## ANNA UNIVERSITY, CHENNAI
### AFFILIATED INSTITUTIONS
### R - 2008
### B.E. AERONAUTICAL ENGINEERING
### II TO VIII SEMESTERS CURRICULUM AND SYLLABI

#### SEMESTER II

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* Common to all B.E. / B.Tech. Programmes

+ Offering English Language Laboratory as an additional subject (with no marks) during 2nd semester may be decided by the respective Colleges affiliated to Anna University Chennai.

**A. CIRCUIT BRANCHES**

I Faculty of Electrical Engineering

1. B.E. Electrical and Electronics Engineering
2. B.E. Electronics and Instrumentation Engineering
3. B.E. Instrumentation and Control Engineering

II Faculty of Information and Communication Engineering

1. B.E. Computer Science and Engineering
2. B.E. Electronics and Communication Engineering
3. B.E. Bio Medical Engineering
4. B.Tech. Information Technology

**B. NON – CIRCUIT BRANCHES**

I Faculty of Civil Engineering

1. B.E. Civil Engineering
II Faculty of Mechanical Engineering

1. B.E. Aeronautical Engineering
2. B.E. Automobile Engineering
3. B.E. Marine Engineering
4. B.E. Mechanical Engineering
5. B.E. Production Engineering

III Faculty of Technology

1. B.Tech. Chemical Engineering
2. B.Tech. Biotechnology
3. B.Tech. Polymer Technology
4. B.Tech. Textile Technology
5. B.Tech. Textile Technology (Fashion Technology)
7. B.Tech. Plastics Technology

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

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<td>Fatigue And Fracture</td>
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### ELECTIVES– III

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## SEMESTER VIII

### ELECTIVES – IV

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<td>Rockets and Missiles</td>
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### ELECTIVES – V

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<td>AE2037</td>
<td>Engine System And Control</td>
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AIM:
To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:
1. To help students develop listening skills for academic and professional purposes.
2. To help students acquire the ability to speak effectively in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help students improve their active and passive vocabulary.
5. To familiarize students with different rhetorical functions of scientific English.
6. To enable students write letters and reports effectively in formal and business situations.

UNIT I
Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading & predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:
1. Exercises on word formation using the prefix ‘self’ - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II

Suggested activities:
1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III
Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations.
Suggested activities:
1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object – verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions – analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.

UNIT IV
12
Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:
1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.

UNIT V
9
Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:
1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL: 60 PERIODS

TEXT BOOK:

REFERENCES:
Extensive Reading:

NOTE:
The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

MA2161 MATHEMATICS – II

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

UNIT III ANALYTIC FUNCTIONS 12
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

UNIT V LAPLACE TRANSFORM 12
Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 60 PERIODS

TEXT BOOK:

REFERENCES:

PH2161 ENGINEERING PHYSICS – II L T P C
3 0 0 3

UNIT I CONDUCTING MATERIALS

UNIT II SEMICONDUCTING MATERIALS

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS
Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS

UNIT V MODERN ENGINEERING MATERIALS
Metallic glasses: preparation, properties and applications.
Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA

TOTAL: 45 PERIODS

TEXT BOOKS:
2. Charles P. Poole and Frank J.Ownen, ‘Introduction to Nanotechnology’, Wiley India(2007) (for Unit V)

REFERENCES:

CY2161 ENGINEERING CHEMISTRY – II

AIM
To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES
- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I ELECTROCHEMISTRY
Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode - Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe²⁺ vs dichromate and precipitation – Ag⁺ vs Cl⁻ titrations) and conduct metric titrations (acid-base – HCl vs NaOH) titrations,
UNIT II    CORROSION AND CORROSION CONTROL  

UNIT III    FUELS AND COMBUSTION  

UNIT IV    PHASE RULE AND ALLOYS  

UNIT V    ANALYTICAL TECHNIQUES  

TEXT BOOKS:  

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

UNIT I    BASICS & STATICS OF PARTICLES

UNIT II    EQUILIBRIUM OF RIGID BODIES

UNIT III    PROPERTIES OF SURFACES AND SOLIDS

UNIT IV    DYNAMICS OF PARTICLES

UNIT V    FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS

TOTAL: 60 PERIODS
TEXT BOOK:

REFERENCES:

EE2151 CIRCUIT THEORY L T P C
(Common to EEE, EIE and ICE Branches) 3 1 0 4

UNIT I BASIC CIRCUITS ANALYSIS 12

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS 12
Network reduction: voltage and current division, source transformation – star delta conversion. Thévenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS 12

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 12
Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V ANALYSING THREE PHASE CIRCUITS 12
Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:

EC2151 ELECTRIC CIRCUITS AND ELECTRON DEVICES
(For ECE, CSE, IT and Biomedical Engg. Branches) 3 1 0 4

UNIT I CIRCUIT ANALYSIS TECHNIQUES 12

UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS 12

UNIT III SEMICONDUCTOR DIODES 12

UNIT IV TRANSISTORS 12
Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only) 12

TOTAL: 60 PERIODS
TEXT BOOKS:

REFERENCES:

GE2151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
(Common to branches under Civil, Mechanical and Technology faculty) 4 0 0 4

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS 12

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS 12

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12


UNIT IV DIGITAL ELECTRONICS 12
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)
UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING  12

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:

GE2152  BASIC CIVIL & MECHANICAL ENGINEERING  L  T  P  C
(Common to branches under Electrical and I & C Faculty)  4 0 0 4

A – CIVIL ENGINEERING

UNIT I  SURVEYING AND CIVIL ENGINEERING MATERIALS  15


UNIT II  BUILDING COMPONENTS AND STRUCTURES  15
Foundations: Types, Bearing capacity – Requirement of good foundations.

TOTAL: 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III  POWER PLANT ENGINEERING  10
Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines –
working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV    I C ENGINES
Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V    REFRIGERATION AND AIR CONDITIONING SYSTEM

TOTAL: 30 PERIODS

REFERENCES:

GE2155    COMPUTER PRACTICE LABORATORY – II

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LIST OF EXPERIMENTS

1. UNIX COMMANDS
   Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING
   Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX
   Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL: 45 PERIODS
HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

☐ 1 UNIX Clone Server
☐ 33 Nodes (thin client or PCs)
☐ Printer – 3 Nos.

Software

☐ OS – UNIX Clone (33 user license or License free Linux)
☐ Compiler - C

GS2165 PHYSICS LABORATORY – II

LIST OF EXPERIMENTS

1. Determination of Young’s modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
5. Spectrometer dispersive power of a prism.
6. Determination of Young’s modulus of the material – uniform bending.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.

