## B.TECH - AERONAUTICAL ENGINEERING
### CURRICULUM AND SYLLABUS
#### CHOICE BASED CREDIT SYSTEM
#### I – VIII SEMESTERS

### SEMESTER I

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- E- Civil, Mechanical, Aeronautical Branches

**Total No. of Contact Hours: 35**  **Total No. of Credits: 27**

** Engineering graphics – Final examination will be evaluated by internal faculty.

* Laboratory classes on alternate weeks. The lab examinations will be held only in the second semester (including the first semester experiments also).
## SEMESTER II

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# Any one of the following courses: BFR201 – French, BGM201 – German, BJP201- Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil

*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)

**Total No. of Contact Hours: 35**  
**Total No. of Credits: 24**

## SEMESTER III

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Total No. of Contact Hours: 30

Total No. of Credits: 26

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Total No. of Contact Hours: 32

Total No. of Credits: 28
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**Total No. of Contact Hours: 31**

**Total No. of Credits: 26**

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**Total No. of Credits: 27**
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- | OE | Open Elective – I | 3 | 0 | 0 | 3

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Total No. of Contact Hours: 30  
Total No. of Credits: 24

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Total No. of Contact Hours: 24  
Total No. of Credits: 16

**OVERALL CREDITS FOR THE PROGRAMME**: 198

**LIST OF ELECTIVES**

**List of Core Elective(CE) I:**

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# - Specialization in Maintenance
* - Specialization in Propulsion
$- Specialization in Structures
+ - Specialization in Aerodynamics

### List of Non Major Elective (NE) I:

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### List of Open Elective (OE) II:
BEN101 ENGLISH - I

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OBJECTIVES
To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1 Understand the importance of being responsible, logical, and thorough.

CO2 Respond to the situations where short reports and instructions are required.

CO3 Explain “how things work”, and what to suggest when “things don’t work.

CO4 Develop our confidence and authority in the practical use of language.

CO5 Understand the importance of being responsible, logical, and thorough.

CO6 Able to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation)  H-High, M-Medium, L-Low

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3 Category

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4 Approval

37th Meeting of Academic Council, May 2015

UNIT I  STRUCTURES
Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making
UNIT II TRANSCODING
Cause and effect relations – Punctuations – Differences between verbal and nonverbal communication -E mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III REPORTING
Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION
Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V METHODOLOGY
Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK
1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

<table>
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<th>BMA101</th>
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OBJECTIVES
To make the students learn Mathematics in order to formulate and solve problems effectively in their respective fields of engineering.

UNIT 1 MATRICES
Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.
UNIT II  THREE DIMENSIONAL ANALYTICAL GEOMETRY  12

UNIT III  DIFFERENTIAL CALCULUS  12
Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes-Envelopes- Applications of Evolutes and Envelopes.

UNIT IV  FUNCTIONS OF SEVERAL VARIABLES  12

UNIT V  MULTIPLE INTEGRALS  12
Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

TEXT BOOK:

REFERENCES:

PH101  ENGINEERING PHYSICS I  L T P C
Total Contact Hours - 45  3 0 0 3
Prerequisite – +2 level Physics
Course Designed by – Department of Physics

OBJECTIVES:
To enhance the fundamental knowledge in Physics and its applications relevant to various stream Engineering and Technology

UNIT I  CRYSTAL PHYSICS  9
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)
UNIT II  PROPERTIES OF MATTER AND THERMAL PHYSICS

UNIT III  QUANTUM PHYSICS

UNIT IV  ACOUSTICS AND ULTRASONICS

UNIT V  PHOTONICS AND FIBRE OPTICS

TEXT BOOKS:

REFERENCES:
1. Searls and Zemansky. University Physics, 2009
5. http://nptel.ac.in/course.php?disciplineId=122

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

UNIT I  WATER TECHNOLOGY

UNIT II  POLYMERS
Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III  ELECTRO CHEMISTRY

UNIT IV  CORROSION AND CORROSION CONTROL

UNIT V  NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES
TEXT BOOKS:

REFERENCES :

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OBJECTIVES
Students will understand the basics of computers and solve computer oriented problems using various computing tools.

UNIT I   INTRODUCTION TO COMPUTER

UNIT II  PROBLEM SOLVING AND OFFICE AUTOMATION

UNIT III INTRODUCTION TO C
Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV  ARRAYS AND STRUCTURES
Overview of C-Constants, Variables and Data types-Operators and Expressions -Managing Input and Output operators-Decision making-Branching and Looping.

UNIT V   INTRODUCTION TO C++
Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

REFERENCES:

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OBJECTIVES
To make students groom their personality and prove themselves as good Samaritans of society.

UNIT I  INTRODUCTION TO PERSONALITY DEVELOPMENT  6

UNIT II  ATTITUDE & MOTIVATION  6
Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III  SELF-ESTEEM  6

UNIT IV  OTHER ASPECTS OF PERSONALITY DEVELOPMENT  6
UNIT V EMPLOYABILITY QUOTIENT
Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview - Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

REFERENCE BOOKS:

BBT102 BIOLOGY FOR ENGINEERS

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Prerequisite – Basic Science
Course Designed by – Department of Industrial Bio Technology

OBJECTIVES
Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system.

UNIT I INTRODUCTION TO LIFE
Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNIT II BIODIVERSITY

UNIT III GENETICS AND IMMUNE SYSTEM

UNIT IV HUMAN DISEASES
Definition - causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V  BIOLOGY AND ITS INDUSTRIAL APPLICATION  6
Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-
recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-
biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic
biomedical instrumentation.

TEXT BOOKS:
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis
   Company, 2011.
   Professional, 2004

REFERENCE BOOKS
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr,
   Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008

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OBJECTIVES: Understand the basic concepts of civil engineering.

UNIT I  CIVIL ENGINEERING MATERIALS  8
Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain
Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II  SURVEYING  5
Surveying – objectives – classification – principles of survey – Measurement of distances – Chain
survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III  FOUNDATION FOR BUILDING  5

UNIT IV  SUPERSTRUCTURE  7
Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering – White Washing (Simple examples only)

UNIT V  MISCELLANEOUS TOPICS  5
Types of Bridges – Dam purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)

TEXT BOOKS:

REFERENCE BOOKS:

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OBJECTIVES
To understand techniques of drawings in various fields of engineering

UNIT I BASIC CURVES, PROJECTION OF POINTS AND STRAIGHT LINES 6+6
Conics-construction of ellipse, parabola and hyperbola by eccentricity method-construction of cycloids- construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards-Orthographic projection principles- Principal planes-First angle projection- Projection of points. Projection of straight lines (only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces.

UNIT II PROJECTIONS OF PLANES AND SOLIDS 6+6
Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone, tetrahedron and truncated solids when the axis is inclined to one of the principal planes/ both principal planes by rotating object method and auxiliary plane method.

UNIT III ORTHOGRAPHIC PROJECTIONS, ISOMETRIC PROJECTIONS & FREEHANDSKETCHING 6+6
Orthographic projection of Simple parts from 3D diagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids-Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems Free hand sketching of orthographic & Isometric projection
UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+6
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids- Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V PERSPECTIVE PROJECTION, BUILDING DRAWING AND COMPUTER AIDED DRAWING 6+6
Perspective projection of simple solids-Prisms, Pyramids and cylinders by visual ray method. Introduction- components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD. Demonstration of drafting packages.

TEXT BOOKS:

REFERENCES:

Special points applicable to University Examinations on Engineering Graphics
1) There will be five questions, each of either or type covering all units of the syllabus.
2) All questions will carry equal marks of 20 each making a total of 100.

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OBJECTIVES
To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.
LIST OF EXPERIMENTS

I. CIVIL ENGINEERING PRACTICE

Buildings:
   a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
   a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
   b) Study of pipe connections requirements for pumps and turbines.
   c) Preparation of plumbing line sketches for water supply and sewage works.
   e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Hand tools and Power tools:
   a) Study of the joints in roofs, doors, windows and furniture.
   b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.
   c) Preparation of half joints, Mortise and Tenon joints.

II MECHANICAL ENGINEERING PRACTICE

Welding:
   a) Preparation of butt joints, lap joints and tee joints by arc welding

   Basic Machining:
   a) Simple Turning and Taper turning
   b) Drilling Practice

Sheet Metal Work:
   a) Forming & Bending:
   b) Model making – Trays, funnels, etc.
   c) Different type of joints
   d) Preparation of air-conditioning ducts
   e) Preparation of butt joints, lap joints and tee joints by arc welding

Machine assembly practice:
   a) Assembling, dismantling and Study of centrifugal pump
   b) Assembling, dismantling and Study of air conditioner
   c) Assembling, dismantling and Study of lathe

Moulding:
   a) Moulding operations like mould preparation for gear and step cone pulley etc

Fitting:
   a) Fitting Exercises – Preparation of square fitting and vee – fitting models.

Demonstration:
   a) Smithy operations, upsetting, swaging, setting down and bending. Example–Exercise – Production of hexagonal headed bolt.
   b) Gas welding.

REFERENCES:

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**Total Contact Hours – 60**

Prerequisite – English I

Course Designed by – Department of English

**OBJECTIVES**

Students will be able to actively participate in group discussions. Students will have Telephonic Skills, Giving Directions and Information Transfer.

**UNIT I ORIENTATION**

12

Numerical adjectives - Meanings in context - Same words used as different parts of speech - Paragraph writing - Non-verbal communication - Regular and Irregular verbs.

**UNIT II ORAL SKILL**

12

Listening to audio cassettes - C.Ds, News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

**UNIT III THINKING SKILL**

12

Self-introduction describing –Group Discussion – Debate –Role play- Telephone- Things-etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

**UNIT IV WRITING SKILL**

12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue).

**UNIT V FORMAL INFORMATION**

12

Editing – Prepositions - Articles - Permission letter for undergoing practical training, Essay writing - Application for a job, letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

**TEXT BOOK:**


**REFERENCE BOOKS:**

OBJECTIVES
Ability to apply these principles of mathematics in projects and research works.

