ANNA UNIVERSITY TIRUCHIRAPPALLI
Tiruchirappalli – 620 024

Regulations 2008

Curriculum

B.E. AERONAUTICAL ENGINEERING

SEMESTER III

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	**MA1201**	Transforms and Partial Differential Equations	3	1	0	4
2	**ME1204**	Mechanics of Machines	3	1	0	4
3	**AE1201**	Aero Engineering Thermodynamics	3	1	0	4
4	**CE1208**	Fluid Mechanics and Machinery	3	1	0	4
5	**CE1209**	Solid Mechanics	3	1	0	4
6	**AE1202**	Elements of Aeronautics	3	0	0	3
Practical						
7	**CE1210**	Strength of Materials Laboratory	0	0	3	2
8	**CE1211**	Fluid Mechanics and Machinery Laboratory	0	0	3	2
9	**ME1205**	Thermodynamics Laboratory	0	0	3	2
					Total	**29**

SEMESTER IV

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	**MA1251**	Numerical Methods	3	1	0	4
2	**AE1251**	Aerodynamics I	3	0	0	3
3	**AE1252**	Aircraft Systems and Instruments	3	0	0	3
4	**PR1206**	Production Technology	3	0	0	3
5	**AE1253**	Aircraft Structures I	3	1	0	4
6	**AE1254**	Propulsion I	3	0	0	3
Practical						
7	**AE1255**	Aircraft Structures Laboratory I	0	0	3	2
8	**AE1256**	Aerodynamics Laboratory	0	0	3	2
9	**AE1257**	Aircraft Component Drawing	0	0	4	2
10	**ME1256**	Manufacturing Technology Laboratory	0	0	3	2
					Total	**28**

SEMESTER V

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	**HS1201**	Environmental Science and Engineering	3	0	0	3
2	**AE1301**	Flight Dynamics	4	0	0	4
3	**AE1302**	Aircraft Structures II	3	1	0	4
4	**AE1303**	Aerodynamics II	3	0	0	3
5	**AE1304**	Control Engineering	3	0	0	3
6	**EC1313**	Microprocessor and Applications	3	0	0	3
Practical						
7	**AE1305**	Aircraft Structures Laboratory II	0	0	3	2
8	**AE1306**	Aircraft Structures Repair Laboratory	0	0	3	2
9	**ME1310**	CAD/CAM Laboratory	0	0	3	2
					Total	**26**

SEMESTER VI

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	**MG1351**	Principles of Management	3	0	0	3
2	**AE1351**	Propulsion II	3	0	0	3
3	**AE1352**	Heat Transfer	3	1	0	4
4	**AE1353**	Experimental Stress Analysis	3	1	0	4
5	**AE1354**	High Temperature Materials	3	0	0	3
6	**E1******	Elective I	3	0	0	3
Practical						
7	**AE1355**	Aircraft Design Project I	0	0	3	2
8	**AE1356**	Propulsion Laboratory	0	0	3	2
9	**AE1357**	Aero Engine Repair and Maintenance Laboratory	0	0	3	2
					Total	**26**

SEMESTER VII

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	**MG1301**	Total Quality Management	3	0	0	3
2	**AE1401**	Avionics	3	1	0	4
3	**AE1402**	Composite Materials and Structures	3	0	0	3
4	**ME1403**	Computer Integrated Manufacturing	3	0	0	3
5	**E2******	Elective II	3	0	0	3
6	**E3******	Elective III	3	0	0	3
Practical						
7	**AE1403**	Aircraft Design Project II	0	0	3	2
8	**AE1404**	Aircraft Systems Laboratory	0	0	3	2
9	**AE1405**	Avionics Laboratory	0	0	3	2
10	**HS1301**	Communication and Soft Skills Laboratory	0	0	3	2
					Total	**27**

SEMESTER VIII

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	**AE1451**	Rocket and Missiles	3	0	0	3
2	**E4******	Elective IV	3	0	0	3
3	**E5******	Elective V	3	0	0	3
Practical						
4	**AE1455**	Project Work	0	0	6	6
					Total	**15**

LIST OF ELECTIVES

ELECTIVES FOR VI SEMESTER

S.No.	Subject Code	Subject	L	T	P	C
1	**AE1001**	Theory of Elasticity	3	0	0	3
2	**AE1002**	Space Mechanics	3	0	0	3
3	**AE1003**	Aircraft General Engineering and Maintenance Practices	3	0	0	3
4	**AE1004**	Aircraft Rules and Regulation	3	0	0	3
5	**AE1005**	Wind Tunnel Techniques	3	0	0	3

ELECTIVES FOR VII SEMESTER

S.No.	Subject Code	Subject	L	T	P	C
1	**AE1006**	Vibration and Aero elasticity	3	0	0	3
2	**AE1007**	Finite Element Method	3	0	0	3
3	**AE1008**	Airframe Maintenance and Repair	3	0	0	3
4	**AE1009**	Aero Engine Maintenance and Repair	3	0	0	3
5	**AE1010**	Theory of Plates and Shells	3	0	0	3

ELECTIVES FOR VIII SEMESTER

S.No.	Subject Code	Subject	L	T	P	C
1	**ME1005**	Computational Fluid Dynamics	3	0	0	3
2	**AE1011**	Fatigue and Fracture	3	0	0	3
3	**AE1012**	Air transportation and Aircraft Maintenance	3	0	0	3
4	**AE1013**	Helicopter Maintenance	3	0	0	3
5	**AE1014**	Air Traffic Control and Aerodrome Design	3	0	0	3
6	**ME1013**	Entrepreneurship Development	3	0	0	3
7	**GE1301**	Professional Ethics and Human Values	3	0	0	3

ANNA UNIVERSITY TIRUCHIRAPPALLI
Tiruchirappalli – 620 024

Regulations 2008

Syllabus

B.E. AERONAUTICAL ENGINEERING

SEMESTER III

MA1201 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to all branches)

L	T	P	C
3	1	0	4

UNIT I FOURIER SERIES **9**

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

UNIT II FOURIER TRANSFORMS **9**

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

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **9**

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

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **9**

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

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS **9**

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

L: 45 T: 15 Total: 60

TEXT BOOK

1. Grewal, B.S, "Higher Engineering Mathematics", 40th Edition, Khanna publishers, 2007.

REFERENCES

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications(P) Ltd., 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, 2007.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics" 8th Edition, Wiley India, 2007.