GS2165 CHEMISTRY LABORATORY – II

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using BaCl₂ vs Na₂SO₄
4. Potentiometric Titration (Fe²⁺ / KMnO₄ or K₂Cr₂O₇)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.
- The lab examinations will be held only in the second semester.

**ME2155 COMPUTER AIDED DRAFTING AND MODELING LABORATORY**

L T P C
0 1 2 2

**List of Exercises using software capable of Drafting and Modeling**

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.

2. Drawing of a Title Block with necessary text and projection symbol.

3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.

4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.

5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).

6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)

7. Drawing of a simple steel truss.

8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,


10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

**Note:** Plotting of drawings must be made for each exercise and attached to the records written by students.

**List of Equipments for a batch of 30 students:**

1. Pentium IV computer or better hardware, with suitable graphics facility – 30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.
EE2155  ELECTRICAL CIRCUIT LABORATORY  L T P C
(Common to EEE, EIE and ICE)  0 0 3 2

LIST OF EXPERIMENTS
1. Verification of ohm’s laws and kirchoff’s laws.
2. Verification of Thevemin’s and Norton’s Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS

EC2155  CIRCUITS AND DEVICES LABORATORY  L T P C
0 0 3 2

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET

TOTAL: 45 PERIODS
ENGLISH LANGUAGE LABORATORY (Optional)

1. Listening: 5
   Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

2. Speaking: 5
   Pronouncing words & sentences correctly – word stress – Conversation practice.

Classroom Session 20
1. Speaking: Introducing oneself, Introducing others, Role play, Debate-
   Presentations: Body language, gestures, postures. 
   Group Discussions etc
2. Goal setting – interviews – stress time management – situational reasons

Evaluation
(1) Lab Session – 40 marks
   Listening – 10 marks
   Speaking – 10 marks
   Reading – 10 marks
   Writing – 10 marks

(2) Classroom Session – 60 marks
   Role play activities giving real life context – 30 marks
   Presentation – 30 marks

Note on Evaluation
1. Examples for role play situations:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.

2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES:
4. Craven, Miles, Listening Extra - A resource book of multi-level skills activities,
MA2211 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS  
L T P C 3 1 0 4  
(Common to all branches)

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electrophysics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I  FOURIER SERIES  9 + 3


UNIT II  FOURIER TRANSFORMS  9 + 3


UNIT III  PARTIAL DIFFERENTIAL EQUATIONS  9 + 3

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

UNIT IV  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  9 + 3

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

UNIT V  Z -TRANSFORMS AND DIFFERENCE EQUATIONS  9 + 3

TEXT BOOKS

REFERENCES

AE 2201 MECHANICS OF MACHINES (Common to Automobile and Aeronautical) L T P C
3 1 0 4

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

UNIT I MECHANISMS
9+3

UNIT II FRICTION
9+3
Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

UNIT III GEARING AND CAMS
9+3
Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque - Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

UNIT IV BALANCING
9+3
Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method
UNIT V  VIBRATION  9+3

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

AE2202  AERO ENGINEERING THERMODYNAMICS  L T P C
3 1 0 4

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

UNIT I  BASIC THERMODYNAMICS  15+3

UNIT II  AIR CYCLES  5+3
Otto, Diesel, Dual combustion and Brayton combustion cycles – Air standard efficiency - Mean effective pressure – Actual and theoretical PV diagrams of two stroke and four stroke IC Engines.

UNIT III  THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW  12+3
Application of continuity, momentum and energy equations- Rankine cycle - Isentropic flow of ideal gases through nozzles - Simple jet propulsion system - Thrust rocket motor – Specific impulse.
UNIT IV  REFRIGERATION AND AIR CONDITIONING  6+3

UNIT V  AIR COMPRESSORS  7+3
Classification and working principle of compressors (Descriptive Treatment). Isothermal and Isentropic efficiency of air compressors.

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

ME2204  FLUID MECHANICS AND MACHINERY  L T P C
(Common to Aeronautical, Mechanical, Automobile & Production)  3 1 0 4

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

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

UNIT I  INTRODUCTION  12
Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.
UNIT II  FLOW THROUG CIRCULAR CONDUITS

UNIT III  DIMENSIONAL ANALYSIS
Dimension and units: Buckingham’s Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT IV  ROTO DYNAMIC MACHINES

UNIT V  POSITIVE DISPLACEMENT MACHINES

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:

AE2203  SOLID MECHANICS  L T P C
3 1 0 4

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

UNIT I  BASICS AND AXIAL LOADING
UNIT II  STRESSES IN BEAMS  10+3
Shear force and bending moment diagrams for simply supported and cantilever beams-
Bending stresses in straight beams-Shear stresses in bending of beams with rectangular, I
& T etc cross sections-beams of uniform strength

UNIT III  DEFLECTION OF BEAMS  10+3
Double integration method – McCauley’s method - Area moment method – Conjugate
beam method-Principle of super position-Castigliano’s theorem and its application

UNIT IV  TORSION  5+3
Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts –
closely coiled helical springs.

UNIT V  BI AXIAL STRESSES  10+3
Stresses in thin circular cylinder and spherical shell under internal pressure – volumetric
Strain. Combined loading – Principal Stresses and maximum Shear Stresses - Analytical
and Graphical methods.

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

AE2204  ELEMENTS OF AERONAUTICS  L T P C
3 0 0 3

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

UNIT I  AIRCRAFT CONFIGURATIONS  6
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  8
Physical properties and structure of the atmosphere, Temperature, pressure and 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 aerofoils, aspect ratio, wing
loading, Mach number,centre of pressure and aerodynamic centre-aerofoil characteristics-
lift, drag curves.
UNIT IV  INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS  12

UNIT V  POWER PLANTS USED IN AIRPLANES  10
Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production., Principles of operation of rocket, types of rockets

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE

AE2206  STRENGTH OF MATERIALS LABORATORY  L T P C
0 0 3 2

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

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

TOTAL : 45 PERIODS
LIST OF EQUIPMENTS
(for a batch of 30 students)

<table>
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<td>Universal Testing Machine</td>
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<td>Impact Testing Machine</td>
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<td>Fatigue tester –Reverse plate bending</td>
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</tbody>
</table>

ME2208 FLUID MECHANICS AND MACHINERY LABORATORY
(Common to Aeronautical, Automobile, Mech & Prod)

L T P C 0 0 3 2

OBJECTIVE
To study the flow measurement and the performance of fluid machinery

LIST OF EXPERIMENTS

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

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Details of Equipments</th>
<th>Qty Req.</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Venturimeter setup</td>
<td>1</td>
<td>1,3</td>
</tr>
<tr>
<td>2.</td>
<td>Pipe friction set up</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Pitot tube set up</td>
<td>1</td>
<td>2,4</td>
</tr>
<tr>
<td>4.</td>
<td>Jet pump</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>5.</td>
<td>Submersible pump</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>6.</td>
<td>Centrifugal pump</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>7.</td>
<td>Reciprocating pump</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>
AE2207  THERMODYNAMICS LABORATORY