UNIT I  ORDINARY DIFFERENTIAL EQUATION  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
Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration– Green’s theorem in a plane , Gauss divergence theorem and Stoke’s theorem (without proofs) – simple applications involving cubes and rectangular parallelepipeds.

UNIT III  ANALYTIC FUNCTIONS  12

UNIT IV  COMPLEX INTEGRATION  12

UNIT V  STATISTICS  12

TEXT BOOK:

REFERENCES:

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**OBJECTIVES**

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

**UNIT I CONDUCTING MATERIALS**


**UNIT II SEMICONDUCTING MATERIALS**

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect – Determination of Hall coefficient – Applications.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS**


**UNIT IV DIELECTRIC MATERIALS**


**UNIT V ADVANCED ENGINEERING MATERIALS**

TEXT BOOKS:

REFERENCES:
5. http://nptel.ac.in/course.php?disciplineId=122

BCH 201

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

UNIT I SURFACE CHEMISTRY

UNIT II PHASE RULE AND ALLOYS

UNIT III ANALYTICAL TECHNIQUES

UNIT IV FUELS

UNIT V ENGINEERING MATERIALS

TEXT BOOKS:

REFERENCES:

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OBJECTIVES
Language gives access and insights into another culture. It is a fundamental truth that cultures define themselves through languages.

UNIT I INTRODUCTION
At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs ‘to be’, ‘to call oneself’, subject pronouns, interrogation

UNIT II GRAMMAR

24
At the University: Savoir-faire: enquiring after one’s welfare, taking leave, expressing appreciation -Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular ‘er’ verbs, ‘to have’, ‘to learn’, negation, irregular verbs

UNIT III CONVERSATION
At the café: Savoir –faire: speaking about one’s likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING
At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS
A concert: Savoir –faire: inviting, accepting, expressing one’s inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS
Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, At Nallir’sSaveoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:
1. Course Material: Synchronie I –Méthode de Français

BGM 201

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OBJECTIVES
At the end of this course, students shall be able to obtain good knowledge of the language, read, write and speak German, whereby the emphasis is laid on speech.

Course structure:
A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT IPRONUNCIATION
Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar – the article “the”, conjugation of verbs

UNIT IISELF INTRODUCTION
Shopping - Grammar – adjectives, endings before nouns, practice. Self introduction

UNIT II TRAINING 9
Addresses, Occupations, Studies - Grammar - ‘to be’, the definite/indefinite articles, individual Training

UNIT IV ORAL 9
Leisure Time, Sports, Hobbies - Grammar – position of a verb in a main clause , oral practice

UNIT V NARRATION 9
At a Restaurant, Food and Drink - Grammar – the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:
1. Sprachkurs Deutsch 1 (VerlagDiesterweg), New Delhi Learning Centre

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OBJECTIVES
To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

UNIT I CULTURAL HERITAGE 9
Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9
Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar– usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9
Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9
Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9
Vocabulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko,
doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

**TEXT BOOKS**

**REFERENCE BOOKS**

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<tr>
<th>BKR 201</th>
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**UNIT I  PLANNING**
Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

**UNIT II  MODIFIERS**
Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

**UNIT III  PLACING ORDERS**
Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something).

**UNIT IV  DESCRIPTIONS**
Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

**UNIT V  GRAMMAR**
Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n’t it? , will (do)

**COURSE MATERIAL:**
Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University
BCN 201  CHINESE  

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Total Contact Hours - 60
Prerequisite – +2 Level English
Course Designed by – Department of English

OBJECTIVES
To have a basic knowledge of Chinese language, Chinese culture and heritage
To impart knowledge on Chinese lifestyle and heritage.

UNIT 1   RISE OF DIALECTS  9
History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT II  VARIETIES  9

UNIT III   CHARACTERS  9
Chinese characters, Homophones, Phonology

UNIT IV   TRANSCRIPTIONS  9
Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V   GRAMMAR  9
Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:
UNIT I  BASICS AND STATICS OF PARTICLES  

UNIT II  EQUILIBRIUM OF RIGID BODIES  
Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions.

UNIT III  PROPERTIES OF SURFACES AND SOLIDS  

UNIT IV  FRICTION  

UNIT V  DYNAMICS OF PARTICLES  

TEXT BOOK:

REFERENCES:
OBJECTIVES: To understand the laws of electrical engineering.

UNIT I  ELECTRIC CIRCUITS  6

UNIT II  ELECTRICAL MACHINES  6

UNIT III  BASIC MEASUREMENT SYSTEMS  6

UNIT IV  SEMICONDUCTOR DEVICES  6

UNIT V  DIGITAL ELECTRONICS  6

TEXT BOOKS:

REFERENCE BOOKS:
## BCS 2L2

### COMPUTER PRACTICE LABORATORY

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**Total Contact Hours** - 45

**Prerequisite** – Fundamentals of Computer

**Course Designed by** – Department of Computer Science & Engineering

**OBJECTIVES:** To impart basic computer knowledge

### A) WORD PROCESSING

Document creation, Text manipulation with Scientific Notations. Table creation, Table formatting and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

### B) SPREAD SHEET

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

### C) SIMPLE C PROGRAMMING*

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

### D) SIMPLE C++PROGRAMMING

- Classes and Objects
- Constructor and Destructor

*For Programming exercises Flow chart and Pseudo code are essential.

## BEE2L1

### BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY

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**Total Contact Hours** – 45

**Prerequisite** – Basic Electrical and Electronics Engineering

**Course Designed by** – Department of Electrical & Electronics Engineering

**OBJECTIVES:** To enhance the student with knowledge on electrical and electronic equipments.

### I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

### II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   b. Assembling electronic components on bread board.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

**PHYSICS AND CHEMISTRY LABORATORY**

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**OBJECTIVES:** To impart knowledge to the students in practical physics and chemistry

**I - LIST OF EXPERIMENTS – PHYSICS**
1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee”s Disc method.
6. Determination of Young”s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster”s Bridge
8. Determination of Young”s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille”s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

**II-LIST OF EXPERIMENTS – CHEMISTRY**
1. Estimation of hardness of Water by EDTA
2. Estimation of Copper in brass by EDTA
3. Determination of DO in water (Winkler’s method)
4. Estimation of Chloride in Water sample (Argento metry)
5. Estimation of alkalinity of Water sample
6. Determination of molecular weight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using BaCl2 vs Na2SO4
10. Potentiometric Titration (Fe2+ / KMnO4 or K2Cr2O7)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.
OBJECTIVES
1. To introduce Fourier series analysis that is important to many applications in engineering apart from its use in solving boundary value problems.
2. To acquaint the student with Fourier transform techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes.
4. To develop Z transform techniques for discrete time systems.
5. To develop the Fourier transform techniques and convolution theorem.

COURSE CONTENT

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS  9+6

UNIT II  FOURIER SERIES  9+6

UNIT III  BOUNDARY VALUE PROBLEMS  9+6
Classifications of second order linear partial differential equation – Solutions of one dimensional wave equation and one-dimensional heat equation.

UNIT IV  LAPLACE TRANSFORMS  9+6

UNIT V  FOURIER TRANSFORMS  9+6

Text Books:

References:
OBJECTIVES
1. To equip the student with the knowledge about the development of aircrafts and spacecrafts through historical reviews and about their basic configurations.
2. To accustom the student to the various basic aerodynamic terms and about the generation of aerodynamic forces.
3. To introduce to the student about the basic types of aircraft constructions and materials and the various loads acting on it.
4. To familiarize the student on the different kinds of propulsion for aircrafts and materials for gas turbine engines
5. To acquaint the student about space vehicles, re-entry, heat transfer and basics of satellite technology

COURSE CONTENT

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<thead>
<tr>
<th>UNIT I</th>
<th>INTRODUCTION TO FLIGHT</th>
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<td>Brief history of Aviation-Hot air balloon and heavier than air flying machines-early airplane configurations-Modern Airplanes-Components of airplane and their functions-Rotary wing aircrafts-Space vehicles.</td>
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<td>International Standard Atmosphere-Pressure, Temperature and Density altitude, Basic Aerodynamics - Continuity, Momentum and Energy equations, Bernoulli’s equation-Mach number-subsonic, transonic, sonic and supersonic flow regimes, Measurement of pressure and airspeed- IAS,EAS and TAS. Airfoil geometry and nomenclature-infinite and finite wing sections-lift, drag and moment coefficients-angle of attack-aspect ratio-Reynolds number-induced drag and parasite drag-airfoil characteristics, Elements of Aircraft performance, stability and control.</td>
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<td>Structural components of an airplane- monocoque and semi monocoque structure –materials for structural components – composite materials and their significance in Aviation Technology</td>
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### Text Books:

### References:
4. [https://books.google.co.in/books?isbn=1600860729](https://books.google.co.in/books?isbn=1600860729)
5. [www.grc.nasa.gov/WWW/k-12/airplane/](http://www.grc.nasa.gov/WWW/k-12/airplane/)

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### OBJECTIVES
1. To learn concepts of fluid, properties of fluid and its classification.
2. To understand fluid statics and dynamics.
3. Significance of similarity and model studies
4. To know about boundary layer concepts and its applications to pipe design.
5. To learn about pumps and turbine design.

### COURSE CONTENT

#### UNIT I
**INTRODUCTION**
10

- Fluid – definition-Fluid properties-Newton’s law of viscosity-Classification of fluids-fluid statics-
- Hydrostatic forces on submerged surfaces- Stability of floating bodies

#### UNIT II
**FLUID FLOW ANALYSIS AND FLOW MEASUREMENT**
14

- Ideal and real flow-Concept of continuum-Eulerian and Lagrangian approaches-Velocity field-Pathline, Streamline, Streamline- Stream tube- Fluid acceleration-Continuity, momentum differential equations-
- Navier Stokes equation- Stream function – Vorticity –Irrotationality- Potential function- Potential flow-
- Laplace equation-Bernoulli’s equation and its applications-Venturimeter-Orifice meter, Flow Rate and Velocity Measurement.