ME1204 – MECHANICS OF MACHINES

(Common to Automobile and Aeronautical)

L	T	P	C
3	1	0	4

UNIT I MECHANISMS 9

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

UNIT II FRICTION 9

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

UNIT III GEARING AND CAMS 9

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains – Simple – Compound gear trains – Epicylic gear trains – Determination of speed and torque – Cams – Types of cams – Design of profiles – Knife edged – Flat faced – Roller ended followers with and without offsets for various types of follower motions

UNIT IV BALANCING 9

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

UNIT V VIBRATION 9

Free – Forced – 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.

L: 45 T: 15 Total: 60

TEXT BOOKS

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

REFERENCES

1. Rao,J.S and Dukkipati, R.V, “Mechanism and Machine Theory”, 2nd Edition, Wiley Eastern Ltd., 2002.
2. Malhotra, D.R and Gupta, H.C., “The Theory of Machines”, Satya Prakasam, Tech. India Publications, 2005.
3. Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, Affiliated East West Press, 2006.

AE1201 – AERO ENGINEERING THERMODYNAMICS

L	T	P	C
3	1	0	4

UNIT I BASIC THERMODYNAMICS 9

Systems – Zeroth Law – First Law – Heat and work transfer in flow – Second law – Clausius statement – Concept of entropy – Entropy change in non-flow processes

UNIT II AIR CYCLES 9

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

UNIT III THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW 9

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

UNIT IV REFRIGERATION AND AIR CONDITIONING 9

Principles of refrigeration – Air conditioning – Heat pumps – Vapour compression – Vapour absorption types – Coefficient of performance – Properties of refrigerants

UNIT V AIR COMPRESSORS 9

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

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Radhakrishnan, E, "Fundamentals of Engineering Thermodynamics", Prentice – Hall, India, 2000
2. Nag. P.K., "Engineering Thermodynamics", 7th Edition, Tata McGraw-Hills Co., Ltd., 1993
3. Rudramoorthy .R., "Thermal Engineering", 5th reprint, Tata McGraw-Hills Co., Ltd., 2003

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)", 2nd Edition, 1986.
3. Yunus A.Cengal., "Thermodynamics an Engineering Approach", Third Edition, Tata McGraw-Hill Co. Ltd., 2002.

CE1208 – FLUID MECHANICS AND MACHINERY

(Common to Mechanical, Automobile, Aeronautical and Production)

L	T	P	C
3	1	0	4

UNIT I INTRODUCTION 9

Units & Dimensions – Properties of fluids – Specific gravity – Specific weight – Viscosity – Compressibility – Vapour pressure and gas laws – Capillarity and surface tension – Flow characteristics: concepts of system and control volume – Application of control volume to continuity equation – Energy equation – Momentum equation – Moment of momentum equation

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

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

UNIT III DIMENSIONAL ANALYSIS 9

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

UNIT IV ROTO DYNAMIC MACHINES 9

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

UNIT V POSITIVE DISPLACEMENT MACHINES 9

Reciprocating pumps – Indicator diagrams – Work saved by air vessels – Rotary pumps – Classification – Working and performance curves

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Streeter. V. L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 1983.
2. Radhakrishnan. E, "Fluid Mechanics", 2nd Edition, Prentice Hall of India, 2007.

REFERENCES

1. Ramamritham. S, "Fluid Mechanics, Hydraulics and Fluid Machines", Dhanpat Rai & Sons, 1988.
2. Kumar. K.L., "Engineering Fluid Mechanics", 7th Edition, Eurasia Publishing House (P) Ltd., 1995.
3. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi Publications (P) Ltd., 2007.

CE1209 – SOLID MECHANICS

L	T	P	C
3	1	0	4

UNIT I BASICS AND AXIAL LOADING 10

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

UNIT II STRESSES IN BEAMS 10

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

UNIT III DEFLECTION OF BEAMS 10

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

UNIT IV TORSION 5

Torsion of circular shafts – Shear stresses and twist in solid and hollow circular shafts – Closely coiled helical springs.

UNIT V BI AXIAL STRESSES 10

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.

L: 45 T: 15 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, 1990.

REFERENCE

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

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AE1202 – ELEMENTS OF AERONAUTICS

L	T	P	C
3	0	0	3

UNIT I AIRCRAFT CONFIGURATIONS 9

Brief History – Components of an airplane and their functions – Different types of flight vehicles – Classifications – Basic instruments for flying

UNIT II INTRODUCTION TO PRINCIPLES OF FLIGHT 9

Physical properties and structure of the atmosphere – Temperature – Pressure – Altitude relationships – Evolution of lift – Drag and moment – Different types of drag

UNIT III INTRODUCTION TO AERODYNAMICS 9

Aerodynamic forces on aircraft – Classification of NACA aero-foils – Aspect ratio – Wing loading – Mach number – Centre of pressure – Aerodynamic centre – Aerofoil characteristics – lift – Drag curves

UNIT IV INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS 9

General types of construction – Monocoque – Semi-monocoque – Typical wing and fuselage structure – Metallic and non-metallic materials – Use of Aluminium alloy – Titanium – Stainless steel and composite materials and smart materials

UNIT V POWER PLANTS USED IN AIRPLANES 9

Basic ideas about piston – Turboprop and jet engines – Use of propeller and jets for thrust production – Principles of operation of rocket and types of rockets

Total: 45

TEXT BOOK

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

REFERENCE

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

2. Kermode, A.C., “Mechanics of flight”, printice Hall 10th Edition, 1996.

CE1210 – STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Brinell Hardness test
2. Rockwell Hardness test
3. Tension test
4. Torsion test
5. Izod Impact test
6. Charpy Impact test
7. Reverse plate bending Fatigue test
8. Rotating Beam Fatigue test
9. Testing of springs
10. Block Compression Test

Total: 45

LIST OF EQUIPMENTS
(for a batch of 30 students)

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

CE1211 – FLUID MECHANICS AND MACHINERY LABORATORY

(Common to Mechanical, Production, Aeronautical and Automobile)

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rotameter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of Centrifugal pump / Submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

LIST OF EQUIPMENTS

(for a batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup

Quantity: one each.