OBJECTIVE

To enhance the basic knowledge in applied thermodynamics

LIST OF EXPERIMENTS

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

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS

(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Details of Equipments</th>
<th>Qty Req.</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>4 stroke twin cylinder diesel engine</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Cut section model of 4 stroke diesel engine and cut section model of 2 stroke petrol engine</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Parallel and counter flow heat exchanger test rig</td>
<td>1</td>
<td>3,4</td>
</tr>
<tr>
<td>4.</td>
<td>Bomb Calorimeter</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>Vapour compression refrigeration test rig</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>6.</td>
<td>Vapour compression air-conditioning test rig</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>7.</td>
<td>Conductive Heat Transfer set up</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>8.</td>
<td>Composite wall</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>
AIM
With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

OBJECTIVES
- At the end of the course, the students would be acquainted with the basic concepts in numerical methods and their uses are summarized as follows:
- The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
- The numerical differentiation and integration find application when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
- Since many physical laws are couched in terms of rate of change of one/two or more independent variables, most of the engineering problems are characterized in the form of either nonlinear ordinary differential equations or partial differential equations. The methods introduced in the solution of ordinary differential equations and partial differential equations will be useful in attempting any engineering problem.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

UNIT II INTERPOLATION AND APPROXIMATION
Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton’s forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS
UNIT V  BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

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 PERIODS

TEXT BOOKS


REFERENCES


AE2251 AERODYNAMICS – I  L T P C
3 0 0 3

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

UNIT I  REVIEW OF BASIC FLUID MECHANICS
Continuity, momentum and energy equations.

UNIT II  TWO DIMENSIONAL FLOWS
Basic flows – Source, Sink, Free and Forced vortex, uniform parallel flow. Their combinations, Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows.

UNIT III  GENERATION OF LIFT

UNIT IV  AIRFOIL AND WING THEORY
Joukowski, Karman - Trefftz, Profiles - Thin aerofoil theory and its applications. Vortex line, Horse shoe vortex, Biot and Savart law, Lifting line theory and its limitations.
UNIT V   VISCOUS FLOW
Newton’s law of viscosity, Boundary Layer, Navier-Stokes equation, displacement, Momentum thickness, Flow over a flat plate, Blasins solution.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

AE2252     AIRCRAFT SYSTEMS AND INSTRUMENTS     L T P C
3 0 0 3

OBJECTIVE
To describe the principle and working of aircraft systems and instruments

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

UNIT II  AIRCRAFT SYSTEMS
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
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
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
TEXT BOOKS

REFERENCES

AE2253 PRODUCTION TECHNOLOGY (Common to Aeronautical & Automobile)  
L T P C  
3 0 0 3

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

UNIT I CASTING
Casting types, procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes-co2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT II WELDING

UNIT III MACHINING
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 arc machining, Electron beam machining and Laser beam machining.

UNIT IV FORMING AND SHAPING OF PLASTICS
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**  
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 PERIODS**

**TEXT BOOK:**

**REFERENCES:**
5. Serope Kalpajian, Steven R. Schimid, Manuyfacturing Engineering and Technology, Pearson Education, Inc.2002 (second Indian Reprint)

<table>
<thead>
<tr>
<th>AE2254</th>
<th>AIRCRAFT STRUCTURES – I</th>
<th>L T P C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3 1 0 4</td>
</tr>
</tbody>
</table>

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

**UNIT I STATICALLY DETERMINATE STRUCTURES**  
Analysis of plane Truss-Method of joints-3 D Truss-Plane frames-Composite beam.

**UNIT II STATICALLY INDETERMINATE STRUCTURES**  

**UNIT III ENERGY METHODS**  
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**  
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

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

TEXT BOOKS

REFERENCE

AE2255 PROPELLER – I

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

UNIT I  FUNDAMENTALS OF GAS TURBINE ENGINES

UNIT II  SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES

UNIT III  COMBUSTION CHAMBERS
UNIT IV NOZZLES

UNIT V COMPRESSORS

TEXT BOOKS

REFERENCES

AE2257 AIRCRAFT STRUCTURES LAB –I L T P C
0 0 3 2

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

LIST OF EXPERIMENTS
1. Determination of Young’s modulus of steel using mechanical extensometers.
2. Determination of Young’s modulus of aluminum using electrical extensometers
3. Determination of fracture strength and fracture pattern of ductile and brittle materials
4. Determination of forces in statically indeterminate force system.
5. Deflection of beams with various end conditions.
6. Verification of Maxwell’s Reciprocal theorem & principle of superposition
7. Column – Testing
8. South – well’s plot.
10. Determination of membrane stresses in a thin cylinder under internal pressure.
## LIST OF EQUIPMENTS
(for a batch of 30 students)

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

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

### LIST OF EXPERIMENTS
1. Generation of lift and tip vortices.
2. Flow visualization in water flow channel.
3. Flow visualization in smoke tunnel.
4. Plot of RPM Vs test section velocity in a subsonic wind tunnel.
5. Pressure distribution over circular cylinder.
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.

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### LIST OF EQUIPMENTS
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Items</th>
<th>Quantity</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Blower, Balance, and small aspect ratio model</td>
<td>1 each.</td>
<td>1</td>
</tr>
</tbody>
</table>

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39
AE2259     AIRCRAFT COMPONENT DRAWING

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

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

TOTAL: 60 PERIODS

LIST OF EQUIPMENT
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Equipments</th>
<th>Quantity</th>
<th>Experiments No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drawing Boards, Drafting machines</td>
<td>30</td>
<td>1, 5</td>
</tr>
</tbody>
</table>
LIST OF EXPERIMENTS

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

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

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

4. MILLING
   4.1. Plain Milling Exercise
   4.2. Gear Milling Exercise

5. GRINDING
   Cylindrical Grinding Exercise

   TOTAL: 45 PERIODS

LIST OF EQUIPMENTS (For A Batch Of 30 Students)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Centre Lathe with accessories</td>
</tr>
</tbody>
</table>
OBJECTIVE
To study the performance of airplanes under various operating conditions and the static and dynamic response of aircraft for both voluntary and involuntary changes in flight conditions.

UNIT I CRUISING FLIGHT PERFORMANCE
International Standard Atmosphere - Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag - estimation of parasite drag co-efficient by proper area method - Drag polar of vehicles from low speed to high speeds - Variation of thrust, power with velocity and altitudes for air breathing engines. Performance of airplane in level flight - Power available and power required curves. Maximum speed in level flight - Conditions for minimum drag and power required.