#### UNIT III
**DIMENSIONAL ANALYSIS**
10

- Buckingham Pi Theorem-Non dimensional numbers and their significance-Flow similarity and model studies.

#### UNIT IV
**FLOW THROUGH PIPES**
12

- Laminar and turbulent flow- Boundary layer flow – Boundary layer thickness - Reynolds number and its significance-Laminar fully developed pipe flow-Hagen-Poiseuille flow-Coefficient of friction-Head loss –
- Darcy-Weisbach equation-Hydraulic gradient- Total energy lines-Moody’s diagram-Turbulent flow through pipes.
UNIT V  FLUID MACHINERY  14

Classification of fluid machines-Reciprocating and centrifugal pumps-impulse and reaction turbines-
Working principle of Pelton, Francis and Kaplan turbines-Velocity triangles-fans and blowers.

Text Books:

References:
1. Yunus A Cengel and John M Cimbala, Fluid mechanics: Fundamentals and Applications, Tata
4. reu.eng.ua.edu › Programs
5. www.fluidmechanics.co.uk/

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<th>BAN303</th>
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OBJECTIVES
1. To introduce the concept of thermodynamic analysis that is central to many applications in engineering.
2. To acquaint the student with the basics of thermodynamic cycles.
3. To introduce a basic idea gas power cycles and vapor power cycles.
4. To develop the basic understanding of refrigeration and air-conditioning system.
5. To develop the basic understanding of aircraft propulsion system.

COURSE CONTENT

UNIT I  BASIC THERMODYNAMICS  16

Systems, Zeroth law, First law - Steady flow energy equation - Heat and work transfer in flow and non-
flow processes - Second law, Kelvin-Planck statement - Clausius statement – Reversibility and irreversibility - Concept of Entropy, Clausius inequality, Principle of increase of entropy – Absolute entropy – Availability - Entropy change in non-flow processes

UNIT II  AIR POWER CYCLES  12

Carnot, Otto, Diesel, Dual, Stirling and Ericsson cycle - Air standard efficiency – Mean effective pressure – Actual and theoretical PV diagram of two stroke and four stroke IC engines.

UNIT III  VAPOUR POWER CYCLES  12


UNIT IV  REFRIGRATION AND AIR – CONDITIONING  10

Principles of refrigeration and Psychometric - Vapour compression - Vapour absorption types - Co-
efficient of performance, Properties of refrigerants – Basic Principle and types of Air conditioning.

UNIT V  THERMODYNAMICS OF AIRCRAFT PROPULSION CYCLES  10

**Text Books:**

**Reference Books:**
7. [www.grc.nasa.gov/WWW/cdtb/software/t-mats.html](http://www.grc.nasa.gov/WWW/cdtb/software/t-mats.html)

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**OBJECTIVES**
1. To provide the students an understanding on the linear statically determinate and indeterminate aircraft tension and compression problems and understanding the strength of materials
2. Introduce students the concept of energy methods for calculating strain energy in axial, torsion, bending and shear loadings.
3. To introduce the concept of buckling and lateral instability and calculation of buckling loads on columns.
4. To provide the design process using different theories of failures.
5. To impart knowledge on various induced stresses.

**COURSE CONTENT**

**UNIT I**

**INTRODUCTION TO STRENGTH OF MATERIALS**


**UNIT II**

**THEORY OF ELASTICITY**

UNIT III  |  BEAM THEORY  |  12
---|---|---
Shear force and bending moment diagrams for simply supported and cantilever beams – stress, strain and deflection in straight beams – flexural and shear stresses -Shear stress variation in beams of symmetric sections – Beams of uniform strength – Methods of evaluation of deflection.

UNIT IV  |  TORSION  |  12
---|---|---
Torsion of solid and hollow circular shafts – Shear stress variation – Power transmission in shafts – Open and closed-coiled helical springs – Stresses in helical springs.

UNIT V  |  BI – AXIAL STRESSES  |  12
---|---|---
Stresses in thin circular and spherical shell under internal pressure – Volumetric strain – Combined loading – Principle stresses and maximum shear stresses – Analytical and graphical methods - Mohr’s circle.

Text Books:

Reference Books:
6. www.mdsolids.com/

**BAN305**

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<tr>
<th>MECHANICS OF MACHINES</th>
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Course Designed by – Department of Aeronautical Engineering

**OBJECTIVES**
1. To impart students with the knowledge about motion, masses and forces in machines.
2. To enable students to apply fundamental of mechanics to machines which include engines, linkages etc.,
3. To impart students with the knowledge about various power transmitting devices such as gears, belts etc.
4. To facilitate students to understand the concept of balancing of rotating and reciprocating masses
5. To give awareness to students on the phenomenon of vibration and its effects

**COURSE CONTENT**
## UNIT I  MECHANISMS  12

## UNIT II  FRICTION  12
Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt(Flat and Vee) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

## UNIT III  GEARING AND CAMS  9
Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, Compound gear trains and epicyclic gear trains - Determination of speed and torque - Cams – Types of cams and followers.

## UNIT IV  FORCE ANALYSIS AND BALANCING  15
Introduction to force analysis - Static and dynamic – Inertia force and inertia torque – D’Alembert’s principle - Static and dynamic balancing – Single and several masses in different planes – Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multicylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.

## UNIT V  VIBRATION  12

### Text Books:

### Reference Books:
6. ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=5593596
7. www.simplementes.org/

### FLUID MECHANICS AND MACHINERIES LAB

<table>
<thead>
<tr>
<th>BAN3L1</th>
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Prerequisite – Engineering Mechanics

Course Designed by – Department of Civil Engineering
**OBJECTIVES**
1. To help the student to understand about pipe flow losses and flow through notches and weirs.
2. To accustom the student about buoyancy test and Bernoulli’s principle
3. To introduce to the student about the various flow meters
4. To acquaint the student about the performance characteristics of various pumps
5. To introduce to the student about the performance characteristics of various turbines

**LIST OF EXPERIMENTS**

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<thead>
<tr>
<th>No.</th>
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<tr>
<td>1</td>
<td>Determination of pipe flow losses.</td>
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<tr>
<td>2</td>
<td>Calibration of orifice meter and venture meter.</td>
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<td>3</td>
<td>Flow through notches and weir.</td>
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<td>4</td>
<td>Flow through open orifice</td>
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<td>5</td>
<td>Buoyancy experiment – Metacentric Height.</td>
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<tr>
<td>6</td>
<td>Verification of Bernoulli’s Equation.</td>
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<td>7</td>
<td>Performance characteristics of centrifugal pump.</td>
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<td>8</td>
<td>Performance characteristics of submergible pump.</td>
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<td>9</td>
<td>Performance characteristics of jet pump.</td>
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<td>10</td>
<td>Performance characteristics of oil gear pump.</td>
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<td>11</td>
<td>Characteristics of impulse turbine – Pelton wheel turbine.</td>
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<tr>
<td>12</td>
<td>Characteristics of reaction turbine – Francis turbine</td>
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</table>

**References:**
1. Fluid Mechanics and Machinery Lab Manual, Department of Civil Engineering, 2015

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**STRENGTH OF MATERIALS LAB**

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<td>Course Designed by – Department of Aeronautical Engineering</td>
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**OBJECTIVES**
1. To enable the student to understand about the tensile test and stress – strain curves and also about the compression tests
2. To accustom the student about shear test, torsion test and hardness tests.
3. To introduce to the student about the impact test.
4. To acquaint the student about the open and closed coil spring tests.
5. To introduce to the student about fatigue test.
LIST OF EXPERIMENTS

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<tr>
<td>1</td>
<td>Tension test of a mild steel rod.</td>
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<td>2</td>
<td>Shear test on mild steel and aluminum rod.</td>
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<td>3</td>
<td>Torsion test on mild steel rod.</td>
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<td>4</td>
<td>Hardness test (a) Brinell &amp; (b) Rockwell.</td>
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<td>5</td>
<td>Impact tests (a) Izod (b) Charpy.</td>
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<td>6</td>
<td>Deflection test on helical spring.</td>
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<td>7</td>
<td>Fatigue test: (a) Reverse plate bending (b) Rotating beam.</td>
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<td>8</td>
<td>Block compression test.</td>
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References:

MACHINE DRAWING

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OBJECTIVES
1. To give the students an idea of fundamental issues common to almost all areas of machine drawing.
2. To train the student to draw an assembled diagram of a machine part based on the details of individual parts.
3. To help the student to understand the machine drawing, nomenclature and various notations.
4. To train the students to prepare a working drawing of machines.
5. To enable the student to communicate his ideas through drawings.

COURSE CONTENT
- Indian standard code (BIS) of practice for engineering drawing – general principle of presentation, conventional representation of threaded parts, springs, Gears and common features, Abbreviations and symbols used in technical drawings.
- Tolerance – Types – Symbols used and representation on the drawing – fit types, selection for different application – Allowance, Interchangeability. Surface finish Relation to the manufacturing processes – Types of representation on the drawing welding symbols.
- Preparation of working drawing for given machine components: Bolts, Screws, Studs, Nuts, Keys and Key-ways.
- Preparation of simple assembly drawings: Different types of cotter and knuckle joints.
- Preparation of simple assembly drawing for following machine with part drawings given: Screw jack, Plummer block, connecting rod, machine vice, tail stock of lath, fuel injection pump for single cylinder engine, stop valve.
**Text Books:**

**References:**
4. [https://www.machinedesignonline.com/](https://www.machinedesignonline.com/)

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<tr>
<th>BMA402</th>
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**OBJECTIVES**
1. To introduce the solution of equations and Eigen value problems.
2. To acquaint the student with interpolation techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of numerical differentiation and integration.
4. To develop the initial value problems for ordinary differential equations.
5. To develop the boundary value problems for ODE and PDE.

**COURSE CONTENT**

**UNIT I**  
INTERPOLATION (FINITE DIFFERENCES)  
9+6


**UNIT II**  
INTERPOLATION (FINITE DIFFERENCES)  
9+6

Newton’s Divided difference formula, Lagrange’s interpolation-forward and backward difference formula-Stirling’s and Bessel’s central difference formula.