Total Number of Periods: 45

ME1205 – THERMODYNAMICS LABORATORY

L	T	P	C
0	0	3	2

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 heating value of a fuel
6. COP test on a vapour compression refrigeration test rig
7. COP test on a vapour compression air-conditioning test rig
8. Determination of specific heat of solid
9. Determination of Thermal Conductivity of solid.
10. Determination of Thermal Resistance of a Composite wall.

Total: 45

LIST OF EQUIPMENTS
(for a batch of 30 students)

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

SEMESTER IV

MA1251 – NUMERICAL METHODS

L	T	P	C
3	1	0	4

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

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

UNIT II INTERPOLATION AND APPROXIMATION 9

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

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

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

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

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

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

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

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Veerarjan, T. and Ramachandran, T., "Numerical Methods with Programming in 'C'" 2nd Edition, Tata McGraw-Hill Publishing Co. Ltd., 2007.
2. Sankara Rao, K., "Numerical Methods for Scientists and Engineers", 3rd Edition, Prentice Hall of India, 2007.

REFERENCES

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, 2007.
2. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, 2006.
3. Grewal, B.S. and Grewal, J.S., "Numerical Methods in Engineering and Science", 6th Edition, Khanna Publishers, 2004.

AE1251 – AERODYNAMICS I

L	T	P	C
3	0	0	3

UNIT I REVIEW OF BASIC FLUID MECHANICS 4

Continuity – Momentum and energy equations.

UNIT II 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.

UNIT III GENERATION OF LIFT 8

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

UNIT IV 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.

UNIT V VISCOUS FLOW 9

Newton's law of viscosity – Boundary layer – Navier-Stokes equation – Displacement – Momentum thickness – Flow over a flat plate – Blasins solution.

Total: 45

TEXT BOOKS

1. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill Book Co., 1998.
2. Houghton, E.L. and Carruthers, N.B., "Aerodynamics for Engineering Students", Edward Arnold Publishers Ltd., 1989.

REFERENCES

1. Milne Thomson, L.H., "Theoretical Aerodynamics", Macmillan, 1985.
2. Clancey, L.J., "Aerodynamics", Pitman, 1986.

AE1252 – AIRCRAFT SYSTEMS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

UNIT I AIRPLANE CONTROL SYSTEMS 10

Conventional control systems: Fully powered flight controls – Power actuated systems. Modern control systems: Digital fly by wire system– Auto pilot system active control technology.

UNIT II AIRCRAFT SYSTEMS 12

Hydraulic systems – Study of typical workable system – Components – Pneumatic systems – Advantages – Working principles – Typical air pressure system – Brake system – Typical pneumatic power system – Components, landing gear systems – Classification.

UNIT III ENGINE SYSTEMS 8

Fuel systems for piston and jet engines – Components of multi engines – Lubricating systems for piston and jet engines – Starting and ignition systems – Typical examples for piston and jet engines.

UNIT IV AUXILIARY SYSTEM 8

Basic Air cycle systems – Vapour cycle systems – Evaporative vapour cycle systems – Evaporative air cycle systems. Fire protection systems, deicing and anti icing systems.

UNIT V AIRCRAFT INSTRUMENTS 7

Flight Instruments and Navigation Instruments: Gyroscope – Accelerometers, air speed indicators – TAS, EAS- Mach meters – Altimeters (Principles and operation). Study of various types of engine instruments: Tachometers – Temperature gauges – Pressure gauges (Operation and principles).

Total: 45

TEXT BOOKS

1. McKinley, J.L. and Bent, R.D., “Aircraft Maintenance and Repair”, McGraw-Hill, 1993.
2. Anonymous, “General Hand Books of Airframe and Power plant Mechanics”, U.S. Department of Transportation, Federal Aviation Administration, The English Book Store, 1995.

REFERENCES

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

PR1206 – PRODUCTION TECHNOLOGY

(Common to Aeronautical and Automobile III Semester)

L	T	P	C
3	0	0	3

UNIT I CASTING 9

Casting types – Procedure to make sand mould – Types of core making – Moulding tolls – Machine moulding – Special moulding processes – Co_2 moulding – Shell moulding – Investment moulding – Permanent mould casting – Pressure die casting – Centrifugal casting – Continuous casting – Casting defects.

UNIT II WELDING 9

Classification of welding processes – Principles of Oxyacetylene gas welding – A.C. metal arc welding – Resistance welding – Submerged arc welding – Tungsten inert gas welding – Metal inert gas welding – Plasma arc welding – Thermic welding – Electron beam welding – Laser beam welding – Defects in welding – Soldering and brazing.

UNIT III MACHIINING 9

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: lathe – shaper – planer – horizontal milling machine – universal drilling machine – Cylindrical grinding machine – Capstan and Turret lathe – Basics of CNC machines.

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

UNIT IV FORMING AND SHAPING OF PLASTICS 9

Types of plastics – Characteristics of the forming and shaping processes – Moulding of thermoplastics – Working principles and typical applications of injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film moulding – Extrusion – typical industrial applications – Thermoforming – Processing of thermosets – Working principles and typical applications – Compression moulding – Transfer moulding – Bonding of thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods.

