HAND" experience in maintenance of various air frame systems in aircraft and rectification of common snags.

LIST OF EXPERIMENTS

1. Aircraft "Jacking Up" procedure
2. Aircraft "Levelling" procedure
3. Control System "Rigging check" procedure
4. Aircraft "Symmetry Check" procedure
5. "Flow test" to assess of filter element clogging
6. "Pressure Test" To assess hydraulic External/Internal Leakage
7. "Functional Test" to adjust operating pressure
8. "Pressure Test" procedure on fuel system components
9. "Brake Torque Load Test" on wheel brake units
10. Maintenance and rectification of snags in hydraulic and fuel systems.

TOTAL : 60

LIST OF EQUIPMENTS

(for a batch of 30 students)

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

AE1405 AVIONICS LABORATORY 0 0 3 100

OBJECTIVE

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

LIST OF EXPERIMENTS

DIGITAL ELECTRONICS

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

MICROPROCESSORS

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

AVIONICS DATA BUSES

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

TOTAL : 60

LIST OF EQUIPMENT

(for a batch of 30 students)

S.No.	Details of Equipments	Quantity	Experiment Nos.
1.	Adder/Subtractor Binary bits Kit	6	1
2	Timer Kit	6	1
3	Encoder Kit	6	3
4	Decoder Kit	6	3
5	Comparator Kit	6	4
6	Multiplexer Kit	6	2
7	Demultiplexer Kit	6	2
8	Shift Registers Kit	6	4
9	Electronic Design Experimeter	6	6,7,9,10
10	Microprocessor 8085 Kit	9	5,6,7,8,9,10
11	4 Digit 7 Segment Display	3	6
12	Switches & LED's Circuit	3	6
13	16 Channel AD Converter	6	10,9
14	Digital to Analog Converter	6	10
15	Cathode Ray Oscilloscope	3	9,10
16	Regulated Power Supply (5V DC)	9	1, 2,3,4
17	MIL-Std 1553B Setup with Remote Terminal	1	12,13
18	Computers	2	11,12,13

AE1451 ROCKETS AND MISSILES 3 0 0 100

OBJECTIVE

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

1. ROCKETS SYSTEM 10

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 13

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 10

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

4. STAGING AND CONTROL OF ROCKETS AND MISSILES 7

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

5. MATERIALS FOR ROCKETS AND MISSILES 5

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

TOTAL : 45

TEXT BOOKS

1. Sutton, G.P., et al., “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 1993.

REFERENCES

1. Mathur, M., and Sharma, R.P., “ Gas Turbines and Jet and Rocket Propulsion”, Standard Publishers, New Delhi 1998.
2. Cornelisse, J.W., “ Rocket Propulsion and Space Dynamics”, J.W., Freeman & Co. Ltd., London, 1982.
3. Parket, E.R., “ Materials for Missiles and Spacecraft”, McGraw-Hill Book Co. Inc., 1982.

AE1452 **COMPREHENSION** **0 0 3 0**
(Common To All Branches)

OBJECTIVE

The objective of comprehension is to provide opportunity for the student to apply the knowledge acquired during the earlier semesters to real life problems which he / she may have to face in future as an engineer. While learning as how to solve the real life problems, student will receive guidance from the faculty and also review various courses learnt earlier.

AE1453 **PROJECT WORK** **0 0 6 200**
(Common to all Branches)

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. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
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.

The continuous assessment shall be made as prescribed by the regulation (vide clause 10.3 of Anna University Regulations 2004 for B.E., B.Tech. programmes)

AE1001 THEORY OF ELASTICITY 3 0 0 100

OBJECTIVE

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

1. ASSUMPTIONS IN ELASTICITY 4

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

2. BASIC EQUATIONS OF ELASTICITY 15

Strain – displacement relations, Stress – strain relations, Lame's constant – cubical dilation, Compressibility of material, bulk modulus, Shear modulus, Compatibility equations for stresses and strains, Principal stresses and principal strains, Mohr's circle, Saint Venant's principle.