**UNIT III**  
NUMERICAL DIFFERENTIATION AND INTEGRATION  
9+6

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson’s 1/3” and 3/8” rule, Double integrals using Trapezoidal and Simpson’s rule.

**UNIT IV**  
INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS  
9+6

Single step methods, Taylor series, Euler and modified Euler, Rungekutta method of first and second order differential equations, multiple step methods, Milne and Adam’s – Bash forth predictor and corrector method.

**UNIT V**  
BOUNDARY VALUE PROBLEMS FOR ODE AND PDE  
9+6

Finite difference for the second order ordinary differential equations, finite difference solutions for one dimensional heat equations (both implicit and explicit), one dimensional wave equation, Two dimensional, Laplace and Poisson equation.
### Text Books:

### References:

### AIRCRAFT STRUCTURES I

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Total Contact Hours – 60

Prerequisite – Engineering Mechanics, Fundamentals of Structural Mechanics

Course Designed by – Department of Aeronautical Engineering

### OBJECTIVES
1. To acquaint students with the fundamentals of aircraft structures.
2. To acquaint students with statically determinate and indeterminate structures.
3. To introduce students to energy methods applied to simple aerospace structural elements.
4. To introduce various structural analysis of various column type aerospace structural elements.
5. To introduce various failure theory of structural analysis.

### COURSE CONTENT

#### UNIT I

**TRUSSES AND FRAMES**

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

#### UNIT II

**STATICALLY DETERMINATE AND INDETERMINATE STRUCTURES**

- Propped Cantilever - Fixed-Fixed beams - Clapeyron’s Three Moment Equation – slope deflection and energy distribution method.

#### UNIT III

**ENERGY METHODS**

- Strain energy evaluation in structural members – energy theorems – dummy load & unit load methods – Maxwell’s reciprocal theorem – energy methods applied to statically determinate and indeterminate beams, frames, rings & trusses

#### UNIT IV

**COLUMNS**

- Euler’s column curve – inelastic buckling – effect of initial curvature – the Southwell plot – columns with eccentricity – use of energy methods – theory of beam columns – beam columns with different end conditions – stresses in beam columns.

#### UNIT V

**FAILURE THEORY**

- Fail safe and safe life structures, factor of safety, Brief introduction of yield material, brittle vs. ductile behavior, Creep and creep rupture, viscoelastic materials - environmental stress, stress potentials, effect of time and temperature - Fatigue and Fracture - Maximum Stress theory –
Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.

**Text Books:**

**References:**

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**OBJECTIVES**
1. To introduce student about basic concepts of mathematical formulation of air flow.
2. To impart theoretical knowledge about the elementary flow and their combination to analysis flow over real object.
3. To Study the distribution of pressure around airfoil for incompressible inviscid flow. To study transformation of flow over circle cylinder into flow over the airfoil
4. To study flow around wing and measure lift generated.
5. To introduce the students about viscous flow theory for flow over flat and solution for incompressible viscous flow over flat plate.

**COURSE CONTENT**

**UNIT I**

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**UNIT II**

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<td>Ideal Flow over a circular cylinder, D’Alembert’s Paradox, Magnus effect, KuttaJoukowski Theorem, Starting Vortex, Kutta condition, Real flow over smooth and rough cylinder, Basics of vortex theory, Basics of compressible flow.</td>
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**UNIT III**

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UNIT IV  |  FINITE WING THEORY  |  12
---|---|---
Vortex Filament, Biot and Savart Law, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Lifting Line Theory and its limitations, induced drag coefficient, elliptic and general lift distribution, Oswald’s wing efficiency factor, effect of plan form and aspect ratio

UNIT V  |  VISCOUS FLOW THEORY  |  12
---|---|---
Laminar Boundary layer and its thickness, displacement thickness, momentum thickness, Energy thickness, Shape parameter, Boundary layer equations for a steady two dimensional incompressible flow, Boundary Layer growth over a Flat plate, Critical Reynolds Number, Blasius solution, Basics of Turbulent flow, Prandtl’s mixing length hypothesis, Free shear layers.

Text Books:

References:
1. Milne Thomson, L.H., Theoretical Aerodynamics, Macmillan, 1985

| BAN403 | AIRCRAFT PROPULSION | L | T | P | C |
| | Total Contact Hours – 60 | | | | |
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OBJECTIVES
1. To provide students with an overview of various aerospace propulsion systems.
2. To provide students with a sound foundation in the fundamentals of thermodynamics of aircraft engines
3. To teach students the elementary principles of inlets and nozzle
4. To teach students basic principles of compressors and turbines used in aircraft propulsion
5. To teach students about the various type of combustion chamber and combustion process

COURSE CONTENT

UNIT I  |  FUNDAMENTALS OF ENGINES  |  10
---|---|---

UNIT II  |  INLETS AND NOZZLES  |  14
---|---|---
UNIT III  COMPRESSIONS  

UNIT IV  COMBUSTION CHAMBERS  

UNIT V  TURBINES  

Text Books:

References:

BAN404  
AIRCRAFT SYSTEMS AND INSTRUMENTATION

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Prerequisite – Fundamentals of Aeronautics and Astronautics

Course Designed by – Department of Aeronautical Engineering

OBJECTIVES
1. To acquaint the student with the various aircraft systems
2. To introduce to the student about the different control systems in aircrafts
3. To familiarize the student to the different systems associated with aircraft engines
4. To acquaint the student to the several auxiliary systems in aircrafts
5. To enable the student to understand about the working of basic aircraft instruments

COURSE CONTENT

UNIT I  AIRCRAFT SYSTEMS  

UNIT II  AIRPLANE CONTROL SYSTEMS  
Conventional Systems - fully powered flight controls - Power actuated systems – Modern control systems
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 SYSTEMS
---|---
Basic Air cycle systems - Vapour Cycle systems, Evaporative vapour cycle systems -Evaporative air cycle systems –Oxygen systems - Fire protection systems, Deicing and anti icing systems.

UNIT V | AIRCRAFT INSTRUMENTS
---|---

Text Books:

References:

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<th>BCE406</th>
<th>ENVIRONMENTAL STUDIES</th>
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OBJECTIVES
1. To acquaint the student about the various natural resources and their associated problems
2. To accustom the student about ecosystem and the different types of ecosystems and their importance
3. To introduce to the student about the values of bio diversity and the importance of its conservation and also on environmental pollution
4. To familiarize the student on the social issues that have a direct effect on the environment
5. To help the student understand about the effects of human population on the environment and remedial measures

COURSE CONTENT
UNIT I | THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES
---|---
Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources
Natural resources and associated problems
a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources: Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

f) Land resources: Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II

ECOSYSTEMS

Concepts 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 following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics: Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III

BIODIVERSITY AND ENVIRONMENTAL POLLUTION

BIODIVERSITY
Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value 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, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

ENVIRONMENTAL POLLUTION
Definition, Causes, effects and control measures of: Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management: floods, earthquake, cyclone and landslides.

UNIT IV

SOCIAL ISSUES AND THE ENVIRONMENT


UNIT V

HUMAN POPULATION AND THE ENVIRONMENT

Text Books:

References:
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

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<tr>
<th>BAN4L1</th>
<th>AIRCRAFT STRUCTURES LABORATORY</th>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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OBJECTIVES
1. To acquaint the student to the various experimental processes to carry out structural analysis.
2. To familiarize to the student about the analysis of beams.
3. To enable the student to understand about the analysis of columns.
4. To help the student to understand about the effect of complex loading on aircraft structures.
5. To introduce to the student about the shear flow estimation in aircraft structures.

LIST OF EXPERIMENTS
1. Determination of Young’s modulus of aluminum using electrical extensometers.
2. Determination of fracture strength and fracture pattern of ductile material.
3. Deflection of beams with various end conditions.
4. Verification of Maxwell’s theorem and principle of superposition.
<table>
<thead>
<tr>
<th>No.</th>
<th>Experiment Description</th>
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<tbody>
<tr>
<td>6</td>
<td>Testing of riveted joints.</td>
</tr>
<tr>
<td>7</td>
<td>Unsymmetrical Bending of a Beam</td>
</tr>
<tr>
<td>8</td>
<td>Determination of Shear Centre in open Section</td>
</tr>
<tr>
<td>9</td>
<td>Determination of Shear Centre in closed Section</td>
</tr>
<tr>
<td>10</td>
<td>Combined bending and Torsion of a Hollow Circular Tube</td>
</tr>
<tr>
<td>11</td>
<td>Constant Strength Beams</td>
</tr>
<tr>
<td>12</td>
<td>Wagner beam – Tension field beam</td>
</tr>
<tr>
<td>13</td>
<td>Free Vibration of a beams</td>
</tr>
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<td>14</td>
<td>Forced Vibration of a beams</td>
</tr>
<tr>
<td>15</td>
<td>Material properties test of composite laminate</td>
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</table>

**References:**
1. Aircraft Structures Lab Manual, Department of Aeronautical Engineering, 2015

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<td>Prerequisite – Manufacturing Engineering</td>
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**OBJECTIVES**
1. To introduce student to various machine cutting operation
2. To train the student for using the lathe
3. To train the student for performing various operation using lathe
4. To train the student for performing drilling operations and boring operation
5. To train the student for using the surface grinding machine and milling machine

**LIST OF EXPERIMENTS**

<table>
<thead>
<tr>
<th>No.</th>
<th>Experiment Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Study of centre, capstan and automatic lathes and their accessories.</td>
</tr>
<tr>
<td>2</td>
<td>Exercise on setting the work piece and the tool in the lathe.</td>
</tr>
<tr>
<td>3</td>
<td>Plane turning and step turning.</td>
</tr>
<tr>
<td>4</td>
<td>Taper turning and knurling.</td>
</tr>
<tr>
<td>5</td>
<td>Eccentric Turning.</td>
</tr>
<tr>
<td>6</td>
<td>Thread cutting and grooving.</td>
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<tr>
<td></td>
<td>Drilling and reaming.</td>
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<td>----</td>
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</tr>
<tr>
<td>8</td>
<td>Drilling and boring.</td>
</tr>
<tr>
<td>9</td>
<td>Surface grinding</td>
</tr>
<tr>
<td>10</td>
<td>Study of shaper and planer machines.</td>
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<td>11</td>
<td>Study of milling and grinding machines.</td>
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**References:**

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**BAN4S1**

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<tr>
<th>COMPUTER AIDED DESIGNING AND DRAFTING</th>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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</table>

**OBJECTIVES**
1. To acquaint the student with various computer softwares for engineering design
2. To familiarize the student with to the various options and types of designs that can be carried out using CATIA software
3. To train the student on the designing of basic mechanical parts
4. To train the student on the assembly of different mechanical parts
5. To train the student on the drafting of the part / model / assembly designed.