UNIT II MANOEUVERING FLIGHT PERFORMANCE
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 on turn - V-n diagram and load factor.

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

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

UNIT V DYNAMIC STABILITY
Introduction to dynamic longitudinal stability - Modes of stability, effect of freeing the stick - Brief description of lateral and directional dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

TEXT BOOKS

TOTAL: 45 PERIODS
REFERENCES

AE2302 AIRCRAFT STRUCTURES – II

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

UNIT I UNSYMMETRICAL BENDING
General, Principal axis and neutral axis methods- bending stresses in beams of symmetric sections with skew loads- bending stresses in beams of unsymmetrical sections.

UNIT II SHEAR FLOW IN OPEN SECTIONS
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
Bredt – Batho formula, Single and multi – cell structures.- 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
Rectangular sheets under compression, local buckling stress of thin walled section- Crippling stresses by Needham’s and Gerard’s methods, Thin walled column strength-sheet stiffener panels-Effective width.

UNIT V STRESS ANALYSIS IN WING AND FUSELAGE
Shear resistant web beams-Tension field web beams(Wagner’s) – Shear and bending moment distribution for cantilever and semi-cantilever types of beams-loads on aircraft –lift distribution-V-n diagram-Gust loads

TUTORIAL: 15, TOTAL: 60 PERIODS

TEXT BOOKS
REFERENCES

AE2303 AERODYNAMICS – II L T P C
3 0 0 3

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

UNIT I ONE DIMENSIONAL COMPRESSIBLE FLOW 10
Energy, Momentum, continuity and state equations, velocity of sound, adiabatic steady state flow equations, Flow through convergent-divergent passage, Performance under various back pressures.

UNIT II NORMAL, OBLIQUE SHOCKS 12
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 polar, flow past wedges and concave corners, strong, weak and detached shocks,

UNIT III EXPANSION WAVES, RAYLEIGH AND FANNO FLOW 10

UNIT IV DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS 7
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 V TRANSONIC FLOW OVER WING 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.

TOTAL: 45 PERIODS

TEXT BOOK
REFERENCES

AE2304               PROPULSION – II               L T P C
                         3 0 0 3

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

UNIT I   AIRCRAFT GAS TURBINES

UNIT II   RAMJET PROPULSION:

UNIT III   FUNDAMENTALS OF ROCKET PROPULSION

UNIT IV   CHEMICAL ROCKETS

UNIT V   ADVANCED PROPULSION TECHNIQUES

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCES

EE2365 CONTROL ENGINEERING

OBJECTIVE
To understand the basic concepts of flight control system.

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 PERIODS

TEXT BOOKS

REFERENCES

GE 2021 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C 3 0 0 3

AIM
- The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional Endeavour that they participates.

OBJECTIVE
- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.
UNIT II ENVIRONMENTAL POLLUTION
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid 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 III NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use 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 IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TOTAL: 45 PERIODS

TEXT BOOKS:
REFERENCES BOOKS:

AE2305            AIRCRAFT STRUCTURES LAB – II            L T P C
                                0 0 3 2

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

LIST OF EXPERIMENTS
1. Unsymmetrical bending of Z-section beams
2. Shear centre location for open channel sections
3. Shear centre location for closed D-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 photo elastic techniques
9. Determination of natural frequencies of cantilever beams
10. Wagner beam – Tension field beam

TOTAL: 45 PERIODS

LIST OF EQUIPMENT
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Equipment</th>
<th>Qty</th>
<th>Experiments Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beam Test set –up</td>
<td>2</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>2</td>
<td>Unsymmetrical ‘Z’ section beam</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Channel section beam</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Closed ‘D’ section beam</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Dial gauges</td>
<td>12</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>6</td>
<td>Strain indicator and strain gauges</td>
<td>One set</td>
<td>4,5,6</td>
</tr>
<tr>
<td>7</td>
<td>Photo – elastic apparatus</td>
<td>1</td>
<td>7, 8</td>
</tr>
<tr>
<td>8</td>
<td>Amplifier</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>
OBJECTIVE
To understand the basic concepts and carryout experiments in Aerospace Propulsion.

LIST OF EXPERIMENTS
1. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
2. Study of magneto and ignition system.
3. Study of an aircraft jet engine compressor.
4. Study of jet engine combustion chamber.
5. Study of jet engine turbine.
6. Study of forced convective heat transfer over a flat plate.
7. Study of free convective heat transfer over a flat plate
8. Study of free jet.
9. Study of wall jet.
10. Study of ramjet.

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Equipments</th>
<th>Qty</th>
<th>Experiments No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Piston engines</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Jet Engine /Engine model</td>
<td>1</td>
<td>2,3,4</td>
</tr>
<tr>
<td>3</td>
<td>Forced Convective apparatus</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Free Convective apparatus</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>2-D travers in mechanism</td>
<td>2</td>
<td>8,9</td>
</tr>
<tr>
<td>6</td>
<td>Free jet test setup</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Aluminium plates with deflection mechanisms</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>Ramjet</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>
OBJECTIVE

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

LIST OF EXPERIMENTS

- Design and Modeling of rectangular plate with hole.
- Design and Modeling of spar components.
- Design and Modeling of Aerofoil structures.
- Design and Modeling of cut section for wings.
- Design and Modeling of Machine component.
- Design and Modeling of Machine components.
- Design and Analysis of a Truss.
- Design and Analysis of Beam distributed load.
- Facing.
- Turning (Taper, Step)

TOTAL 45 PERIODS

LIST OF EQUIPMENT

(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Equipment</th>
<th>Quantity</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Computer nodes</td>
<td>30</td>
<td>1 to 10</td>
</tr>
<tr>
<td>2</td>
<td>Modeling Packages</td>
<td>30 licenses</td>
<td>1 to 6</td>
</tr>
<tr>
<td>3</td>
<td>FEA&amp;CAM SOFTWARE</td>
<td>30 licenses</td>
<td>7 to 10</td>
</tr>
<tr>
<td>4</td>
<td>UPS</td>
<td>1</td>
<td>1 to 10</td>
</tr>
</tbody>
</table>

GE2321  COMMUNICATION SKILLS LABORATORY  L T P C  0 0 4 2

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students’ overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES:

- To equip students of engineering and technology with effective speaking and listening skills in English.
To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.

- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

<table>
<thead>
<tr>
<th>I. PC based session</th>
<th>(Weightage 40%)</th>
<th>24 periods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. ENGLISH LANGUAGE LAB</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. LISTENING COMPREHENSION:</td>
<td>(6)</td>
<td></td>
</tr>
<tr>
<td>Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. READING COMPREHENSION:</td>
<td>(6)</td>
<td></td>
</tr>
<tr>
<td>Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. SPEAKING:</td>
<td>(6)</td>
<td></td>
</tr>
<tr>
<td>Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B. DISCUSSION OF AUDIO-VISUAL MATERIALS</strong></td>
<td>(6 PERIODS)</td>
<td></td>
</tr>
<tr>
<td>(Samples are available to learn and practice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. RESUME / REPORT PREPARATION / LETTER WRITING</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Structuring the resume / report - Letter writing / Email Communication - Samples.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. PRESENTATION SKILLS:</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. SOFT SKILLS:</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management &amp; Poise - Video Samples</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. GROUP DISCUSSION: (1)

Why is GD part of selection process? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD - Video samples

5. INTERVIEW SKILLS: (1)

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

<table>
<thead>
<tr>
<th>II. Practice Session</th>
<th>(Weightage – 60%)</th>
<th>24 periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Resume / Report Preparation / Letter writing: Students prepare their own resume and report. (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Presentation Skills: Students make presentations on given topics. (8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Group Discussion: Students participate in group discussions. (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Interview Skills: Students participate in Mock Interviews (8)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES:


LAB REQUIREMENTS:
1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software
**Guidelines for the course**

**GE2321  COMMUNICATION SKILLS LABORATORY**

1. A batch of 60 / 120 students is divided into two groups – one group for the PC- based session and the other group for the Class room session.

2. The English Lab (2 Periods) will be handled by a faculty member of the English Department. The Career Lab (2 Periods) may be handled by any competent teacher, not necessarily from English Department.

3. **Record Notebook:** At the end of each session of English Lab, review exercises are given for the students to answer and the computer evaluated sheets are to be compiled as record notebook. Similar exercises for the career lab are to be compiled in the record notebook.

4. **Internal Assessment:** The 15 marks (the other 5 marks for attendance) allotted for the internal assessment will be based on the record notebook compiled by the candidate. 10 marks may be allotted for English Lab component and 5 marks for the Career Lab component.

5. **End semester Examination:** The end-semester examination carries 40% weightage for English Lab and 60% weightage for Career Lab.

   Each candidate will have separate sets of questions assigned by the teacher using the teacher-console enabling PC–based evaluation for the 40% of marks allotted.

   The Career Lab component will be evaluated for a maximum of 60% by a local examiner & an external examiner drafted from other Institutions, similar to any other lab examination conducted by Anna University.

**Requirement for a batch of 60 students**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Server</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o PIV system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o 1 GB RAM / 40 GB HDD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o OS: Win 2000 server</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Audio card with headphones (with mike)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o JRE 1.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Client Systems</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o PIII or above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o 256 or 512 MB RAM / 40 GB HDD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o OS: Win 2000</td>
<td></td>
</tr>
</tbody>
</table>

1 No.

60 No.
<table>
<thead>
<tr>
<th>No.</th>
<th>Item Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Handicam Video Camera (with video lights and mic input)</td>
<td>1 No.</td>
</tr>
<tr>
<td>4.</td>
<td>Television - 29”</td>
<td>1 No.</td>
</tr>
<tr>
<td>5.</td>
<td>Collar mike</td>
<td>1 No.</td>
</tr>
<tr>
<td>6.</td>
<td>Cordless mikes</td>
<td>1 No.</td>
</tr>
<tr>
<td>7.</td>
<td>Audio Mixer</td>
<td>1 No.</td>
</tr>
<tr>
<td>8.</td>
<td>DVD Recorder / Player</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

**MG2351 PRINCIPLES OF MANAGEMENT**

(2021-22) L T P C 3 0 0 3

(Common to all Branches)

**OBJECTIVE**

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

**UNIT I OVERVIEW OF MANAGEMENT**


**UNIT II PLANNING**


**UNIT III ORGANISING**


**UNIT IV DIRECTING**

UNIT V  CONTROLLING

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

AE2351  FINITE ELEMENT METHOD

OBJECTIVE
To introduce the concept of numerical analysis of structural components

UNIT I  INTRODUCTION
Review of basic approximate methods of analyses – Stiffness and Flexibility matrix for simple cases – Governing equation and convergence criteria of finite element method.

UNIT II  DISCRETE ELEMENTS
Bar, Frame, beam elements – Application to static, dynamic and stability analysis.

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

UNIT IV  ISOPARAMETRIC ELEMENTS
Applications to two and three-dimensional problems.

UNIT V  FIELD PROBLEM
Applications to other field problems like heat transfer and fluid flow.

TOTAL: 45 PERIODS

TEXT BOOK
REFERENCES

AE2352 EXPERIMENTAL STRESS ANALYSIS

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

UNIT I MEASUREMENTS & EXTENSOMETER 10
Principles of measurements, Accuracy, Sensitivity and range of measurements. Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

UNIT II ELECTRICAL RESISTANCE STRAIN GAUGES 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 III 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 IV BRITTLE COATING AND MOIRE METHODS 8
Introduction to Moire techniques, brittle coating methods and holography.

UNIT V NON – DESTRUCTIVE TESTING 7
Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

AE2353 WIND TUNNEL TECHNIQUES

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

UNIT I WIND TUNNELS

UNIT II HIGH SPEED WIND TUNNELS
Blow down, in draft and induction tunnel layouts and their design features, Transonic, supersonic and hypersonic tunnels, their peculiarities and calibration. Helium and gun tunnels, Shock tubes,

UNIT III WIND TUNNEL MEASUREMENTS

UNIT IV FLOW VISUALIZATION
Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.

UNIT V NON-INTRUSIVE FLOW DIAGNOSTICS

TOTAL: 45 PERIODS

TEXT BOOK

REFERENCE
OBJECTIVE
To learn damage mechanism and failure of components of elevated temperatures

UNIT I CREEP
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, temperatures and strain rate.

UNIT II DESIGN FOR CREEP RESISTANCE
Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.

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

UNIT IV OXIDATION AND HOT CORROSION
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 SUPER ALLOYS AND OTHER MATERIALS
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 PERIODS

TEXT BOOKS

REFERENCES
AE2355  AERO ENGINE LABORATORY  LT PC  0 0 3 2

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

1. Dismantling of a piston engine
2. Engine (Piston Engine) - cleaning, visual inspection, NDT checks.
3. Piston Engine Components - dimensional checks.
4. Study of carburetor.
5. Piston – Engine reassembly.
6. Dismantling of a jet engine
8. Jet Engine – NDT checks and dimensional checks
10. Engine starting procedures.