UNIT V METAL FORMING AND POWDER METALLURGY 9

Principles and applications of the following processes: Forging, rolling, extrusion, wire drawing and spinning – Powder metallurgy – Principal steps involved – Advantages, disadvantages and limitations of powder metallurgy.

Total: 45

TEXT BOOKS

1. Harija Choudry, “Elements of workshop Technology, Vol. I and II”, Media Promoters and Publishers Private Ltd., 2001.
2. Jain, R. K. and Gupta, S. C., “Production Technology”, 16th Edition, Khanna Publishers, 2001.

REFERENCES

1. H. M. T., “Production Technology-Hand book”, Tata Mc Graw-Hill, 2000.
2. Linberg, R.A., “Process and Materials of Manufacturing Technology”, Prentice Hall of India, 2000.
3. Adithan, M. and Cupta, A. B., “Manufacturing Technology”, New Age International, 1996.

AE1253 – AIRCRAFT STRUCTURES I

L	T	P	C
3	1	0	4

UNIT I STATICALLY DETERMINATE STRUCTURES 10

Analysis of plane truss – Method of joints – 3 D truss – Plane frames – Composite beam.

UNIT II STATICALLY INDETERMINATE STRUCTURES 10

Propped cantilever – Fixed beams – Clapeyron's three moment equation – Moment distribution method.

UNIT III ENERGY METHODS 10

Strain energy due to axial, bending and torsional loads – Castigliano's theorems – Maxwell's reciprocal theorem – Unit load method – Application to beams, trusses, frames, rings, etc.,

UNIT IV COLUMNS 10

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

UNIT V FAILURE THEORY 5

Maximum stress theory – Maximum strain theory – Maximum shear stress theory – Distortion theory – Maximum strain energy theory – Application to aircraft structural problems.

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Donaldson, B.K., "Analysis of Aircraft Structures – An Introduction", McGraw-Hill, 1993.
2. Bruhn. E.F., "Analysis and Design of Flight Vehicle Structures", Tri Set of Offset Company, 1973.

REFERENCE

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

AE1254 – PROPULSION I

L	T	P	C
3	0	0	3

UNIT I FUNDAMENTALS OF GAS TURBINE ENGINES 12

Illustration of working of gas turbine engine – 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, Numerical Problems.

UNIT II SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES 8

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

UNIT III COMBUSTION CHAMBERS 6

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

UNIT IV NOZZLES 6

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

UNIT V COMPRESSORS 13

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

Total: 45

TEXT BOOKS

1. Hill, P.G. and Peterson, C.R., “Mechanics and Thermodynamics of Propulsion” Addison–Wesley Longman INC, 1999.
2. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., “Gas Turbine Theory”, Longman, 1989.

REFERENCES

1. Oates, G.C., “Aero thermodynamics of Aircraft Engine Components”, AIAA Education Series, 1985.
2. Mathur, M.L. and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers and Distributors, 1999.
3. Ganesan, V “Gas Turbines”, Tata McGraw Hill publications, second edition.

AE1255 – AIRCRAFT STRUCTURES LABORATORY I

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Determination of Young's modulus of Steel using Mechanical Extensometers.
2. Determination of Young's modulus of Aluminum using Electrical Extensometers
3. Determination of Fracture strength and Fracture pattern of Ductile and Brittle materials
4. Determination of Forces in statically indeterminate force system.
5. Deflection of Beams with various end conditions.
6. Verification of Maxwell's Reciprocal theorem and principle of Superposition
7. Column – Testing
8. South – well's plot.
9. Testing of Riveted Joints.
10. Determination of Membrane stresses in a thin cylinder under internal pressure.

Total: 45

LIST OF EQUIPMENTS
(for a batch of 30 students)

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

AE1256 – AERODYNAMICS LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

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

Total: 45

LIST OF EQUIPMENT S
(for a batch of 30 students)

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

AE1257 – AIRCRAFT COMPONENT DRAWING

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS

1. Design and Drafting of Riveted joints.
2. Design and Drafting of Welded joints.
3. Design and Drafting Control Components Cam.
4. Design and Drafting Control Components Bell Crank.
5. Design and Drafting Control Components Gear.
6. Design and Drafting Control Components Push-pull rod.
7. Three view diagram of a Typical Aircraft.
8. Layout of Typical Wing Structure.
9. Layout of Typical Fuselage Structure.
10. Layout of Control System.

Total: 60

LIST OF EQUIPMENT
(for a batch of 30 students)

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

ME1256 – MANUFACTURING TECHNOLOGY LABORATORY

(Common to Aeronautical & Automobile)

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. LATHE

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

2. SHAPER AND SLOTTER

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

3. DRILLING

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

4. MILLING

4.1. Plain Milling Exercise.
4.2. Gear Milling Exercise.

5. GRINDING

Cylindrical Grinding Exercise.

Total: 45

LIST OF EQUIPMENTS (For a batch of 30 students)

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

SEMESTER V

HS1201 – ENVIRONMENTAL SCIENCE AND ENGINEERING

(Common to all branches)

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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, and hill slopes, etc.

UNIT III 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

UNIT IV 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

UNIT V 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", Second Edition, Pearson education Pvt., Ltd., 2004. (ISBN 81-297-0277-0)
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., 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, 2001.
4. Wager K.D., "Environmental Management", W.B. Saunders Co., Philadelphia, 1998.