**LIST OF EXPERIMENTS**

<table>
<thead>
<tr>
<th></th>
<th>Study of various softwares for engineering design and drafting</th>
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<tbody>
<tr>
<td>2</td>
<td>Study of CATIA and its tools</td>
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<tr>
<td>3</td>
<td>Exercise on 2D drawing</td>
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<td>4</td>
<td>Exercise on pad and groove</td>
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<td>5</td>
<td>Exercise on shaft, mirror and array</td>
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<tr>
<td>6</td>
<td>Exercise on threading, bores and tappings</td>
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<tr>
<td>7</td>
<td>Exercise on part assembly</td>
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<td>8</td>
<td>Exercise on drafting</td>
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<td>Exercise on surface modeling</td>
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<td>Exercise on kinematics</td>
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**References:**
1. CADD Lab Manual, Department of Aeronautical Engineering, 2015
BAN501

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<td>Course Designed by – Department of Aeronautical Engineering</td>
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**OBJECTIVES**

1. To understand the basic concepts of Aircraft structural Mechanics in Aeronautical engineering and society. Understand the basics of unsymmetrical bending loadings and the parameters and know how to use them in real problems.

2. Understand the basic concept of shear flow in open sections and know how to use it to solve engineering problems and understand shear flow in closed sections and know how to use them to solve engineering problems.

3. Understand the buckling of plates and using the concepts to solve the sheet panel problems.

4. Understand the basics of stress analysis in wing and fuselage and to develop the skill to solve fundamental engineering problem.

5. Overall improvement in subject knowledge in Aircraft Structures.

**COURSE CONTENT**

**UNIT I**  
**UNSYMETRICAL BENDING**  
12

Bending of symmetric beams subject to skew loads - bending stresses in beams of unsymmetrical sections – generalized ‘k’ method, neutral axis method, principal axis method- advantages and disadvantages.

**UNIT II**  
**SHEAR FLOW IN OPEN SECTIONS**  
12

Thin walled beams – concept of shear flow – the shear centre and its determination – shear flow distribution in symmetrical and unsymmetrical thin-walled sections – structural idealization – shear flow variation in idealized sections.

**UNIT III**  
**SHEAR FLOW IN CLOSED SECTIONS**  
12

Bredt - Batho theory – single-cell and multi-cell tubes subject to torsion – shear flow distribution in thin-walled single & multi-cell structures subject to combined bending torsion – with walls effective and ineffective in bending – shear center of closed sections.

**UNIT IV**  
**BUCKLING OF PLATES**  
12


**UNIT V**  
**STRESS ANALYSIS OF WING AND FUSELAGE**  
12


**Text Books:**


References:

<table>
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<th>AERODYNAMICS II</th>
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<td>Prerequisite – Fundamentals of Fluid Mechanics, Aerodynamics I</td>
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OBJECTIVES
1. To make the student understand concepts and 1-d equations used for compressible flows.
2. To acquaint the student with the estimation of flow properties across normal shock, oblique shock and
   expansion waves.
3. To familiarize the student to the governing equations in compressible flows.
4. To educate the student on problems faced by high speed flow airfoils, wings and airplane configuration
   and to understand design modifications required to overcome problems..
5. To create awareness among the students about various experimental methods and measurement
   techniques.

COURSE CONTENT

UNIT I  FUNDAMENTAL ASPECTS OF COMPRESSIBLE FLOW 12
Compressibility, Continuity, Momentum and Energy equation for steady one dimensional flow,
Compressible Bernoulli’s equation, Area – Mach number – Velocity relation, Mach cone, Mach angle,
One dimensional Isentropic flow through variable area duct, Isentropic relations - Critical conditions,
Characteristic Mach number, Maximum discharge velocity.

UNIT II  SHOCKS AND EXPANSION WAVES 12
Normal shock relations, Prandtl’s relation, Hugonoit equation, Raleigh Supersonic Pitot tube equation,
Moving normal shock waves, Oblique shocks, 0βM relation, Shock Polar, Reflection of oblique shocks,
Left running and Right running waves, Interaction of oblique shock waves, slip line, Rayleigh flow, Fanno
flow, Expansion waves, Prandtl-Meyer expansion, Maximum turning angle, Simple and non-simple
regions, Operating characteristics of convergent and convergent-divergent nozzles.

UNIT III  TWO DIMENSIONAL COMPRESSIBLE FLOW 12
Potential equation for 2-dimensional compressible flow, Linearization of potential equation,Small
perturbation theory, Linearised Pressure Coefficient, Linearised subsonic flow, Prandtl-Glauert rule,
Linearised supersonic flow, Method of characteristics, Wave drag coefficient.

UNIT IV  HIGH SPEED FLOW OVER AIRFOILS, WINGS AND AIRPLANE
    CONFIGURATION 12
Critical Mach number, Drag divergence Mach number, Shock Stall, Shock- Boundary layer interaction,
Supercritical Airfoil Sections, Transonic area rule, Swept wing, Airfoils for supersonic flows, Lift, drag,
Pitching moment and Centre of pressure for supersonic profiles, Shock-expansion theory, wave drag,
supersonic wings, Design considerations for supersonic aircrafts, Introduction to Hypersonic Flows,
Numerical Analysis of one Dimensional flow.
UNIT V | EXPERIMENTAL METHODS
--- | ---
Wind tunnels for Subsonic, transonic, Supersonic and hypersonic flows, Various Measurement techniques, Power requirement, Force and moment measurement, Wind tunnel balance, Wind tunnel corrections, Flow visualization techniques, Hot wire technique, Optical methods, Shock tube, Gun tunnels

Text Books:

References:

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**BAN503**

**ADVANCED AEROSPACE PROPULSION**

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Total Contact Hours – 60
Prerequisite – Fundamentals of Aero – Thermodynamics, Aircraft Propulsion
Course Designed by – Department of Aeronautical Engineering

**OBJECTIVES**
1. To acquaint the student about the various scramjet and ramjet engine propulsion.
2. To accustom the student about pulsejet propulsion and the different types of jet propulsion their importance.
3. To introduce to the student about the importance of solid propellant rockets.
4. To introduce to the student about the importance of liquid propellant rockets.
5. To help the student understand about the non conventional propulsion techniques.

**COURSE CONTENT**

**UNIT I | RAMJET AND SCRAMJET PROPULSION**


**UNIT II | PULSEJET PROPULSION**

Pulse propulsion – Combustion process in pulse jet engines – inlet charging process – Supercritical charging and subcritical discharging – Subcritical charging and subcritical discharging – Subcritical charging and supercritical discharging.

**UNIT III | SOLID PROPELLANT ROCKETS**

---
Operating principle – Specific impulse of a rocket – Internal ballistics – Selection criteria of solid propellants – propellant grain design considerations – Progressive, Regressive and neutral burning in solid rockets.

### UNIT IV  LIQUID PROPELLANT ROCKETS  12


### UNIT V  NON-CONVENTIONAL PROPULSION TECHNIQUES  12

Introduction to nozzleless propulsion and basic concepts - Electric rocket propulsion – Plasma as a fluid- Diffusion in Partially Ionized gases - Ion propulsion – Nuclear rocket – Types – Solar Sail - comparison of performance of these propulsion systems with chemical rocket propulsion systems.

Text Books:

References:

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<th><strong>BAN504</strong></th>
<th><strong>FLIGHT MECHANICS</strong></th>
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Prerequisite – Fundamentals of Aeronautics and Astronautics, Aerodynamics I

Course Designed by – Department of Aeronautical Engineering

**OBJECTIVES**

1. To understand aircraft performance relating to steady level
2. To understand aircraft performance relating to Range, Endurance, climb & Glide
3. To acquire knowledge about Take off, Landing and Turning performance
4. To understand the principles of stability and control relating to longitudinal stability
5. To understand the principles of stability and control relating to directional and lateral stability

**COURSE CONTENT**

### UNIT I  STEADY LEVEL FLIGHT  12

International Standard Atmosphere, TAS, IAS and EAS, Streamlined and Bluff body – Skin friction Drag, Pressure Drag and Induced Drag – Drag Polar – Various drags of an airplane – Methods of Drag Reduction - Effect on Drag Polar. Steady level flight, Thrust required and Power required, Thrust available and Power available for propeller driven and jet powered aircraft, Effect of altitude, conditions for minimum drag and minimum power required

### UNIT II  RANGE, ENDURANCE, CLIMB AND GLIDE PERFORMANCE  12
Range and Endurance of Propeller and Jet aircrafts, Shallow and steep angles of climb, Rate of climb, Climb hodograph, Maximum Climb angle and Maximum Rate of climb- Effect of design parameters for propeller and jet aircrafts, Absolute and service ceiling, Cruise climb, Gliding flight, Glide hodograph

UNIT III | TAKE OFF, LANDING AND TURNING PERFORMANCE 10

Take-off and landing performance, Turning performance, bank angle and load factor, Constraints on load factor, Pull up and pull down maneuvers, maximum turn rate, V-n diagram.