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Equipments</th>
<th>Qty</th>
<th>Experiments No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Piston Engines</td>
<td>1</td>
<td>1,2,3,4,5</td>
</tr>
<tr>
<td>2</td>
<td>Jet Aero Engines</td>
<td>1</td>
<td>6,7,8,9,10</td>
</tr>
<tr>
<td>3</td>
<td>Standard tools for dismantling and assembly</td>
<td>2 sets</td>
<td>1,5,6,10</td>
</tr>
<tr>
<td>4</td>
<td>Precision instruments (Vernier Caliper, Micro meter, Cylinder bore gauge, depth gauge, Bevel Protector and DTI)</td>
<td>2 sets</td>
<td>3,5,8</td>
</tr>
<tr>
<td>5</td>
<td>NDT Equipment</td>
<td>1 set</td>
<td>2,8</td>
</tr>
</tbody>
</table>

AE2356  AIRCRAFT DESIGN PROJECT – I  LT PC  0 0 3 2

OBJECTIVE
To introduce and develop the basic concept of aircraft design.

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

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

TOTAL: 45 PERIODS

**LIST OF EQUIPMENTS**
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engineering Drawing Board</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Engineering Drawing Instruments</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>Computers with suitable software</td>
<td>30</td>
</tr>
</tbody>
</table>

AE2357   AIRFRAME LAB

**OBJECTIVE**
To give training on riveting, patchwork, welding and carpentry

**LIST OF EXPERIMENTS**
Aircraft wood gluing-single scarf joint
Aircraft wood gluing-double scarf joint
Study on MIG, TIG & PLASMA welding of aircraft components
Welded single & double V-joints.
Fabric Patch repair
Riveted patch repairs.
Tube bending and flaring
Sheet metal forming.
Preparation of glass epoxy of composite laminates and specimens.
Determination of elastic constants of composite specimens.

TOTAL : 45 PERIODS

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

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Equipment</th>
<th>Quantity</th>
<th>Experiment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shear cutter pedestal type</td>
<td>1</td>
<td>4,6</td>
</tr>
<tr>
<td>2</td>
<td>Drilling Machine</td>
<td>1</td>
<td>4,5,6</td>
</tr>
<tr>
<td>3</td>
<td>Bench Vices</td>
<td>1</td>
<td>1, 2, 6, 7, 8</td>
</tr>
<tr>
<td>4</td>
<td>Radius Bend bars</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>
**GE2022**  
**TOTAL QUALITY MANAGEMENT**  
(Common to all branches)  
**L T P C**  
3 0 0 3

**UNIT I  INTRODUCTION**  
9  

**UNIT II  TQM PRINCIPLES**  
9  
Leadership – Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal – Continuous process improvement – PDSA cycle, 5s, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

**UNIT III  TQM TOOLS & TECHNIQUES I**  
9  

**UNIT IV  TQM TOOLS & TECHNIQUES II**  
9  

**UNIT V  QUALITY SYSTEMS**  
9  

**TOTAL: 45 PERIODS**

**TEXT BOOK**


**REFERENCES**


AE2401 AVIONICS

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

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

UNIT I INTRODUCTION TO AVIONICS
Need for Avionics in civil and military aircraft and space systems – Integrated Avionics system – Typical avionics sub systems – Design approaches and recent advances - Application Technologies.

UNIT II PRINCIPLES OF DIGITAL SYSTEMS

UNIT III DIGITAL AVIONICS ARCHITECTURE
Avionics system architecture– salient features and applications of Data buses MIL–STD 1553 B–ARINC 429–ARINC 629.

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

UNIT V AVIONICS SYSTEMS

TOTAL: 45 PERIODS

TEXT BOOKS
REFERENCES

AE2402 COMPUTATIONAL FLUID DYNAMICS L T P C
3 0 0 3

OBJECTIVE
To study the flow of dynamic fluids by computational methods

UNIT I FUNDAMENTAL CONCEPTS 10

UNIT II GRID GENERATION 7

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 6
Overview of Finite Element Techniques in Computational Fluid Dynamics. Strong and Weak Formulations of a Boundary Value Problem.

UNIT V FINITE VOLUME TECHNIQUES 14

TOTAL: 45 PERIODS

TEXT BOOK
REFERENCES

AE2403 VIBRATIONS AND ELEMENTS OF AEROElasticITY

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

UNIT I BASIC NOTIONS 8

UNIT II SINGLE DEGREE OF FREEDOM SYSTEMS 12

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 PERIODS

TEXT BOOKS
REFERENCES

AE2404 AIRCRAFT DESIGN PROJECT – II

OBJECTIVE
• To enhance the knowledge in continuation of the design given in project–I
• Each student is assigned the work in continuation of the design project – I. The
following assignments are to be carried out.

LIST OF EXPERIMENTS
1. V-n diagram for the design study
2. Gust and maneuverability envelopes
3. Critical loading performance and final V-n graph calculation
4. Structural design study – Theory approach
5. Load estimation of wings
8. Detailed structural layouts
9. Design of some components of wings, fuselage

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Items</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Drawing Board</td>
<td>30</td>
</tr>
<tr>
<td>2.</td>
<td>Drawing Instrument</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>Computers and suitable software</td>
<td>30</td>
</tr>
</tbody>
</table>
AE2405 AIRCRAFT SYSTEMS LABORATORY L T P C 0 0 3 2

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

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

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS
(for a batch of 30 students)

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

AE2406 AVIONICS LABORATORY L T P C 0 0 3 2

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

DIGITAL ELECTRONICS
Addition/Subtraction of binary numbers.
Multiplexer/Demultiplexer Circuits.
Encoder/Decoder Circuits.
Timer Circuits, Shift Registers, Binary Comparator Circuits.

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

AVIONICS DATA BUSES
Study of Different Avionics Data Buses.
MIL-Std – 1553 Data Buses Configuration with Message transfer.
MIL-Std – 1553 Remote Terminal Configuration.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT
(for a batch of 30 students)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Details of Equipments</th>
<th>Quantity</th>
<th>Experiment Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Adder/Subtractor Binary bits Kit</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Timer Kit</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Encoder Kit</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Decoder Kit</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Comparator Kit</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>Multiplexer Kit</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Demultiplexer Kit</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Shift Registers Kit</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>Electronic Design Experimeter</td>
<td>6</td>
<td>6,7,9,10</td>
</tr>
<tr>
<td>10</td>
<td>Microprocessor 8085 Kit</td>
<td>9</td>
<td>5,6,7,8,9,10</td>
</tr>
<tr>
<td>11</td>
<td>4 Digit 7 Segment Display</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
<td>Switches &amp; LED’s Circuit</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>13</td>
<td>16 Channel AD Converter</td>
<td>6</td>
<td>10,9</td>
</tr>
<tr>
<td>14</td>
<td>Digital to Analog Converter</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>Cathode Ray Oscilloscope</td>
<td>3</td>
<td>9,10</td>
</tr>
<tr>
<td>16</td>
<td>Regulated Power Supply (5V DC)</td>
<td>9</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>17</td>
<td>MIL-Std 1553B Setup with Remote Terminal</td>
<td>1</td>
<td>12,13</td>
</tr>
<tr>
<td>18</td>
<td>Computers</td>
<td>2</td>
<td>11,12,13</td>
</tr>
</tbody>
</table>
OBJECTIVE
To understand the fabrication, analysis and design of composite materials & structures.