AE1301 – FLIGHT DYNAMICS

L	T	P	C
4	0	0	4

UNIT I DRAG ON THE AIRPLANE 12

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

UNIT II AIRCRAFT PERFORMANCE 12

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

UNIT III STATIC LONGITUDINAL STABILITY 12

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

UNIT IV LATERAL AND DIRECTIONAL STABILITY 12

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

UNIT V DYNAMIC STABILITY 12

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: 60

TEXT BOOK

1. Perkins, C.D., and Hage, R.E., “Airplane Performance stability and Control”, John Wiley & Son:, Inc, 1988.
2. Anderson, J.D., “Aircraft performance”, McGraw-Hill Book Co.,

REFERENCES

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

AE1302 – AIRCRAFT STRUCTURES II

L	T	P	C
3	1	0	4

UNIT I UNSYMMETRICAL BENDING 8

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

UNIT II SHEAR FLOW IN OPEN SECTIONS 10

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

UNIT III SHEAR FLOW IN CLOSED SECTIONS 10

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

UNIT IV BUCKLING OF PLATES 10

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

UNIT V STRESS ANALYSIS IN WING AND FUSELAGE 7

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).

L: 45 T: 15 Total: 60

TEXT BOOK

1. Peery, D.J., and Azar, J.J., "Aircraft Structures", Second Edition, McGraw–Hill, 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, 1985.
3. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, 1993.

AE1303 – AERODYNAMICS II

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V 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.
2. Shapiro, A.H., “Dynamics and Thermodynamics of Compressible Fluid Flow”, Ronold Press, 1982.

REFERENCES

1. Zucrow, M.J. and Anderson, J.D., “Elements of gas dynamics”, McGraw-Hill Book Co., 1989.
2. Mc Cornick. W., “Aerodynamics, Aeronautics and Flight Mechanics”, John Wiley, 1979.
3. Anderson Jr., D., “Modern compressible flows”, McGraw-Hill Book Co., 1999.

AE1304 – CONTROL ENGINEERING

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 6

Historical review – Simple pneumatic – hydraulic and thermal systems – Series and parallel systems – Analogies – Mechanical and electrical components – Development of flight control systems.

UNIT II 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.

UNIT III CHARACTERISTIC EQUATION AND FUNCTIONS 10

Laplace 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

UNIT IV CONCEPT OF STABILITY 15

Necessary and sufficient conditions – Routh-Hurwitz criteria of stability – Root locus and Bode techniques – Concept and construction – Frequency response

UNIT V 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., 1998.
2. GOPAL. M., “Control Systems, Principles and Design”, Tata McGraw-Hill Publication, 2000.

REFERENCES

1. Azzo, J.J.D. and C.H. Houpis, “Feed back control system analysis and synthesis”, Third Edition, McGraw-Hill International, 1998.
2. Kuo, B.C., “Automatic control systems”, Prentice-Hall of India Pvt. Ltd., 1998.
3. Houpis, C.H. and Lamont, G.B., “Digital Control Systems”, McGraw-Hill Book Co., 1995.

EC1313 – MICROPROCESSORS AND APPLICATIONS

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V APPLICATIONS 5

Microprocessor Applications in aerospace – Case study.

Total: 45

TEXT BOOKS

1. "Computer principles of architecture", Fourth Edition, Tata McGraw-Hill, 2002.
2. Goankar. R.S., "Microprocessors, Programming to Architecture 8085", Fifth Edition, Penram International publishing PVT Ltd, 2002
3. V.K. Mehta, "Principles of Electronics", Second Edition, S. Chand & Co, 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", Revised Edition, Tata McGraw-Hill, 1995.
4. Douglas, Hall, "Microprocessors and Interfacing", Revised Edition, Tata McGraw–Hill, 1990.
5. Mathur A.P., "Introduction to Microprocessors", Revised Edition, Tata McGraw–Hill, 1995.

AE1305 – AIRCRAFT STRUCTURES LAB II

L	T	P	C
0	0	3	2

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: 45

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 LABORATORY

L	T	P	C
0	0	3	2

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: 45

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

ME1310 – CAD / CAM LABORATORY

L	T	P	C
0	0	3	2

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: 45

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

SEMESTER VI

MG1351 – PRINCIPLES OF MANAGEMENT

(Common to all Branches)

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II PLANNING 9

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

UNIT III 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.

UNIT IV 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.

UNIT V 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”, Fourth Edition, Prentice Hall of India, 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”, Sixth Edition, Pearson Education, 2004.
4. Fraidoon Mazda, “Engineering Management”, Addison Wesley, 2000.

AE1351 – PROPULSION – II

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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.

UNIT III FUNDAMENTALS OF ROCKET PROPULSION 8

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

UNIT IV 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.

UNIT V ADVANTAGES OF PROPULSION TECHNIQUES 5

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

Total: 45

TEXT BOOKS

1. Sutton, G.P., “Rocket Propulsion Elements”, Fifth Edition, John Wiley & Sons Inc., 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 Edition, 1989.
2. Gorden, C.V., “Aero thermodynamics of Gas Turbine and Rocket Propulsion”, AIAA Education Series, 1989.
3. Mathur, M., and Sharma, R.P., “Gas Turbines and Jet and Rocket Propulsion”, Standard Publishers, 1988.

AE1352 – HEAT TRANSFER

L	T	P	C
3	1	0	4

UNIT I 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 – Heislier charts – Application of Numerical Techniques.

UNIT II 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.

UNIT III RADIATIVE HEAT TRANSFER 8

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

UNIT IV HEAT EXCHANGERS 8

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

UNIT V 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.

L: 45 T: 15 Total: 60

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”, Sixth Edition, McGraw-Hill Book Co., Inc., 1991.
3. Sachdeva, S.C., “Fundamentals of Engineering Heat & Mass Transfer”, Wiley Eastern Ltd., 1981.
4. Mathur, M. and Sharma, R.P. “Gas Turbine and Jet and Rocket Propulsion”, Standard Publishers, 1988.

AE1353 – EXPERIMENTAL STRESS ANALYSIS

L	T	P	C
3	1	0	4

UNIT I MEASUREMENTS 4

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

UNIT II EXTENSOMETERS 6

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

UNIT III 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, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT IV 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.

UNIT V 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.

