5.1   AERODYNAMICS

L T P
4 - 4

RATIONALE

An aircraft is capable of flying in spite of its large weight. It has particular shape and becomes air borne beyond certain speeds. In order to appreciate the principles involved in flying it is essential to gain knowledge and skill in the area of mechanics of air applied to flying.

DETAILED CONTENTS

1.   Introduction   (12 hrs)

Importance of aerodynamics, Some fundamentals aerodynamic variables, Aerodynamic forces and moment, center of pressure, Aerodynamic center, different types of flow, flow similarity

2.   Some basic equation and fundamental principles   (09 hrs)

Models of fluid: control volume and fluid elements, Continuity equation, momentum equation and energy equation, streamline and pathline, angular velocity, vorticity and strain, stream function and velocity function

3.   Fundamental of inviscid and incompressible flow   (09 hrs)

Bernoulli's equation, incompressible flow in a duct: the venture and low speed wind tunnel, Pitot tube: measurement of air speed, Laplace equation, uniform flow, source flow, doublet flow, lifting and non lifting flow over a cylinder

4.   Incompressible Flow over an airfoil   (16 hrs)

Introduction, airfoil nomenclature, airfoil characteristic, cambered airfoil, solution for low speed flow over an airfoil, classical thin airfoil theory for symmetric airfoil, the kutta condition.

5.   Compressible flow   (9 hrs)

Introduction, review of thermodynamics, definition of compressibility, governing equation for inviscid , compressible flow, definition of total(stagnation) condition, some aspects of supersonic flow.

6.   Compressible flow through nozzle, diffusers and wind tunnel   (09 hrs)

Introduction, governing equation for quasi-one dimensional flow, nozzle flow, diffuser, supersonic wind tunnel

LIST OF PRACTICALS

1. Smoke flow visualization studies on a two-dimensional circular cylinder at low speeds.
2. Smoke flow visualization studies on a two dimensional airfoil at different angles of incidence at low speeds.
3. Tuft flow visualization on a wing model at different angles of incidence at low speeds: identify zones of attached and separated flows.
4. Surface pressure distributions on a two-dimensional symmetric airfoil at zero incidence at low speeds.
5. Surface pressure distributions on a two-dimensional cambered airfoil at different angles of incidence and calculation of lift and pressure drag.
6. Calculation of total drag of a two-dimensional symmetrical airfoil at low speeds at incidence using pitot-static probe wake survey.

INSTRUCTIONAL STRATEGY

1. Power point presentation for making students understand the theoretical concept.
2. For promoting the solving abilities different assignment will be planned.

RECOMMENDED BOOKS

1. Fundamentals of Aerodynamics by Anderson, Jr. J.D; Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2007. (Special Indian Edition).
2. Aerodynamics for Engineering Students by Houghton E.L and Carpenter P.W; CBS Publications and Distributors, 1993. (4th Edition).

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	16
2	09	16
3	09	14
4	16	26
5	09	14
6	09	14
Total	**64**	**100**

5.2   AIRCRAFT STRUCTURES

L T P
4 - 4

RATIONALE

In aircraft structures the students must have knowledge of strength of materials so that they understand the concept of structures. This knowledge will be helpful in doing the structural analysis.

DETAILED CONTENTS

1.   Basic elasticity   (10 hrs)

Stress, Notation for Forces and Stresses, Plane Stress, Boundary Conditions, Hookes law, youngs modulus, poisson ratio, Principal Stresses, Strain, Compatibility Equations, Plane Strain, Principal Strains, Stress–Strain Relationships.

2.   2-D Problems In Elasticity   (10 hrs)

2- D problems, stress functions, inverse and semi inverse method, St. Venant principle, bending of end-loaded cantilever, torsion of solid sections, Prandtl stress function solution. St. Venant warping function solution.

3.   Cables and Arches   (8 hrs)

Cables, cable subjected to concentrated loads, cable subjected to a uniform distributed load, arches, Three-hinged arch problems.

4.   Loads On Structural Components   (8 hrs)

Functions of structural components, factor of safety, limit load, V-n diagram, aircraft inertia loads, steady pull out, banked turn, gust loads.

5.   Columns   (10hrs)

Euler Buckling of Column, Inelastic Buckling, Effect of Initial Imperfections, Stability of Beams under Transverse and Axial Loads, Energy Method for the Calculation of Buckling Loads in Columns.

6.   Fatigue   (9 hrs)

Safe Life and Fail-Safe Structures , Designing Against Fatigue, Fatigue Strength of Components, Prediction of Aircraft Fatigue Life, Crack Propagation.

7. Joints and fittings (9 hrs)

Introduction, bolted or riveted joints, standard parts, accuracy of fitting analysis, eccentrically loaded connections, welded joints

LIST OF PRACTICALS

1. Verification of Maxwell's Reciprocal theorem & principle of superposition.
2. Deflection of beams with various end conditions.
3. Calculation of shear center of open and closed section.
4. Calculate torsional rigidity of open and closed section
5. Verify column-testing and south well plot
6. Tensile test, tear test, shear test and bearing test of riveted/screwed/bolted joints.