3. PLANE STRESS AND PLANE STRAIN PROBLEMS 8

Airy's stress function, Bi-harmonic equations, Polynomial solutions, Simple two-dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams, etc.

4. POLAR COORDINATES 10

Equations of equilibrium, Strain displacement relations, Stress – strain relations, Axi – symmetric problems, Kirsch, Michell's and Boussinesque problems.

5. TORSION 8

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

TOTAL : 45

TEXT BOOK

1. Timoshenko, S., and Goodier, T.N., "Theory of Elasticity", McGraw–Hill Ltd., Tokyo, 1990.

REFERENCES

1. Enrico Volterra & J.H. Caines, "Advanced Strength of Materials", Prentice Hall New Jersey, 1991.
2. Wng, C.T., "Applied Elasticity", McGraw–Hill Co., New York, 1993.
3. Sokolnikoff, I.S., "Mathematical Theory of Elasticity", McGraw–Hill New York, 1978.

AE1002 SPACE MECHANICS 3 0 0 100

OBJECTIVE

To study the basic concepts of orbital Mechanics with particular emphasis on interplanetary trajectories

1. BASIC CONCEPTS 4

The Solar System – References Frames and Coordinate Systems – The Celestial Sphere – The Ecliptic – Motion of Vernal Equinox – Sidereal Time – Solar Time – Standard Time – The Earth's Atmosphere.

2. THE GENERAL N-BODY PROBLEM 10

The many body Problem – Lagrange – Jacobian Identity –The Circular Restricted Three Body Problem – Libration Points- Relative Motion in the N-body Problem –Two –Body Problem – Satellite Orbits – Relations Between Position and Time – Orbital Elements.

3. SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS 12

General Aspects of satellite Injections – Satellite Orbit Transfer –Various Cases – Orbit Deviations Due to Injection Errors – Special and General Perturbations – Cowell's Method – Encke's Method – Method of vibrations of Orbital Elements – General Perturbations Approach.

4. INTERPLANETARY TRAJECTORIES 6

Two Dimensional Interplanetary Trajectories –Fast Interplanetary Trajectories – Three Dimensional Interplanetary Trajectories – Launch if Interplanetary Spacecraft –Trajectory about the Target Planet.

5. BALLISTIC MISSILE TRAJECTORIES AND MATERIALS 13

The Boost Phase – The Ballistic Phase –Trajectory Geometry- Optimal Flights – Time of Flight – Re – entry Phase – The Position of the Impact Point – Influence Coefficients. Space Environment – Peculiarities – Effect of Space Environment on the Selection of Spacecraft Material.

TOTAL : 45

TEXT BOOK

1. Cornelisse, J.W., "Rocket Propulsion and Space Dynamic", W.H. Freeman & Co., 1984.

REFERENCES

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley, 1993.
2. Van de Kamp, P., "Elements of Astromechanics", Pitman, 1979.
3. Parker E.R., "Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1982.

AE1003 AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE PRACTICES

3 0 0 100

OBJECTIVE

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

1. AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT 10

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

2. GROUND SERVICING OF VARIOUS SUB SYSTEMS 8

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

3. MAINTENANCE OF SAFETY 5

Shop safety – Environmental cleanliness – Precautions.

4. INSPECTION 10

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

5. AIRCRAFT HARDWARE, MATERIALS, SYSTEMS PROCESSES 12

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

TOTAL : 45

TEXT BOOK

1. KROES WATKINS DELP, “Aircraft Maintenance and Repair” – McGraw-Hill, New York 1993.

REFERENCES

1. A & P MECHANICS, “Aircraft hand Book” – F. A. A. Himalayan Book House, New Delhi, 1996.
2. A & P MECHANICS, “General hand Book” – F. A. A. Himalayan Book House, New Delhi, 1996.