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., “Experimental Stress Analysis”, Tata McGraw-Hill, 1984.

REFERENCES

1. Dally, J.W., and Riley, W.F., “Experimental Stress Analysis”, McGraw-Hill Inc., 1998.
2. Hetyenyi, M., “Hand book of Experimental Stress Analysis”, John Wiley and Sons Inc., 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

L	T	P	C
3	0	0	3

UNIT I CREEP 9

Crystal structure - 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–Introduction to creep map.

UNIT II DESIGN FOR CREEP RESISTANCE 9

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

UNIT III FRACTURE 9

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

UNIT IV OXIDATION AND HOT CORROSION 9

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

UNIT V 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, 1985.
2. Hertzberg R. W., “Deformation and Fracture Mechanics of Engineering materials”, Forth Edition, John Wiley, 1996.

REFERENCES

1. Boyle J.T, Spencer J, “Stress Analysis for Creep”, Butterworths, 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, 1985.

AE1355 – AIRCRAFT DESIGN PROJECT I

L	T	P	C
0	0	3	2

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: 45

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

L	T	P	C
0	0	3	2

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: 45

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

L	T	P	C
0	0	3	2

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: 45

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

SEMESTER VII

MG1301 – TOTAL QUALITY MANAGEMENT

(Common to all branches)

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 9

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

UNIT II TQM PRINCIPLES 9

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

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

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

UNIT IV TQM TOOLS 9

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

UNIT V QUALITY SYSTEMS 9

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

Total: 45

TEXT BOOKS

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2004. (ISBN 81-297-0260-6).
2. James R.Evans & William M.Lidsay, "The Management and Control of Quality", Fifth Edition, South-Western, 2002. (ISBN 0-324-06680-5).

REFERENCES

1. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
2. Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., 1989.
3. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 1996.
4. Zeiri, "Total Quality Management for Engineers", Wood Head Publishers, 1991.

AE1401 – AVIONICS

L	T	P	C
3	1	0	4

UNIT I 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.

UNIT II PRINCIPLES OF DIGITAL SYSTEMS 10

Digital Computers – Microprocessors – Memories

UNIT III DIGITAL AVIONICS ARCHITECTURE 6

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

UNIT IV 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

UNIT V INTRODUCTION TO AVIONICS SYSTEMS 15

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

L: 45 T: 15 Total: 60

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., 1990.

REFERENCES

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

AE1402 – COMPOSITE MATERIALS AND STRUCTURES

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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.

UNIT III LAMINATED PLATES 12

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

UNIT IV SANDWICH CONSTRUCTIONS 8

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

UNIT V 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, 1998.
2. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., 1985.

REFERENCES

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

ME1403 – COMPUTER INTEGRATED MANUFACTURING

(Common to Mechanical, Production, Mechatronics and Aeronautical)

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 8

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

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

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

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

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS 9

Shop floor control-phases -factory data collection system -automatic identification methods-Bar code technology-automated data collection system – FMS-components of FMS - types - FMS workstation -material handling and storage systems- FMS layout -computer control systems-application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION 10

CIM and company strategy - system modeling tools -IDEF models - activity cycle diagram CIM open system architecture (CIMOSA) - manufacturing enterprise wheel-CIM architecture-Product data management-CIM implementation software – Communication fundamentals-local area networks -topology -LAN implementations - network management and installations.

UNIT V OPEN SYSTEM AND DATABASE FOR CIM 8

Open systems-open system inter connection - manufacturing automations protocol and technical office protocol (MAP /TOP) – Development of databases -database terminology-architecture of database systems-data modeling and data associations -relational data bases - database operators - advantages of data base and relational database.

Total: 45

TEXT BOOK

1. Mikell.P.Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson Education 2001.

REFERENCES

1. Yorem koren, “Computer Integrated Manufacturing System”, McGraw-Hill, 1983.
2. Ranky, Paul G., “Computer Integrated Manufacturing”, Prentice Hall International, 1986.
3. Roger Hanman, “Computer Intergrated Manufacturing”, Addison – Wesley, 1997.
4. Mikell.P.Groover and Emory Zimmers Jr., “CAD/CAM”, Prentice Hall of India Pvt. Ltd., 1998.
5. Kant Vajpayee S, “Principles of Computer Integrated Manufacturing”, Prentice Hall India, 2003.
6. Radhakrishnan P, Subramanyan S.and Raju V., “CAD/CAM/CIM”, Second Edition, New Age International (P) Ltd., 2000.

AE1403 – AIRCRAFT DESIGN PROJECT – II

L	T	P	C
0	0	3	2

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: 45

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

L	T	P	C
0	0	3	2

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: 45

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

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

DIGITAL ELECTRONICS

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

MICROPROCESSORS

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

AVIONICS DATA BUSES

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

Total: 45

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

HA1301 – COMMUNICATION AND SOFT SKILLS LABORATORY

L	T	P	C
0	0	3	2

The aim of the course is two-fold: to enable the students to develop communication skills in the language laboratory and to arrange discussions for developing soft skills in the lab and/or the classroom. Each lab session shall last for three periods.

List of activities that are to be carried out: (15 sessions x 3 periods = 45)

Lab session # 1: Listening and speaking practice exercises with communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 2: Practice with more advanced communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 3: Pronunciation exercises with Oxford Advanced Learners' Dictionary of Current English or any other standard Dictionary

Lab session # 4: Making an oral presentation in English. Learning Material: Professional Presentations VCD (Cambridge University Press)

Lab session # 5: Listening to telephone conversations in English and completing the tasks. Learning material: Essential Telephoning in English ACD (Cambridge University Press)

Lab session # 6: Giving an exposure to and practice with model group discussion and interviews. Learning material: How to Prepare for Group Discussion and Interview Audio Cassette (McGraw-Hill)

Lab session # 7: Giving insights into the format and the task types in the IELTS (International English Language Testing System). Learning Material: Objective IELTS, Intermediate Level (CUP)

Lab session # 8: Understanding the format and the task types in the TOEFL (Test of English as a Foreign Language). Learning Material: Understanding the TOEFL (Educational Testing Services, Princeton)

Lab session # 9: Administering the BEC (Business English Certificate) Diagnostic Test. Learning Material: BEC Practice Materials (British Council, Chennai)

Lab session # 10: Completing the steps involved in Career, Life Planning and Change Management. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 11: Setting goals and objectives exercises. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 12: Prioritizing and time planning exercises. Learning Material: Managing Time Multimedia Program CD

Lab session # 13: Taking a Personality Typing/ Psychometric Test Learning Material: 200 Psychometric Test prepared by the CUIC, Anna University Chennai

Lab session # 14: Critical and creative thinking exercises.