UNIT IV | LONGITUDINAL STABILITY 14

General concepts, Static and dynamic stability, Stability and Controllability, Requirements of control surfaces, criteria for longitudinal static stability, contribution to stability by wing, tail, fuselage, wing fuselage combination, Total longitudinal stability, Neutral point-Stick fixed and Stick free aspects, Free elevator factor, static margin, Hinge moment, Power effects on stability-propeller and jet aircrafts, longitudinal control, Movement of centre of gravity, elevator control power, elevator angle to trim, elevator angle per g, maneuver point, Stick force gradient and stick force per g, Aerodynamic balancing

Aircraft Equations of motion, small disturbance theory, Estimation of longitudinal stability derivatives Routh’s discriminant, solving the stability quartic, Phugoid motion, Factors affecting the period and damping.

UNIT V | LATERAL AND DIRECTIONAL STABILITY 12

Directional stability-yaw and sideslip, contribution to static directional stability by wing, fuselage, vertical tail, Power effects on directional stability-propeller and jet aircrafts, Rudder lock and Dorsal fin, Directional control, rudder control power, rudder requirements, adverse yaw, asymmetric power condition, spin recovery, Lateral stability-Dihedral effect, contribution of various components, lateral control, aileron control power, strip theory, roll control by spoilers, aileron reversal, aileron reversal speed

Text Books:

References:
2. Pamadi, B.N. Performance, Stability, Dynamics, and Control of Airplanes, AIAA Education Series, 2004

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<td>Prerequisite –Engineering mechanics</td>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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</table>
**OBJECTIVES**
1. To introduce student about various metal working process
2. To impart theoretical knowledge about the metal cutting and machining process.
3. Introduce students about various special purpose machine and milling machine.
4. Introducing students about various drilling, boring and surface finish operations.
5. Introduce students about various non conventional process and high energy rate forming process.

<table>
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<th>COURSE CONTENT</th>
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<tr>
<td><strong>UNIT I</strong></td>
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<tr>
<td>Mechanical working of metals –hot and cold working –rolling, extrusion, spinning, wire-drawing, press working. Welding – different types of gas and arc welding process, soldering and brazing. Casting –different types, furnaces, casting defects and inspection</td>
</tr>
<tr>
<td><strong>UNIT II</strong></td>
</tr>
<tr>
<td><strong>UNIT III</strong></td>
</tr>
<tr>
<td>Shaper, planer and slotter: types, specifications, mechanisms, holding devices, difference between shaper and planer. Milling machine – types and specification, mechanisms, holding devices, milling operations. Milling tool nomenclature, indexing types-simple, compound and differential</td>
</tr>
<tr>
<td><strong>UNIT IV</strong></td>
</tr>
<tr>
<td><strong>UNIT V</strong></td>
</tr>
<tr>
<td>Non-traditional machining techniques, classification, Abrasive jet machining, Electrical Discharge Machining, E. D wire cutting, Electro chemical machining, Electron Beam Machining, Laser Beam Machining, Ultrasonic Machining. Explosive forming, Electro hydraulic, Electromagnetic forming, Dynapack machine.</td>
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**Text Books:**

**References:**
<table>
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<tr>
<th><strong>BAN5V1</strong></th>
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**OBJECTIVES**
1. To acquaint the student about personal value, responsibility in the society and about self confidence and self esteem
2. To introduce about goal setting, time management and planning
3. To boost the creativity, lateral thinking of the students
4. To familiarize the student on teamwork, interpersonal skills, leadership skills and ability to manage stressed situations
5. To help the student understand about decision making and self assessment

**LIST OF ACTIVITIES**

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<td>An activity to describe the personal value.</td>
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<tr>
<td>2</td>
<td>An activity to describe the responsibility of students in society.</td>
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<tr>
<td>3</td>
<td>An activity to enhance self-confidence and self-esteem.</td>
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<td>4</td>
<td>An activity to make a goal setting.</td>
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<td>5</td>
<td>An activity to make a time management chart.</td>
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<tr>
<td>6</td>
<td>An activity to describe the planning process.</td>
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<tr>
<td>7</td>
<td>An activity to enhance the creativity of students.</td>
</tr>
<tr>
<td>8</td>
<td>An activity to improve the lateral thinking.</td>
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<td>9</td>
<td>An activity to describe the importance of teamwork.</td>
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<tr>
<td>10</td>
<td>An activity to enhance the interpersonal skills.</td>
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<td>11</td>
<td>An activity to enhance the leadership skills.</td>
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<td>12</td>
<td>An activity to manage the stressed situation.</td>
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<tr>
<td>13</td>
<td>An activity to describe the decision making.</td>
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<td>14</td>
<td>An activity to weighing positives and negatives.</td>
</tr>
<tr>
<td>15</td>
<td>An activity to make a SWOT analysis.</td>
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**References:**
1. Value Added Program Booklet, Department of Aeronautical Engineering, 2015
### BAN5L1

<table>
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**Prerequisite** – Fundamentals of Fluid Mechanics, Aerodynamics

**Course Designed by** – Department of Aeronautical Engineering

### OBJECTIVES
1. To acquaint the student to the various experimental processes to carry out structural analysis.
2. To familiarize to the student about the analysis of beams.
3. To enable the student to understand about the analysis of columns.
4. To help the student to understand about the effect of complex loading on aircraft structures.
5. To introduce to the student about the shear flow estimation in aircraft structures.

### LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th><strong>1</strong></th>
<th>Calibration of subsonic wind tunnel.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2</strong></td>
<td>Pressure distribution over smooth cylinder</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Pressure distribution over rough cylinder</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Pressure distribution over symmetric airfoil.</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Pressure distribution over cambered airfoil.</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Pressure distribution over a wing</td>
</tr>
<tr>
<td><strong>7</strong></td>
<td>Force measurement using wind tunnel balance.</td>
</tr>
<tr>
<td><strong>8</strong></td>
<td>Determination of base drag of a missile model.</td>
</tr>
<tr>
<td><strong>9</strong></td>
<td>Study of flow field over a backward facing step.</td>
</tr>
<tr>
<td><strong>10</strong></td>
<td>Power estimation of Wind Turbine</td>
</tr>
<tr>
<td><strong>11</strong></td>
<td>Aerodynamic studies of automotive models.</td>
</tr>
<tr>
<td><strong>12</strong></td>
<td>Study of Fanno flow</td>
</tr>
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<td><strong>13</strong></td>
<td>Study of profile drag of bodies by wake survey method.</td>
</tr>
<tr>
<td><strong>14</strong></td>
<td>Flow visualization at subsonic velocity (a) Using Tuft (b) Oil flow visualization.</td>
</tr>
<tr>
<td><strong>15</strong></td>
<td>Flow visualization studies in supersonic flows by schilren system.</td>
</tr>
</tbody>
</table>

### References:
1. Aerodynamics Lab Manual, Department of Aeronautical Engineering, 2015
OBJECTIVES
1. To design and fabricate gliders, catapult and power gliders.
2. To design and fabricate single, double and pivoted double crank flapping wing mechanism.
3. To design and fabricate wing, vertical and horizontal stabilizer using balsa wood.
4. To design and fabricate fuselage and control surfaces using polystyrene and glass fibers.
5. To estimate discharge rate of Li-Po battery, propeller thrust and assembling Remote Control Aircraft.

LIST OF EXPERIMENTS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Design and fabrication of gliders using balsa wood.</td>
</tr>
<tr>
<td>2</td>
<td>Design and fabrication of catapult.</td>
</tr>
<tr>
<td>3</td>
<td>Design and fabrication of power gliders.</td>
</tr>
<tr>
<td>4</td>
<td>Design and fabrication of single crank flapping wing mechanism.</td>
</tr>
<tr>
<td>5</td>
<td>Design and fabrication of double crank flapping wing mechanism.</td>
</tr>
<tr>
<td>6</td>
<td>Design and fabrication of pivoted double crank flapping wing mechanism.</td>
</tr>
<tr>
<td>7</td>
<td>Design and fabrication of wing using balsa wood.</td>
</tr>
<tr>
<td>8</td>
<td>Design and fabrication of horizontal and vertical stabilizer using balsa wood</td>
</tr>
<tr>
<td>9</td>
<td>Design and fabrication of fuselage using hardened polystyrene.</td>
</tr>
<tr>
<td>10</td>
<td>Design and fabrication of control surfaces using glass fibers composite.</td>
</tr>
<tr>
<td>11</td>
<td>Design and fabrication of fuselage using glass fibers composite.</td>
</tr>
<tr>
<td>12</td>
<td>Design and fabrication of fuselage using hardened polystyrene.</td>
</tr>
<tr>
<td>13</td>
<td>Estimation the discharge rate of Li-Po battery for different thrust setting.</td>
</tr>
<tr>
<td>14</td>
<td>Estimating the propeller thrust for different voltage setting.</td>
</tr>
<tr>
<td>15</td>
<td>Assembling of Remote Control Aircraft.</td>
</tr>
</tbody>
</table>

References:
1. Aero Design and Modeling Lab Manual, Department of Mechanical Engineering, 2015
BAN5S1

COMPUTER AIDED ANALYSIS LABORATORY

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<thead>
<tr>
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Total Contact Hours – 30

Prerequisite – Aircraft Structures, Aerodynamics

Course Designed by – Department of Aeronautical Engineering

OBJECTIVES
1. To acquaint the student with various computer softwares for engineering analysis
2. To familiarize the student with to the various options and types of analysis that can be carried out using ANSYS software
3. To train the student on basic structural analysis
4. To train the student on basic thermal analysis
5. To train the student on basic fluid flow analysis

LIST OF EXPERIMENTS

1. Study of ANSYS and its tools
2. Stress analysis of beams with different loading conditions
3. Stress analysis of a plate with circular hole
4. Stress analysis of an axisymmetric component
5. Vibration analysis of cantilever beam
6. Simple conduction example
7. Thermal mixed boundary example
8. Flow field analysis of jets
9. Flow field simulation over an airfoil
10. Fluid – Structure interaction

References:
1. CAA Lab Manual, Department of Aeronautical Engineering, 2015

BAN5C1

COMPREHENSION I

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</table>

Total Contact Hours : Test will be conducted at the end of the semester

Prerequisite – All the courses up to fifth semester

Course Designed by – Dept. Aeronautical Engineering

OBJECTIVES
- To provide a complete review of Aerospace Engineering topics covered up to fifth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the
employment potential.
• To provide overview of all topics covered and to assess the overall knowledge level up to fifth semester.