AE1004 AIRCRAFT RULES AND REGULATIONS 3 0 0 100

OBJECTIVE

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

1. C.A.R. SERIES 'A' – PROCEDURE FOR CIVIL AIR WORTHINESS REQUIREMENTS AND RESPONSIBILITY OPERATORS Vis-à-vis AIR WORTHINESS DIRECTORATE 8

Responsibilities of operators / owners- Procedure of CAR issue, amendments etc., Objectives and targets of airworthiness directorate; Airworthiness regulations and safety oversight of engineering activities of operators.

C.A.R. SERIES 'B' – ISSUE APPROVAL OF COCKPIT CHECK LIST, MEL, CDL: Deficiency list (MEL & CDL); Preparation and use of cockpit checklist and emergency list.

2. C.A.R. SERIES 'C' – DEFECT RECORDING, MONITORING, INVESTIGATION AND REPORTING 7

Defect recording, reporting, investigation, rectification and analysis; Flight report; Reporting and rectification of defects observed on aircraft; Analytical study of in-flight readings & recordings; Maintenance control by reliability Method.

C.A.R. SERIES 'D' – AND AIRCRAFT MAINTENANCE PROGRAMMES
Reliability Programmes (Engines); Aircraft maintenance programme & their approval; On condition maintenance of reciprocating engines; TBO – Revision programme; Maintenance of fuel and oil uplift and consumption records – Light aircraft engines; Fixing routine maintenance periods and component TBOs – Initial & revisions.

3. C.A.R. SERIES 'E' – APPROVAL OF ORGANISATIONS 10

Approval of organizations in categories A, B, C, D, E, F, & G - Requirements of infrastructure at stations other than parent base.

C.A.R. SERIES 'F' – AIR WORTHINESS AND CONTINUED AIR WORTHINESS: Procedure relating to registration of aircraft; Procedure for issue / revalidation of Type Certificate of aircraft and its engines / propeller; Issue / revalidation of Certificate of Airworthiness; Requirements for renewal of Certificate of Airworthiness.

4. C.A.R. SERIES 'L'&'M' 8

Issue of AME Licence, its classification and experience requirements, Mandatory Modifications / Inspections.

5. C.A.R. SERIES 'T'&'X' 12

Flight testing of (Series) aircraft for issue of C of A; Flight testing of aircraft for which C of A had been previously issued.
Registration Markings of aircraft; Weight and balance control of an aircraft; Provision of first aid kits & Physician's kit in an aircraft; Use furnishing materials in an aircraft; Concessions; Aircraft log books; Document to be carried on board on Indian registered aircraft; Procedure for issue of tax permit; Procedure for issue of type approval of aircraft components and equipment including instruments.

TOTAL : 45

TEXT BOOKS

1. "Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness)" – Published by DGCA, The English Book Store, 17-1, Connaught Circus, New Delhi 2000.

2. Aeronautical Information Circulars (relating to Airworthiness) from DGCA 2000.

REFERENCES

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

AE1005 WIND TUNNEL TECHNIQUES 3 0 0 100

OBJECTIVE

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

1. PRINCIPLES OF MODEL TESTING 6

Buckingham Theorem – Non-Dimensional Numbers –Scale Effect Types of Similartes.

2. WIND TUNNELS 8

Classification – Special problems of Testing in Subsonic, Transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.

3. CALIBRATION OF WIND TUNNELS 11

Test section speed – Horizontal buoyancy – Flow angularities – Turbulence measurements – Associated instrumentation – Calibration of supersonic tunnels.

4. WIND TUNNEL MEASUREMENTS 12

Pressure and velocity measurements – Force measurements – Three component and six component balances – Internal balances.

5. FLOW VISUALIZATION 8

Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.