Lab session # 15: Improving body language and cross-cultural communication with pictures. Learning material: Body Language (S. Chand and Co.)

For a detailed plan, refer to the topics given below;

UNIT I LISTENING AND SPEAKING PRACTICE IN COMMUNICATIVE FUNCTIONS

Introductions and Meetings – Talking about Studies and/or Job – Expressing Likes and Dislikes – Describing Daily Routines and Current Activities – Talking about Past States and Events – Talking about Future Plans and Intentions – Expressing Preferences – Giving Reasons – Expressing Opinions, agreement and Disagreement – Seeking and Giving Advice – Making Suggestions.

UNIT II SPEAKING APPLICATIONS

Making an Oral Presentation – Preparing the Presentation – Performing the Presentation – Beginning – Language – Visual Aids and Body Language – Voice – Ending – Questions – Telephone Conversations – Group Discussion and Interview.

UNIT III UNDERSTANDING AND PREPARING FOR INTERNATIONAL ENGLISH LANGUAGE EXAMINATIONS

International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Business English Certificate (BEC)

UNIT IV SOFT SKILLS (1)

Preparing for and Dealing With Change – Motivation, Goal-Setting and Self-Esteem – Managing Time and Stress – Career and Life Planning – Team Work – Leadership Traits.

UNIT V SOFT SKILLS (2)

Multiple Intelligences – Learning Styles and Personality Typing – Critical and Creative Thinking – People, Cultures and Self – Intercultural Communication.

RESOURCES

1. Kamalesh Sadanand and Susheela Punitha, "Spoken English**:** A Foundation Course" for Speakers of Indian Languages, Part 2 Audio CD, Hyderabad: Orient Longman, 2008
2. Malcome Goodale, "Professional Presentations", (VCD) New Delhi: Cambridge University Press, 2005
3. Barbara Garside and Tony Garside, Essential Telephoning in English (Audio CD**),** Cambridge: Cambridge University Press, 2002
4. Hari Mohan Prasad and Rajnish Mohan, "How to Prepare for Group Discussion and Interview **(**Audio Cassette)", Tata McGraw-Hill Publishing
5. International English Language Testing System Practice Tests, CUP
6. Business English Certificate Materials, Cambridge University Press
7. Understanding the TOEFL**.** Educational Testing Services, Princeton, US
8. Interactive Multimedia Programs on Managing Time and Stress
9. Robert M. Sherfield and et al "Developing Soft Skills", 4th Edition, New Delhi, Pearson Education, 2009.

Total: 60

SEMESTER VIII

AE1451 – ROCKETS AND MISSILES

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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.

UNIT III ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD 10

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

UNIT IV 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.

UNIT V 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., 1993.

REFERENCES

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

AE1455 – PROJECT WORK

(Common to all Branches)

L	T	P	C
0	0	6	6

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)

ELECTIVES

AE1001 – THEORY OF ELASTICITY

L	T	P	C
3	0	0	3

UNIT I ASSUMPTIONS IN ELASTICITY 4

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

UNIT II 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.

UNIT III 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.

UNIT IV POLAR COORDINATES 10

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

UNIT V 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., 1990.

REFERENCES

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

AE1002 – SPACE MECHANICS

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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.

UNIT III 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.

UNIT IV INTERPLANETARY TRAJECTORIES 6

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

UNIT V 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

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II GROUND SERVICING OF VARIOUS SUB SYSTEMS 8

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

UNIT III MAINTENANCE OF SAFETY 5

Shop safety – Environmental cleanliness – Precautions.

UNIT IV INSPECTION 10

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

UNIT V AIRCRAFT HARDWARE, MATERIALS, 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, 1996.
2. A & P Mechanics, “General hand Book” – F. A. A. Himalayan Book House, 1996.

AE1004 – AIRCRAFT RULES AND REGULATIONS

L	T	P	C
3	0	0	3

UNIT I 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.

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

Defect recording, reporting, investigation, rectification and analysis; Flight report; Reporting and rectification of defects observed on aircraft; Analytical study of in-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.

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

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

C.A.R. SERIES 'F' – AIR WORTHINESS AND CONTINUED AIR WORTHINESS

Procedure relating to registration of aircraft; Procedure for issue / revalidation of Type Certificate of aircraft and its engines / propeller; Issue / revalidation of Certificate of Airworthiness; Requirements for renewal of Certificate of Airworthiness.

UNIT IV C.A.R. SERIES 'L'&'M' 8

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

UNIT V 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, 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 Circulars
2. Advisory Circulars from DGCA 2003.

AE1005 – WIND TUNNEL TECHNIQUES

L	T	P	C
3	0	0	3

UNIT I PRINCIPLES OF MODEL TESTING 6

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

UNIT II WIND TUNNELS 8

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

UNIT III CALIBRATION OF WIND TUNNELS 11

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

UNIT IV WIND TUNNEL MEASUREMENTS 12

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

UNIT V 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

L	T	P	C
3	0	0	3

UNIT I BASIC NOTIONS 8

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

UNIT II SINGLE DEGREE OF FREEDOM SYSTEMS 12

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

UNIT III MULTI DEGREES OF FREEDOM SYSTEMS 10

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

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

UNIT IV APPROXIMATE METHODS 5

Rayleigh's and Holzer Methods to find natural frequencies.