UNIT I STRESS STRAIN RELATION

UNIT II METHODS OF ANALYSIS

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

UNIT IV SANDWICH CONSTRUCTIONS
Basic design concepts of sandwich construction -Materials used for sandwich construction - Failure modes of sandwich panels.

UNIT V FABRICATION PROCESSES

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
COMPREHENSION
(Common To All Branches)

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

PROJECT WORK
(Common to all Branches)

OBJECTIVE
The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be in 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)

THEORY OF ELASTICITY

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

UNIT I ASSUMPTIONS IN ELASTICITY
Definitions- notations and sign conventions for stress and strain, Equations of equilibrium.

UNIT II BASIC EQUATIONS OF ELASTICITY
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 PERIODS

TEXT BOOK

REFERENCES

AE2022 AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE AND PRACTICES

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

UNIT I AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT 10

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

UNIT V     AIRCRAFT HARDWARE, MATERIALS, SYSTEM PROCESSES
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 and 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 PERIODS

TEXT BOOK

REFERENCES:

AE2023       SPACE MECHANICS       L  T  P  C
3  0  0  3

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

UNIT I     BASIC CONCEPTS

UNIT II     THE GENERAL N-BODY PROBLEM

UNIT III     SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS
General Aspects of satellite Injections – Satellite Orbit Transfer –Various Cases – Orbit Deviations Due to Injection Errors – Special and General Perturbations – Cowell’s Method

UNIT IV INTERPLANETARY TRAJECTORIES
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

TEXT BOOK

REFERENCES

AE2024 HEAT TRANSFER L T P C 3 0 0 3

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

UNIT I HEAT CONDUCTION

UNIT II CONVECTIVE HEAT TRANSFER
UNIT III  RADIATIVE HEAT TRANSFER  8

UNIT IV  HEAT EXCHANGERS  8

UNIT V  HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING  8

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

AE2025  HELICOPTER THEORY  L T P C
3 0 0 3

OBJECTIVE:
To present the basic ideas of evolution, performance and associated stability problems of helicopter.

UNIT I  DEVELOPMENT OF ROTATING WING AIRCRAFT  6
Evolution of helicopter-Helicopter configurations-rotor arrangements-compound Helicopter - jet rotor-no tail rotor concepts

UNIT II  DYNAMICS OF HOVERING FLIGHT  12
Actuator disc theory-Blade Element Theory-ideal twist Induced & profile power-Figure of merit-Thrust and power coefficients-calculation of drag, torque, power-Ground effect in hover- Estimation of hover ceiling.

UNIT III  DYNAMICS OF FORWARD FLIGHT  10
Forward flight performance-Parasite drag and Power-Stall limitations-flapping-cyclic pitch-Autorotation in hover and in forward flight-Dead man’s curve.
UNIT IV  CLIMB AND DESCENT PERFORMANCE  9
Vertical flight-flow patterns surrounding the rotor-Power required in climb and descent-Descent speed calculations-Take-off techniques.

UNIT V  HELICOPTER STABILITY AND CONTROL  8
Trim-Static stability-dynamic stability-Pilot’s control-Rotor control-Flight control systems and stability argumentation-Flying qualities.

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
UNIT V   FLOW INDUCED VIBRATIONS
Vortex shedding, lock & effects of Reynolds number on wake formation in turbulent flows - across wind galloping-wake galloping-long wind galloping of circular cables-oscillation of tall structures and launch vehicles under wind loads-stall flutter.

TOTAL: 45 PERIODS

REFERENCES:

AE2027   AIRFRAME MAINTENANCE AND REPAIR

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

UNIT I    WELDING IN AIRCRAFT STRUCTURAL COMPONENTS
Equipments used in welding shop and their maintenance – Ensuring quality welds – Welding jigs and fixtures – Soldering and brazing.

UNIT II   PLASTICS AND COMPOSITES IN AIRCRAFT

UNIT III  AIRCRAFT JACKING, ASSEMBLY AND RIGGING

UNIT IV   REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM
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

TOTAL: 45 PERIODS

TEXT BOOK

REFERENCES

AE2028       AERO ENGINE MAINTENANCE AND REPAIR       L       T       P       C
3 0 0 3

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

UNIT I     CLASSIFICATION OF PISTON ENGINE COMPONENTS
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
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     OVERHAULING OF PISTON ENGINES

UNIT IV     CLASSIFICATION OF JET ENGINE COMPONENTS
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.


UNIT V OVERHAUL PROCEDURES 10

TOTAL: 45 PERIODS

TEXT BOOK

REFERENCES

AE2029 THEORY OF PLATES AND SHELLS L T P C
3 0 0 3

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

UNIT I CLASSICAL PLATE THEORY
Classical Plate Theory – Assumptions – Differential Equation – Boundary Conditions.

UNIT II PLATES OF VARIOUS SHADES

UNIT III EIGEN VALUE ANALYSIS
Stability and free Vibration Analysis of Rectangular Plates.

UNIT IV APPROXIMATE METHODS

UNIT V SHELLS
Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.
TEXT BOOK

REFERENCES

AE2030 FATIGUE AND FRACTURE

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

UNIT I FATIGUE OF STRUCTURES

UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR
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 AND FRACTURE

UNIT IV FATIGUE DESIGN AND TESTING
Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

UNIT V FUNDAMENTALS OF FAILURE ANALYSIS
TEXT BOOKS

REFERENCES

AE2031 HYPERSONIC AERODYNAMICS

OBJECTIVE:
To present the basic ideas of hypersonic flow and the associated problem areas.

UNIT I FUNDAMENTALS OF HYPERSONIC AERODYNAMICS
Introduction to hypersonic aerodynamics-differences between hypersonic aerodynamics and supersonic aerodynamics-concept of thin shock layers-hypersonic flight paths-hypersonic similarity parameters-shock wave and expansion wave relations of in viscid hypersonic flows.