TOTAL : 45

TEXT BOOK

1. Rae, W.H. and Pope, A. "Low Speed Wind Tunnel Testing", John Wiley Publication, 1984.

REFERENCE

1. Pope, A., and Goin, L., "High Speed wind Tunnel Testing", John Wiley, 1985.

AE1006 VIBRATIONS AND AEROELASTICITY 3 0 0 100

OBJECTIVE

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

1. BASIC NOTIONS 8

Simple harmonic motion – Terminologies – Newton's Law – D' Alembert's principle – Energy Methods

2. SINGLE DEGREE OF FREEDOM SYSTEMS 12

Free vibrations – Damped vibrations – Forced Vibrations, with and without damping – support excitation – Vibration measuring instruments.

3. MULTI DEGREES OF FREEDOM SYSTEMS 10

Two degrees of freedom systems – Static and Dynamic couplings vibration absorber- Principal co-ordinates, Principal modes and orthogonal condition – Eigen value problems.

Hamilton's principle- Lagrangean equation and application – Vibration of elastic bodies- Vibration of strings- Longitudinal, Lateral and Torsional vibrations.

4. APPROXIMATE METHODS 5

Rayleigh's and Holzer Methods to find natural frequencies.

5. ELEMENTS OF AEROELASTICITY 10

Concepts – Coupling – Aero elastic instabilities and their prevention – Basic ideas on wing divergence, loss and reversal of aileron control – Flutter and its prevention.

TOTAL : 45

TEXT BOOKS

1. TIMOSHENKO S., "Vibration Problems in Engineering"– John Wiley and Sons, New York, 1993.
2. FUNG Y.C., "An Introduction to the Theory of Aeroelasticity" – John Wiley & Sons, New York, 1995.

REFERENCES

1. BISPLINGHOFF R.L., ASHELY H and HOGMAN R.L., "Aeroelasticity" – Addision Wesley Publication, New York, 1983.
2. TSE. F.S., MORSE, I.F., HUNKLE, R.T., "Mechanical Vibrations", – Prentice Hall, New York, 1984.
3. SCANLAN R.H. & ROSENBAUM R., "Introduction to the study of Aircraft Vibration & Flutter", John Wiley and Sons. New York, 1982.
4. BENSON H.TONGUE, "Principles of Vibration", Oxford University Press, 2000.

AE1007 FINITE ELEMENT METHOD 3 0 0 100

OBJECTIVE

To introduce the concept of numerical analysis of structural components

1. INTRODUCTION 4

Review of basic analysis – Stiffness and Flexibility matrix for simple cases – Governing equation and convergence criteria of finite element method.

2. DISCRETE ELEMENTS 12

Bar, Frame, beam elements – Application to static, dynamic and stability analysis.

3. CONTINUUM ELEMENTS 10

Various types of 2-D-elements Application to plane stress, plane strain and axisymmetric problems.

4. ISOPARAMETRIC ELEMENTS 10

Applications to two and three-dimensional problems.

5. FIELD PROBLEM 9

Applications to other field problems like heat transfer and fluid flow.

TOTAL : 45

TEXT BOOK

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall India, Third Edition, 2003.

REFERENCES

1. Reddy J.N. "An Introduction to Finite Element Method", McGraw-Hill, 2000.
2. Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw-Hill, 2000.
3. Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.

AE1008 AIRFRAME MAINTENANCE AND REPAIR 3 0 0 100

OBJECTIVE

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

1. WELDING IN AIRCRAFT STRUCTURAL COMPONENTS 10

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

SHEET METAL REPAIR AND MAINTENANCE

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

2. PLASTICS AND COMPOSITES IN AIRCRAFT 10

Review of types of plastics used in airplanes – Maintenance and repair of plastic components – Repair of cracks, holes etc., various repair schemes – Scopes.

Inspection and Repair of composite components – Special precautions – Autoclaves.