<table>
<thead>
<tr>
<th>BSS601</th>
<th>VALUE EDUCATION AND PROFESSIONAL ETHICS</th>
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<td>Prerequisite – Professional Courses</td>
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<td>Course Designed by – Department of Humanities and Social Sciences</td>
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</table>

**OBJECTIVES**
1. To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
2. To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

**COURSE CONTENT**

<table>
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<tr>
<th>UNIT I</th>
<th>PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES</th>
<th>9</th>
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<tr>
<th>UNIT II</th>
<th>SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE)</th>
<th>9</th>
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<tbody>
<tr>
<td></td>
<td>Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftiness (Thrift)/Economics. Health - Education - Governance - People’s Responsibility / duties of the community, World peace.</td>
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<tr>
<th>UNIT III</th>
<th>MIND CULTURE &amp; TENDING PERSONAL HEALTH</th>
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<tbody>
<tr>
<td></td>
<td>Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelising the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases</td>
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<tr>
<th>UNIT IV</th>
<th>ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS’ RESPONSIBILITIES FOR SAFETY</th>
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<tr>
<th>UNIT V</th>
<th>ENGINEER’S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES</th>
<th>9</th>
</tr>
</thead>
</table>
Text Books:
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata McGraw Hill, Newyork 2005 (Units IV & V)

References:
1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road, Thanjavur 613 004 (for Units I - III)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004(for Units IV-V)

BAN601
AEROSPACE STRUCTURAL MATERIALS AND COMPOSITES

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Total Contact Hours – 45

Prerequisite – Fundamentals of Structural Mechanics

Course Designed by – Department of Aeronautical Engineering

OBJECTIVES
1. To acquaint the student with various types of aerospace composite materials.
2. To develop the understanding of composite mechanics.
3. To learn different theory of laminate design.
4. To learn different theory of failure analysis.
5. To have a clear understanding of composite fabrication process.

COURSE CONTENT

UNIT I INTRODUCTION
Atomic structure and bonding in materials-Crystal structure of materials-crystal systems- unit cells and space lattices- determination of structures of simple crystals by x-ray diffraction- miller indices of planes and directions- packing geometry in metallic- ionic and covalent solids-Concept of amorphous-single and polycrystalline structures and their effect on properties of materials-Crystal growth techniques-Imperfections in crystalline solids and their role in influencing various properties.

UNIT II AEROSPACE MATERIALS

UNIT III MECHANICS OF COMPOSITES

UNIT IV LAMINATION THEORY AND FAILURE ANALYSIS
Governing differential equation for a unidirectional lamina and general laminate, angle ply and cross ply laminate, Failure criteria for composites--Failure modes of sandwich panels - Bending stress and shear flow in composite beams.

UNIT V FABRICATION METHODS
Various open and closed mould processes, Manufacture of fibers, Types of resins, properties and applications, Netting analysis-Basic design concepts of sandwich construction - Materials used for sandwich construction.

Text Books:

References:

<table>
<thead>
<tr>
<th>BAN602</th>
<th>FINITE ELEMENT METHODS</th>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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OBJECTIVES
1. To acquaint the student with basic numerical methods for analyzing structural components.
2. To develop the understanding of finite element modeling and analysis of one dimensional system.
3. To develop the understanding of finite element modeling and analysis of two dimensional system.
4. To develop the understanding of finite element modeling and analysis of three dimensional system.
5. To acquaint with the application of finite element method to aerospace structures.

COURSE CONTENT

UNIT I INTRODUCTION
Introduction to FEA - historical background - Review of various approximate methods – Raleigh Ritz’s, Galerkin and finite difference methods- Governing equation and convergence criteria of finite element method - Examples of Finite Element Modeling

UNIT II ONE DIMENSIONAL SYSTEMS
Direct stiffness method – spring element- Derivation of the stiffness matrix- Example of a spring assemblage- Assembly of global stiffness matrix- Types of boundary conditions- The Potential energy approach – Examples- Prismatic bar under axial loading- bending of beams - Fundamentals of Finite Element Modeling – Element Division - Numbering Scheme- Coordinate and Shape Functions- The Potential Energy Approach- Assembly of Global Stiffness Matrix and Load Vector- Treatment of
UNIT III TWO DIMENSIONAL SYSTEMS
Plane stress & strain – Constant Strain Triangle (CST)- Isoparametric Representation- Potential Energy Approach - Element Stiffness; Force Terms Stress Calculations- Temperature Effects- Examples

UNIT IV THREE DIMENSIONAL SYSTEMS
Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions and Nodal Solution; Mapping and Numerical Integration– Four node quadrilateral for axisymmetric problems –Applications to cylinders under internal or external pressures – Rotating discs

UNIT V APPLICATIONS OF FEM TO AEROSPACE STRUCTURES
Linear static analysis-non linear static analysis –dynamic analysis-simple harmonic motion-damping consideration-forced vibration- typical issues in contact analysis-contact impact algorithm-Case studies problems using software packages and MATLAB coding.

Text Books:

References:

<table>
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<tr>
<th>BAN603</th>
<th>CONTROL SYSTEM</th>
<th>L</th>
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<tr>
<td></td>
<td>Prerequisite – Basic Electrical and Electronics&amp; Mathematics</td>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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</table>

OBJECTIVES
1. To provide students an understanding on various physical systems, development of flight control system and their important. Also Introduce students the concept of electrical analogies to mechanical system
2. Introduce students the concept of feedback control system, Block diagram reduction technique and signal flow graph
3. To impart knowledge on various signals, system response on respective signals and time response of first order and second order system. Also to provide knowledge on steady state errors
4. To provide knowledge on concept of stability, Routh Hurwitz criteria for stability. Make student to develop Stability analysis using Bode plot, Root locus technique
5. To provide students brief knowledge on digital control system, Digital controllers. To introduce z-plane and z-transform techniques.

**COURSE CONTENT**

**UNIT I**
**INTRODUCTION**

Historical review, Simple pneumatic, hydraulic and thermal systems, Series and parallel system, Analogies, mechanical and electrical components, Development of flight control systems.

**UNIT II**
**OPEN AND CLOSED LOOP SYSTEMS**

Feedback control systems Block diagram representation of control systems, Reduction of block diagrams, Output to input ratios.

**UNIT III**
**CHARACTERISTIC EQUATION AND FUNCTIONS**

Laplace transformation, Response of systems to different inputs viz., Step impulse, pulse, 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**

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

**UNIT V**
**SAMPLED DATA SYSTEMS**


**Text Books:**

**References:**
2. To enhance the presentation skills of the student
3. To familiarize the student on attractive resume writing
4. To familiarize the student on Interviews and Group Discussions
5. To advance the problem solving ability of the student

**COURSE CONTENT**

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<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
<td>A business letter to a company asking for Quotation.</td>
</tr>
<tr>
<td>2</td>
<td>A cover letter for applying a Job.</td>
</tr>
<tr>
<td>3</td>
<td>A sample Email communication for the given situation.</td>
</tr>
<tr>
<td>4</td>
<td>A model Technical report writing.</td>
</tr>
<tr>
<td>5</td>
<td>An activity to analysis the audience.</td>
</tr>
<tr>
<td>6</td>
<td>An activity to practice the body language.</td>
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<td>7</td>
<td>An activity to practice the voice modulation.</td>
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<tr>
<td>8</td>
<td>An activity to present a self introduction.</td>
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<tr>
<td>9</td>
<td>An activity to present a technical seminar.</td>
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<tr>
<td>10</td>
<td>An activity to write a proper resume.</td>
</tr>
<tr>
<td>11</td>
<td>A mock interview and group discussion.</td>
</tr>
<tr>
<td>12</td>
<td>Problems on critical reasoning and sentence correction.</td>
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<tr>
<td>13</td>
<td>Problems on number, Simple interest and compound interest.</td>
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<tr>
<td>14</td>
<td>Problems on Analytical and Logical Reasoning.</td>
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<tr>
<td>15</td>
<td>Problems on probability, permutation and combination.</td>
</tr>
</tbody>
</table>

**References:**
1. Value Added Program II Preparatory Material, Department of Aeronautical Engineering, 2015

<table>
<thead>
<tr>
<th>BAN6L1</th>
<th>AIRCRAFT SYSTEM LABORATORY</th>
<th>L</th>
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<td><strong>Course Designed by – Department of Aeronautical Engineering</strong></td>
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</table>

**OBJECTIVES**
1. Appreciate the need of various aircraft systems, components, accessories and its functions.
2. Understand the importance of aircraft system maintenance and checks.
3. Understand the jacking procedure, leveling and symmetric checks done in the aircraft.
4. Understand the rigging procedure of the aircraft, Understand the operation of Brake torque load test and fuel clogging test
5. Develop the skills of trouble shooting and rectification of snags.