INSTRUCTIONAL STRATEGY

1. Initially some of the concept related to strength of materials will be looked at.
2. Expose students to real life problem.
3. Power point presentation for making students understand the theoretical concept.

RECOMMENDED BOOKS

1. Aircraft Structures by D J Perry
2. An introduction to Aircraft Structural analysis by T.H.G Megson
3. Analysis of Aircraft Structures – An Introduction by Donaldson, B.K; McGraw Hill, 1993.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	12
2	10	14
3	08	14
4	08	14
5	10	16
6	09	14
7	09	16
Total	**64**	**100**

5.3   AIRCRAFT INSTRUMENTS

L T P
4 - 2

RATIONALE

The subject aims at development of knowledge and skills regarding various measuring and testing instruments and inspection techniques as applied to general aeronautical practice.

DETAILED CONTENTS

1.   **Electronic and Flight Instruments**   (12 hrs)

Display -units, presentation, failure detection and annunciation, Display of air data.

2   .**Communication**   (12 hrs)

High frequency, Ultra/Very high frequency, satellite communication, air traffic control (ATC), transponder, traffic collision & avoidance system (TCAS), identification of friend and foe(IFF),

3.   **Pitot Static Instruments System**   (14 hrs)

Pitot static system, air speed indicator, altimeter, attitude indicator, radio magnetic indicator, mach meter, turn and slip indicator, vertical speed indicator

4.   **Gyroscopic instruments**   (12 hrs)

Gyroscope and its properties, gyro horizon, turn and bank indicator, turn coordinator, direct reading magnetic compass, directional gyroscope

5.   **Navigational Instruments**   (14 hrs)

Very high and ultra high frequency radio aids, Very high frequency Omni Range, Tactical air navigation, VOR+ TACAN, Very High Frequency direction finding, instrument landing system , microwave landing system, Transponder landing system.

LIST OF PRACTICALS

1.   Study and demonstration of flight instruments.
2.   Study and demonstration of instrument related to pitot static tube for calculation of altimeter, air speed.
3.   Study and demonstration of stall warning instruments and angle of attack indicator.
4.   Study and demonstration of fuel system and fuel flow indicator.

5. Study and demonstration of Auto pilot model, automatic control cockpit voice recorder, coded departure routes and flight data recorder.

INSTRUCTIONAL STRATEGY

1. The design of cockpit is initially shown so that student will understand the where which instrument is present.
2. Power point presentation for making students understands the theoretical concept.
3. For promoting the solving abilities different assignment will be planned.

RECOMMENDED BOOKS

1. Aircraft Systems by Ian Moir and Allan Seabridge
2. Aircraft Instruments by E H J Pallet

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	18
2	12	16
3	14	26
4	12	18
5	14	22
Total	**64**	**100**

5.4   ENVIRONMENTAL SCIENCE

L T P
3 - -

RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

DETAILED ONTENTS

1.   Basics of ecology, eco system and sustainable development   (03 hrs)

2.   Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table   (04 hrs)

3.   Sources of pollution - natural and man made, their effects on living and non-living organisms, Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms, Pollution of air-causes and effects of man, animal, vegetation and non-living organisms, Sources of noise pollution and its effects   (18 hrs)

4.   Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods   (06 hrs)

5.   Mining, blasting, deforestation and their effects   (03 hrs)

6.   Legislation to control environment   (04 hrs)

7.   Environmental Impact Assessment (EIA), Elements for preparing EIA statements   (04 hrs)

8.   Current issues in environmental pollution and its control, role of non-conventional sources of energy in environmental protection   (06 hrs)

INSTRUCTIONAL STRATEGY

Some experts from the field may be invited for extension lectures, video films on environment, may be shown to explain the importance of environment protection.

RECOMMENDED BOOKS

1.   Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.

2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Engineering and Management by Suresh K Dhamija; SK Kataria and Sons, New Delhi.
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	0	06
2	0	10
3	1	40
4	0	12
5	0	04
6	0	08
7	0	08
8	0	12
Total	**4**	**100**

5.5   THEORY OF MACHINES

L T P
4 - -

RATIONALE

A diploma holder in this course is required to assist in the design and development of prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components of machine and application of these principles for designing. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

DETAILED CONTENTS
THEORY

1.   Simple Mechanisms   (06 hrs)

1.1   Introduction to link, kinematic pair, lower and higher pair, Kinematic chain, mechanism, Inversions.
1.2   Different types of mechanisms (with examples)

2.   Friction   (10 hrs)

2.1   Definition and its necessity
2.2   Horizontal force required to move a body on an inclined plane both upward and downward
2.3   Frictional torque in screws , both for square and V threads
2.4   Screw jack (Derivation and Numericals)
2.5   Different types of bearings and their application