UNIT V 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, 1993.
2. Fung Y.C., "An Introduction to the Theory of Aeroelasticity", John Wiley & Sons, 1995.

REFERENCES

1. Bisplinghoff R.L., Ashely H and Hogman R.L., "Aeroelasticity", Addision Wesley Publication, 1983.
2. TSE. F.S., Morse, I.F., Hunkle, R.T., "Mechanical Vibrations", Prentice Hall, 1984.
3. Scanlan R.H. & Rosenbaum R., "Introduction to the study of Aircraft Vibration & Flutter", John Wiley and Sons, 1982.
4. Benson H.Tongue, "Principles of Vibration", Oxford University Press, 2000.

AE1007 – FINITE ELEMENT METHOD

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION **4**

Review of basic analysis – Stiffness and Flexibility matrix for simple cases – Applications of FEA - assembly of elements – properties of stiffness matrices -Governing equation and convergence criteria of finite element method.

UNIT II DISCRETE ELEMENTS **12**

Bar, Frame, Beam elements – Application to mechanical loads and stresses – Thermal loads and stresses – Example problems ,static, dynamic and stability analysis.

UNIT III CONTINUUM ELEMENTS **10**

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

UNIT IV ISOPARAMETRIC ELEMENTS **10**

Applications to two and three-dimensional problems.

UNIT V 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”, Third Edition, Prentice Hall India, 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

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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., and various repair schemes – Scopes.
Inspection and Repair of composite components – Special precautions – Autoclaves.

UNIT III 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.

UNIT IV 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)

UNIT V 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, 1992.

REFERENCES

1. Larry Reithmeir, “Aircraft Repair Manual”, Palamar Books, Marquette, 1992.
2. Brimm D.J. Bogges H.E., “Aircraft Maintenance”, Pitman Publishing corporation, 1940

AE1009 – AERO ENGINE MAINTENANCE AND REPAIR

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V 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, 1994.

REFERENCES

1. Turbomeca, “Gas Turbine Engines”, The English Book Store, 1993.
2. United Technologies Pratt & Whitney, “The Aircraft Gas turbine Engine and its Operation”, The English Book, 1993.

AE1010 – THEORY OF PLATES AND SHELLS

L	T	P	C
3	0	0	3

UNIT I CLASSICAL PLATE THEORY 3

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

UNIT II 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.

UNIT III EIGEN VALUE ANALYSIS 8

Stability and free Vibration Analysis of Rectangular Plates.

UNIT IV APPROXIMATE METHODS 10

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

UNIT V 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.

ME1005 – COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II PANEL METHODS 7

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

UNIT III 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.

UNIT IV 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.

UNIT V 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, 1988.

REFERENCES

1. John F. Wendt (Editor), “Computational Fluid Dynamics - An Introduction”, Springer – Verlag, 1992
2. Charles Hirsch, “Numerical Computation of Internal and External Flows”, Vols. I and II. John Wiley & Sons, 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

L	T	P	C
3	0	0	3

UNIT I FATIGUE OF STRUCTURES 7

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

UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR 10

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

UNIT III PHYSICAL ASPECTS OF FATIGUE 10

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

UNIT IV FRACTURE MECHANICS 10

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

UNIT V FATIGUE DESIGN 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", Pegamon press. Oxford, 1983.

REFERENCES

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

AE1012 – AIR TRANSPORTAION AND AIRCRAFT MAINTENANCE

L	T	P	C
3	0	0	3

UNIT I 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.

UNIT II 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.

UNIT III 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.

UNIT IV AIRCRAFT RELIABILITY 9

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

UNIT V 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 Publication.
5. Alexander T Wells, “Air Transportation”, Wadsworth Publishing Company, 1993.

AE1013 – HELICOPTER MAINTENANCE

L	T	P	C
3	0	0	3

UNIT I HELICOPTER FUNDAMENTAL 5

Basic directions – Ground handling, bearing – Gears.

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V 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, 1986.
2. Larry Reithmier, “Aircraft Repair Manual”, Palamar Books Marquette, 1992.

AE1014 – AIR TRAFFIC CONTROL AND AERODROME DESIGN

L	T	P	C
3	0	0	3

UNIT I BASIC CONCEPTS 9

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

UNIT II AIR TRAFFIC SERVICES 9

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

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

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

UNIT IV AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION 9

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

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

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

Total: 45

TEXT BOOK

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

REFERENCES

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

ME1013 – ENTREPRENEURSHIP DEVELOPMENT

(Common to all branches)

L	T	P	C
3	0	0	3

UNIT I ENTREPRENEURSHIP 9

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

UNIT II MOTIVATION 9

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

UNIT III 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.

UNIT IV 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.

UNIT V 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., 1999.
2. Hisrich R D and Peters M P, “Entrepreneurship” Fifth Edition, Tata McGraw-Hill, 2002.

REFERENCES

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

GE1301 – PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to all branches)

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UNIT I HUMAN VALUES 10

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

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - Variety of moral issued - Types of inquiry - Moral dilemmas - Moral autonomy - Kohlberg's theory - Gilligan's theory - Consensus and controversy – Models of Professional Roles - Theories about right action - Self-interest - Customs and Religion - Uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - Engineers as responsible experimenters - Codes of ethics - A balanced outlook on law - The challenger case study

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - Assessment of safety and risk - Risk benefit analysis and reducing risk - The three mile island and chernobyl case studies.

Collegiality and loyalty - Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime - Professional rights - Employee rights - Intellectual Property Rights (IPR) - Discrimination.

UNIT V GLOBAL ISSUES 8

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

Total: 45

TEXT BOOKS

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

REFERENCES

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, 2004.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, 2000.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001.