3. AIRCRAFT JACKING, ASSEMBLY AND RIGGING 8

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

4. REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM 10

Trouble shooting and maintenance practices – Service and inspection. – Inspection and maintenance of landing gear systems. – Inspection and maintenance of air-conditioning and pressurisation system, water and waste system. Installation and maintenance of Instruments – handling – Testing – Inspection. Inspection and maintenance of auxiliary systems – Fire protection systems – Ice protection system – Rain removal system – Position and warning system – Auxiliary Power Units (APUs)

5. SAFETY PRACTICES 7

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

TOTAL : 45

TEXT BOOK

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

REFERENCES

1. LARRY REITHMEIR, "Aircraft Repair Manual", Palamar Books, Marquette, 1992.
2. BRIMM D.J. BOGGES H.E., "Aircraft Maintenance", Pitman Publishing corp. New York, 1940

AE1009 AERO ENGINE MAINTENANCE AND REPAIR 3 0 0 100

OBJECTIVE

To study the basic concepts of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.

1. CLASSIFICATION OF PISTON ENGINE COMPONENTS 5

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

2. INSPECTIONS OF PISTON ENGINES 8

Inspection and maintenance and trouble shooting – Inspection of all engine components – Daily and routine checks – Overhaul procedures – Compression testing of cylinders – Special inspection schedules – Engine fuel, control and exhaust systems – Engine mount and super charger – Checks and inspection procedures.

3. INSPECTIONS OF PISTON ENGINES 10

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

4. CLASSIFICATION OF JET ENGINE COMPONENTS 12

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

Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures – Component maintenance procedures – Systems maintenance procedures.
Gas turbine testing procedures – test schedule preparation – Storage of Engines – Preservation and de-preservation procedures.

5. OVERHAUL PROCEDURES 10

Engine Overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of Gas turbine components.
Trouble Shooting - Procedures for rectification – Condition monitoring of the engine on ground and at altitude – engine health monitoring and corrective methods.

TOTAL : 45

TEXT BOOK

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

REFERENCES

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

AE1010 THEORY OF PLATES AND SHELLS 3 0 0 100

OBJECTIVE

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

1. CLASSICAL PLATE THEORY 3

Classical Plate Theory – Assumptions – Differential Equation – Boundary Conditions.

2. PLATES OF VARIOUS SHADES 15

Navier's Method of Solution for Simply Supported Rectangular Plates – Leavy's Method of Solution for Rectangular Plates under Different Boundary Conditions. Governing Equation – Solution for Axi-symmetric loading – Annular Plates – Plates of other shapes.

3. EIGEN VALUE ANALYSIS 8

Stability and free Vibration Analysis of Rectangular Plates.

4. APPROXIMATE METHODS 10

Rayleigh – Ritz, Galerkin Methods– Finite Difference Method – Application to Rectangular Plates for Static, Free Vibration and Stability Analysis.

5. SHELLS 9

Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.

TOTAL : 45

TEXT BOOK

1. Timoshenko, S.P. Winowsky. S., and Kreger, "Theory of Plates and Shells", McGraw-Hill Book Co. 1990.

REFERENCES

1. Flugge, W. "Stresses in Shells", Springer – Verlag, 1985.
2. Timoshenko, S.P. and Gere, J.M., "Theory of Elastic Stability", McGraw-Hill Book Co. 1986.

ME1011 COMPUTATIONAL FLUID DYNAMICS 3 0 0 100

OBJECTIVE

To study the flow of dynamic fluids by computational methods

1. FUNDAMENTAL CONCEPTS 10

Introduction - Basic Equations of Fluid Dynamics - Incompressible In viscid Flows: Source, vortex and doublet panel, methods - lifting flows over arbitrary bodies. Mathematical properties of Fluid Dynamics Equations -_ Elliptic, Parabolic and Hyperbolic equations - Well posed problems - discretization of partial Differential Equations -Transformations and grids - Explicit finite difference methods of subsonic, supersonic and viscous flows.