3.   Power Transmission   (14 hrs)

3.1   Introduction to Belt and Rope drives
3.2   Types of belt drives and types of pulleys
3.3   Concept of velocity ratio, slip and creep; crowning of pulleys (simple numericals)
3.4   Flat and V belt drive: Ratio of driving tensions, power transmitted, centrifugal tension, and condition for maximum horse power (simple numericals)
3.5   Different types of chains and their terminology
3.6   Gear terminology, types of gears and their applications; simple and compound gear trains; power transmitted by simple spur gear

4.   Flywheel   (08 hrs)

4.1   Principle and applications of flywheel
4.2   Turning - moment diagram of flywheel for different engines

4.3   Fluctuation of speed and fluctuation of energy - Concept only
4.4   Coefficient of fluctuation of speed and coefficient of fluctuation of energy

5.   Governor   (10 hrs)

5.1   Principal of governor
5.2   Simple description and working of Watt, Porter and Hartnel governor (simple numerical based on watt and porter governor)
5.3   Hunting, isochronism, stability, sensitiveness of a governor

6.   Balancing   (06 hrs)

6.1   Concept of balancing
6.2   Introduction to balancing of rotating masses (simple numericals)

7.   Vibrations   (10 hrs)

7.1   Types-longitudinal, transverse and torsional vibrations (simple numericals)
7.2   Dampening of vibrations
7.3   Causes of vibrations in machines, their harmful effects and remedies

INSTRUCTIONAL STRATEGY

1.   Use teaching aids for classroom teaching
2.   Give assignments for solving numerical problems
3.   Arrange industry visits to explain the use of various machine components like belt, rope, chain, gear drives, action due to unbalanced masses, brake clutch, governors, fly wheels, cams and gear drives
4.   Video films may be used to explain the working of mechanisms and machine components like clutch, governors, brake etc.

RECOMMENDED BOOKS

1.   Theory of Machines by D.R. Malhotra; Satya Prakashan, New Delhi.
2.   Theory of Machines by V.P Singh; Dhanpat Rai and sons, New Delhi.
3.   Theory of Machines Jagdish Lal; Metropolitan Publishers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	10	15
3	14	22
4	08	12
5	10	16
6	06	10
7	10	15
Total	**64**	**100**

5.6   **COMPUTER AIDED DRAFTING**

L T P
- - 7

RATIONALE

Computer applications play a very vital role in the professional life of diploma holder. This subject offers applications of various computer software in aeronautical engineering.

DETAILED CONTENTS

1.   Introduction to AutoCAD commands (6 drawing sheets)

   1.1   Concept of AutoCAD, Tool bars in Auto CAD, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar)
   1.2   Drawing commands – point, line, arc, circle, ellipse,
   1.3   Editing commands – scale, erase, copy, stretch, lengthen and explode.
   1.4   Dimensioning and placing text in drawing area
   1.5   Sectioning and hatching
   1.6   Inquiry for different parameters of drawing entity

2.   Detail and assembly drawing of the following using AUTOCAD (4 sheets)

   2.1   Plummer Block
   2.2   Wall Bracket
   2.3   Stepped pulley, V-belt pulley
   2.4   Flanged coupling
   2.5   Machine tool Holder (Three views)
   2.6   Screw jack or knuckle joint

3.   Isometric Drawing by CAD using Auto CAD (one sheet)

   Drawings of following on computer:
   -     Cone
   -     Cylinder
   -     Isometric view of objects

4.   Modelling   (01 sheet)

   3D modelling, Transformations, scaling, rotation, translation

5.   Introduction to other CAD softwares;

   (Pro Engineer/CATIA / Inventor/Unigraphics/Solid Work: Salient features, simple drawing of components (2 D and 3D)(At least one software)

INSTRUCTIONAL STRATEGY

1.   Teachers should show model or realia of the component/part whose drawing is to be made.

2.   Emphasis should be given on cleanliness, dimensioning, & layout of sheet.

3.   Teachers should ensure use of IS codes related to drawing.

RECOMMENDED BOOKS

1.   Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.

2.   AutoCAD for Engineering Drawing Made Easy by P. Nageswara Rao; Tata McGraw Hill, New Delhi.

3.   AutoCAD 2000 for you by Umesh Shettigar and Abdul Khader; Janatha Publishers, Udupi.

4.   Auto CAD 2000 by Ajit Singh, TMH, New Delhi.

5.   Designing with Pro Engineer, Sham Tickoo by Dream Tech Publications, New Delhi.

6.   Designing with CATIA, by Sham Tickoo, Dream Tech. Publications, New Delhi.

PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1.   Communication Skills

2.   Correspondence and job finding/applying/thanks and follow-up

3.   Resume Writing

4.   Interview Techniques: In-Person Interviews; Telephonic Interview' Panel interviews; Group interviews and Video Conferencing etc.

5.   Presentation Techniques

6.   Group Discussions Techniques

7.   Aspects of Personality Development

8.   Motivation

9.   Leadership

10.   Stress Management

11.   Time Management

12.   Interpersonal Relationship

13.   Health and Hygiene