UNIT II SIMPLE SOLUTION METHODS FOR HYPERSONIC IN VISCID FLOWS
Local surface inclination methods-Newtonian theory-modified Newtonian law-tangent wedge and tangent cone and shock expansion methods-approximate theory-thin shock layer theory.

UNIT III VISCOUS HYPERSONIC FLOW THEORY
Boundary layer equation for hypersonic flow-hypersonic boundary layers-self similar and non self similar boundary layers-solution methods for non self similar boundary layers-aerodynamic heating.

UNIT IV VISCOUS INTERACTIONS IN HYPERSONIC FLOWS
Introduction to the concept of viscous interaction in hypersonic flows-strong and weak viscous interactions-hypersonic viscous interaction similarity parameter-introduction to shock wave boundary layer interactions.

UNIT V INTRODUCTION TO HIGH TEMPERATURE EFFECTS
Nature of high temperature flows-chemical effects in air-real and perfect gases-Gibb’s free energy and entropy-chemically reacting mixtures-recombination and dissociation.

TEXT BOOKS:
REFERENCES:

AE2032 EXPERIMENTAL AERODYNAMICS  L T P C
3 0 0 3

Objectives: To present the measurement techniques involved in aerodynamic testing.

UNIT I WIND TUNNEL TESTING  8
Low speed wind tunnels-estimation of energy ratio and power required supersonic wind tunnels-calculation of running time and storage tank requirements.

UNIT II EXPERIMENTS IN SUBSONIC WIND TUNNELS  10
Estimation of flow angularity and turbulence factor-calculation of $C_L$ and $C_D$ on aerofoils from pressure distribution- $C_D$ from wake survey-Test section average velocity using traversing rakes-span wise load distribution for different taper ratios of wing

UNIT III EXPERIMENTS IN HIGH SPEED TUNNELS  10
Mach number estimation in test section by pressure measurement and using a wedge – preliminary estimates of blowing and running pressures, nozzle area ratios, mass flow for a given test section size and Mach number-starting problem and starting loads.

UNIT IV MEASUREMENT TECHNIQUES  9
Hot wire anemometer and laser Doppler anemometer for turbulence and velocity measurements-Use of thermocouples and pyrometers for measurement of static and total temperatures-Use of pressure transducers, Rotameters and ultrasonic flow meters.

UNIT V SPECIAL PROBLEMS  8
Pitot-static tube correction for subsonic and supersonic Mach numbers-boundary layer velocity profile on a flat plate by momentum-integral method -Calculation of $C_D$ from wall shear stress-Heating requirements in hypersonic wind tunnels-Re-entry problems.

TOTAL: 45 PERIODS

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

UNIT I    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 II   STAGING AND CONTROL OF ROCKETS AND MISSILES    10
Rocket Thrust Vector Control Methods.

UNIT III   AERODYNAMICS OF ROCKETS AND MISSILES    10

UNIT IV   ROCKET PROPULSION SYSTEMS    10

UNIT V    MATERIALS FOR ROCKETS AND MISSILES    5
Selection of Materials – Special Requirements of Materials to Perform under Adverse Conditions.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  FORCE DEFLECTION PROPERTIES OF STRUCTURES  
Constraints and Generalized coordinates-Virtual work and generalized forces-Force-Deflection influence functions-stiffness and flexibility methods.

UNIT II  PRINCIPLES OF DYNAMICS  
Free and forced vibrations of systems with finite degrees of freedom-Damped oscillations-D’Alembert’s principle-Hamilton’s principle-Lagrangian equations of motion and applications.

UNIT III  NATURAL MODES OF VIBRATION  
Equation of motion for free vibrations solution of Eigen value problems-Normal coordinates and orthogonality relations.

UNIT IV  ENERGY METHODS  
Rayleigh’s principle-Rayleigh-Ritz method-Coupled natural modes-Effect of rotary inertia and shear on lateral vibrations of beams-Natural vibrations of plates.

UNIT V  APPROXIMATE METHODS  
Approximate methods of evaluating the Eigen frequencies and the dynamics response of continuous systems-Matrix methods of dynamic stress analysis.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

UNIT I  BASIC CONCEPTS  9
Objectives of ATS - Parts of ATC service – Scope and Provision of ATCs – VFR & IFR operations – Classification of ATS air spaces – Varies kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS – Division of responsibility of control.

UNIT II  AIR TRAFFIC SERVICES  9
Area control service, assignment of cruising levels minimum flight altitude ATS routes and significant points – RNAV and RNP – Vertical, lateral and longitudinal separations based on time / distance – ATC clearances – Flight plans – position report

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

UNIT IV  AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION  9

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 PERIODS

TEXT BOOK

REFERENCES
AE2036  PRODUCTION PLANNING AND CONTROL  L T P C  3 0 0 3

OBJECTIVE:
To understand the various components and functions of production planning and control such as product planning, product scheduling and inventory control.

UNIT I   INTRODUCTION  8
Factors affecting planning—Forecasting information necessary for pre-planning—sources of information—Methods of forecasting—aircraft components requiring overhaul—repair—modifications—premature—failures—project planning—estimates of plant, machinery, buildings, manpower, materials, spare parts, time, and cost estimates.

UNIT II   MATERIALS, MACHINES AND PROCESSES  9
Production engineering knowledge necessary for Planning, machine tools and processes.—Materials including aircraft materials and their processing—Spare parts required for overhaul and maintenance—Ground handling equipment—testing of components and aircraft overhaul—standards for acceptance after overhaul.

UNIT III   EQUIPMENT AND TOOLS  10
Pre—planning required for provision of special tools, jigs, fixtures and test equipment required for overhaul and maintenance—types and description of major test equipment.

UNIT IV   PRODUCTION PLANNING  10
Production planning function of routing, estimating and scheduling —LOB—CPM and PERT. Queuing theory, sequencing in jobs, shop scheduling, assembly line balancing—charts and graphs.

UNIT V   PRODUCTION CONTROL  8
Production control functions of dispatching, progressing and evaluation—Activities of progressing—shop procedures—maintenance of critical data statistics of evaluation control charts.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE
To give an exposure to the different systems in Aircraft Engines and the methodologies as well as instruments used for engine controls & indication.

UNIT I ENGINE CONSTRUCTION

UNIT II ENGINE SYSTEMS

UNIT III MAINTENANCE & INSPECTION

UNIT IV CONTROL INSTRUMENTS

UNIT ENGINE INSTRUMENTS

TOTAL: 45 PERIODS

TEXT BOOKS
3. Aircraft Gas Turbine and Operation – PRATT AND WHITENY, United Technologies, English Book Stores, New Delhi

REFERENCES
2. Turbo Mache of Gas Turbine, English Book Stores, New Delhi