2. PANEL METHODS 7

Introduction – Source panel method – Vortex panel method – Applications.

3. DISCRETIZATION 8

Boundary layer Equations and methods of solution -Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation --Stability properties of explicit and implicit methods - Conservative upwind discretization for Hyperbolic systems - Further advantages of upwind differencing.

4. FINITE ELEMENT TECHNIQUES 10

Finite Element Techniques in Computational Fluid Dynamics; introduction - Strong and Weak Formulations of a Boundary Value Problem - Strong formulation - Weighted Residual Formulation - Galerkin Formulation - Weak Formulation - Variational Formulation - Piecewise defined shape functions - Implementation of the FEM - The Solution Procedure.

5. FINITE VOLUME TECHNIQUES 10

Finite Volume Techniques - Cell Centered Formulation - ~ Lax - Vendoroff Time Stepping - Runge - Kutta Time Stepping - Multi - stage Time Stepping - Accuracy -. Cell Vertex Formulation - Multistage Time Stepping - FDM -like Finite Volume Techniques - Central and Up-wind Type Discretizations - Treatment of Derivatives.

TOTAL : 45

TEXT BOOK

1. Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics", Vols. I and II, Springer - Verlag, Berlin, 1988.

REFERENCES

1. John F. Wendt (Editor), "Computational Fluid Dynamics - An Introduction", Springer – Verlag, Berlin, 1992
2. Charles Hirsch, "Numerical Computation of Internal and External Flows", Vols. I and II. John Wiley & Sons, New York, 1988.
3. Klaus A Hoffmann and Steve T. Chiang. "Computational Fluid Dynamics for Engineers", Vols. I & II Engineering Education System, P.O. Box 20078, W. Wichita, K.S., 67208 - 1078 USA, 1993.
4. Anderson, Jr.D., "Fundamentals of Aerodynamics", McGraw-Hill, 2000.

AE1011 FATIGUE AND FRACTURE 3 0 0 100

OBJECTIVE

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

1. FATIGUE OF STRUCTURES 7

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factors - Notched S.N. curves.

2. STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR 10

Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life - cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques -Cumulative damage - Miner's theory - Other theories.

3. PHYSICAL ASPECTS OF FATIGUE 10

Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces.

4. FRACTURE MECHANICS 10

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

5. FATIGUE DESIGN ANDTESTINIG 8

Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

TOTAL : 45

TEXT BOOKS

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

REFERENCES

1. Sin, C.G., "Mechanics of fracture" Vol. I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1989.
2. Knott, J.F., "Fundamentals of Fracture Mechanics", Buterworth & Co., Ltd., London, 1983

AE1012 AIR TRANSPORTAION AND AIRCRAFT MAINTENANCE 3 0 0 100

OBJECTIVE

To study the concepts of air transportation and the maintenance management of aircraft.

1. INTRODUCTION 8

Development of air transportation, 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.

2. AIRLINE ECONOMICS 10

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

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.

3. PRINCIPLES OF AIRLINES SCHEDULING 10

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 – Aircraft scheduling in line with aircraft maintenance practices.

4. AIRCRAFT RELIABILITY 9

Aircraft reliability – The maintenance schedule & its determinations – Condition monitoring maintenance – Extended range operations (EROPS) & ETOPS – Ageing aircraft maintenance production.

5. TECHNOLOGY IN AIRCRAFT MAINTENANCE 8

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.

TOTAL : 45

TEXT BOOKS

1. FEDRIC J.H., "Airport Management", 2000.
2. C.H. FRIEND, "Aircraft Maintenance Management", 2000.

REFERENCES

1. GENE KROPF, "Airline Procedures".
2. WILSON & BRYON, "Air Transportation".
3. PHILIP LOCKLIN D, "Economics of Transportation".
4. "Indian Aircraft manual" – DGCA Pub.
5. ALEXANDER T WELLS, "Air Transportation", Wadsworth Publishing Company, California, 1993.

AE1013 HELICOPTER MAINTENANCE 3 0 0 100

OBJECTIVE

To study the procedure adapted to the maintenance of helicopter.

1. HELICOPTER FUNDAMENTAL 5

Basic directions – Ground handling, bearing – Gears.

2. MAIN ROTOR SYSTEM 9

Head maintenance – blade alignment – Static main rotor balance – Vibration – Tracking – Span wise dynamic balance – Blade sweeping –Electronic balancing – Dampener maintenance – Counter weight adjustment – Auto rotation adjustments – Mast & Flight Control Rotor - Mast – Stabilizer, dampeners – Swash plate flight control systems collective – Cyclic – Push pull tubes – Torque tubes – Bell cranks – Mixer box – Gradient unit control boosts – Maintenance & Inspection control rigging.

3. MAIN ROTOR TRANSMISSIONS 12

Engine transmission coupling – Drive shaft – Maintenance clutch – Free wheeling units – Spray clutch – Roller unit – Torque meter – Rotor brake – Maintenance of these components – vibrations – Mounting systems – Transmissions.

4. POWER PLANTS & TAIL ROTORS 12

Fixed wing power plant modifications – Installation – Different type of power plant maintenance.

Tail rotor system – Servicing tail rotor track – System rigging.

5. AIRFRAMES AND RELATED SYSTEMS 7

Fuselage maintenance – Airframe Systems – Special purpose equipment.

TOTAL : 45

TEXT BOOK

1. JEPPESEN, "Helicopter Maintenance", Jeppesons and Sons Inc., 2000.

REFERENCES

1. "Civil Aircraft Inspection Procedures", Part I and II, CAA, English Book House, New Delhi, 1986.
2. LARRY REITHMIER, "Aircraft Repair Manual", Palamar Books Marquette, 1992.

AE1014 AIR TRAFFIC CONTROL AND AERODROME DESIGN 3 0 0 100

OBJECTIVE

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

1. BASIC CONCEPTS 9

Objectives of ATS - Parts of ATC service – Scope and Provision of ATCs – VFR & IFR operations – Classification of ATS air spaces – Varies kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS – Division of responsibility of control.

2. AIR TRAFFIC SERVICES 9

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

3. FLIGHT INFORMATION ALERTING SERVICES, COORDINATION, EMERGENCY PROCEDURES AND RULES OF THE AIR 10

Radar service, Basic radar terminology – Identification procedures using primary / secondary radar – performance checks – use of radar in area and approach control services – assurance control and co-ordination between radar / non radar control – emergencies – Flight information and advisory service – Alerting service – Co-ordination and emergency procedures – Rules of the air.

4. AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION 9

Aerodrome data - Basic terminology – Aerodrome reference code – Aerodrome reference point – Aerodrome elevation – Aerodrome reference temperature – Instrument runway, physical Characteristics; length of primary / secondary runway – Width of runways – Minimum distance between parallel runways etc. – obstacles restriction.

5. VISUAL AIDS FOR NAVIGATION, VISUAL AIDS FOR DENOTING OBSTACLES EMERGENCY AND OTHER SERVICES 8

Visual aids for navigation Wind direction indicator – Landing direction indicator – Location and characteristics of signal area – Markings, general requirements – Various markings – Lights, general requirements – Aerodrome beacon, identification beacon – Simple approach lighting system and various lighting systems – VASI & PAPI - Visual aids for denoting obstacles; object to be marked and lighter – Emergency and other services.

TOTAL : 45

TEXT BOOK

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

REFERENCES

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

ME1020 ENTREPRENEURSHIP DEVELOPMENT 3 0 0 100

(Common to all branches)

OBJECTIVE

Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

1. ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurical Growth.

2. MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

3. BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

4. FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

5. SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL : 45

TEXT BOOKS

1. S.S.KHANKA "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.

REFERENCES

1. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
2. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.