LIST OF EXPERIMENTS

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>Aircraft systems observations during Ground run.</td>
</tr>
<tr>
<td>2</td>
<td>Aircraft “Mooring” procedure.</td>
</tr>
<tr>
<td>3</td>
<td>Aircraft “Leveling” procedure</td>
</tr>
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<td>4</td>
<td>Control System “Rigging check” procedure</td>
</tr>
<tr>
<td>5</td>
<td>Aircraft “Symmetry Check” procedure</td>
</tr>
<tr>
<td>6</td>
<td>Procedure to find the centre of gravity of Aircraft</td>
</tr>
<tr>
<td>7</td>
<td>“Flow test” to assess of filter element clogging</td>
</tr>
<tr>
<td>8</td>
<td>“Pressure Test” To assess hydraulic External/Internal Leakage</td>
</tr>
<tr>
<td>9</td>
<td>“Functional Test” to adjust operating pressure</td>
</tr>
<tr>
<td>10</td>
<td>“Pressure Test” procedure on aircraft fuel system components</td>
</tr>
<tr>
<td>11</td>
<td>“Brake Torque Load Test” on wheel brake units</td>
</tr>
<tr>
<td>12</td>
<td>Maintenance and rectification of snags in hydraulic systems.</td>
</tr>
<tr>
<td>13</td>
<td>Rectification of snags in aircraft fuel systems.</td>
</tr>
<tr>
<td>14</td>
<td>Tyre pressure checking and Oleo leg pressure procedure.</td>
</tr>
<tr>
<td>15</td>
<td>Landing gear strut wheel dismantling and assembly procedure.</td>
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References:

PROPULSION LABORATORY

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OBJECTIVES
1. Understand the need of various incompressible circular and non circular jets.
2. Understand the importance of velocity in supersonic circular and noncircular jets.
3. Understand the determination of wall jet velocity profile in the aircraft.
4. Understand the need of operation of a ramjet engine.
5. Develop the studies of liquid fuel atomizer and pre-mixed flame.
## LIST OF EXPERIMENTS

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>Estimation of spread rate in incompressible circular jets.</td>
</tr>
<tr>
<td>2</td>
<td>Estimation of spread rate in incompressible non-circular jets.</td>
</tr>
<tr>
<td>3</td>
<td>Estimation of centre line velocity decay in supersonic circular jets.</td>
</tr>
<tr>
<td>4</td>
<td>Estimation of centre line velocity decay in supersonic non-circular jets.</td>
</tr>
<tr>
<td>5</td>
<td>Determination of Wall jet velocity profile.</td>
</tr>
<tr>
<td>6</td>
<td>Determination of Impingement jet velocity profile.</td>
</tr>
<tr>
<td>7</td>
<td>Study of free convective heat transfer over a flat plate.</td>
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<tr>
<td>8</td>
<td>Study of forced convective heat transfer over a flat plate.</td>
</tr>
<tr>
<td>9</td>
<td>Study of conduction heat transfer in a flat plate.</td>
</tr>
<tr>
<td>10</td>
<td>Operation of a subsonic Ramjet engine.</td>
</tr>
<tr>
<td>11</td>
<td>Flame stabilization studies using conical flame holders.</td>
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<tr>
<td>12</td>
<td>Velocity and pressure measurements of Co-axial jets.</td>
</tr>
<tr>
<td>13</td>
<td>Effect of swirl on diffusion flame.</td>
</tr>
<tr>
<td>14</td>
<td>Studies liquid fuel atomizers.</td>
</tr>
<tr>
<td>15</td>
<td>Studies on pre-mixed flame.</td>
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**References:**
1. Propulsion Lab Manual, Department of Aeronautical Engineering, 2015

## AIRCRAFT DESIGN PROJECT I

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</tbody>
</table>

**Total Contact Hours – 60**

Prerequisite – Fundamentals of Aeronautics and Astronautics, Flight Mechanics

Course Designed by – Department of Aeronautical Engineering

**OBJECTIVES**

1. To familiarize the student to the different configurations of airplanes and on the comparison of the parameters of different airplanes to arrive at a proper selection of main parameters to design a new aircraft
2. To enable the student to be able to estimate the weight of the aircraft according to the main parameters selected
3. To enable the student to select an appropriate power plant and estimate the wing geometry according to the results of weight estimation
4. To enable the student to calculate tail dimensions and to estimate the total drag of the airplane and also to perform a stability analysis of the airplane
5. To make the student able to draft a three view diagram of the designed airplane.
### METHODOLOGY

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>Comparative configuration study of different types of airplanes</td>
</tr>
<tr>
<td>2</td>
<td>Comparative study on specification and performance details of aircraft</td>
</tr>
<tr>
<td>3</td>
<td>Preparation of comparative data sheets</td>
</tr>
<tr>
<td>4</td>
<td>Work sheet layout procedures</td>
</tr>
<tr>
<td>5</td>
<td>Comparative graphs preparation.</td>
</tr>
<tr>
<td>6</td>
<td>selection of main parameters for the design</td>
</tr>
<tr>
<td>7</td>
<td>Preliminary weight estimations.</td>
</tr>
<tr>
<td>8</td>
<td>Selection of main parameters,</td>
</tr>
<tr>
<td>9</td>
<td>Power plant selection.</td>
</tr>
<tr>
<td>10</td>
<td>Aerofoil selection,</td>
</tr>
<tr>
<td>11</td>
<td>Wing and stabilizers selection.</td>
</tr>
<tr>
<td>12</td>
<td>Control surfaces designing.</td>
</tr>
<tr>
<td>13</td>
<td>Drag estimation</td>
</tr>
<tr>
<td>14</td>
<td>Detailed performance calculations and stability estimates</td>
</tr>
<tr>
<td>15</td>
<td>Preparation of layouts of balance diagram and three view drawings</td>
</tr>
</tbody>
</table>

**References:**
2. Analysis and Design of Flight Vehicle Structures, E F Bruhn
3. CADD and CAA Lab Manuals, Department of Aeronautical Engineering, 2015

### OBJECTIVES

1. To make the student be familiar with the various fluid flow analysis technique.
2. To give insight of various computational technique for fluid flow analysis.
3. To acquaint the student with various challenges involved in computational techniques.
4. To get exposure regarding its applications and recent developments.
5. To learn advanced computing techniques like parallel computing, vector computing etc.
# COURSE CONTENT

## UNIT I  INTRODUCTION
10


## UNIT II  GOVERNING EQUATIONS
9


## UNIT III  WALL EFFECTS
8

The Role of Walls – Wall functions – Renormalization Group k- Models – Low-Reynolds number k-Models

## UNIT IV  NUMERICAL METHODS
10


## UNIT V  APPLICATIONS
8


**Text Books:**

**References:**

<table>
<thead>
<tr>
<th>BAN702</th>
<th>AVIONICS</th>
<th>L</th>
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<td>Prerequisite – Basic Electricals &amp; Electronics, Aircraft Systems &amp; Instrumentation and Aerodynamics</td>
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<tr>
<td>Course Designed by – Department of Aeronautical Engineering</td>
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</table>

**OBJECTIVES**
1. To provide the students an understanding on need for avionics in civil and military industry, avionics subsystems, integrated systems and design approaches
2. Introduce students about digital computer, digital numbering, digital arithmetics, logic gates, combinational logic circuits, microprocessor & memories and interface to it with analogue system
3. To introduce avionics system architecture - Data buses, MIL, ARINC standards
4. To provide idea of different cockpits, cockpit displays, panels, I/O technologies
5. To impart brief knowledge on various avionics systems. Reliability, maintainability and certification

COURSE CONTENT

UNIT I  INTRODUCTION TO AVIONICS  9
Need for avionics in civil and military aircraft and space systems – Integrated avionics and weapon systems – Typical avionics subsystems - Design approaches and recent advances - Application Technologies.

UNIT II  PRINCIPLE OF DIGITAL SYSTEMS  9

UNIT III  DIGITAL AVIONICS ARCHITECTURE  9

UNIT IV  FLIGHT DECKS AND COCKPITS  9
Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT V  INTRODUCTION TO AVIONICS SYSTEMS  9

Text Books:

References:

HEAT TRANSFER

<table>
<thead>
<tr>
<th>BAN703</th>
<th>HEAT TRANSFER</th>
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<tr>
<td></td>
<td>Prerequisite – Fundamentals of Aero – Thermodynamics, Fluid Mechanics</td>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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</table>

OBJECTIVES
1. To acquaint the student about the fundamentals of heat transfer.
2. To introduce to the student about the heat transfer analysis of conduction problems.
3. To introduce to the student about the heat transfer analysis of convection problems.
4. To introduce to the student about the heat transfer analysis of radiation problems.
5. To help the student understand about the various heat transfer problems in the aerospace applications.

### COURSE CONTENT

<table>
<thead>
<tr>
<th>UNIT I</th>
<th>FUNDAMENTALS OF HEAT TRANSFER</th>
<th>9</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>UNIT II</th>
<th>CONDUCTION HEAT TRANSFER</th>
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<thead>
<tr>
<th>UNIT III</th>
<th>CONVECTIVE HEAT TRANSFER</th>
<th>9</th>
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<th>UNIT IV</th>
<th>RADIATIVE HEAT TRANSFER AND HEAT EXCHANGERS</th>
<th>9</th>
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<tr>
<th>UNIT V</th>
<th>HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING</th>
<th>9</th>
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<tbody>
<tr>
<td>Heat transfer problems in gas turbine, rocket thrust chambers and Re-entry vehicles – numerical problems using MATLAB.</td>
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</table>

### Text Books:

### References:

### AIRFRAME AND AERO ENGINE REPAIR LAB

<table>
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<tr>
<th>BAN7L1</th>
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<td></td>
<td>Prerequisite – Aircraft Structures &amp; Propulsion</td>
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<td></td>
<td>Course Designed by – Department of Aeronautical Engineering</td>
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</table>

### OBJECTIVES
1. To know the basic concepts of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.
2. To practice the procedures of dismantling of piston engine and jet engine, study of components,
accessories of both engines and handling safety precautions.  
3. To demonstrate the various inspection methods such as visual inspection dimensional checks and testing methods especially NDT have studied clearly and  
4. Ability to inspect surface defects, internal defects, by using dye penetrant method and identification of defects on jet engine components.  
5. To know about the reassembly procedure of piston engines, jet engines and starting procedure of piston engines.

**LIST OF EXPERIMENTS**

<table>
<thead>
<tr>
<th></th>
<th>Experiment Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Dismantling and reassembling a piston engine</td>
</tr>
<tr>
<td>2</td>
<td>Piston Engine - cleaning, visual inspection, NDT checks.</td>
</tr>
<tr>
<td>3</td>
<td>Piston Engine Components - dimensional checks.</td>
</tr>
<tr>
<td>4</td>
<td>Study of carburetor, fuel pump, spark plug and ignition system.</td>
</tr>
<tr>
<td>5</td>
<td>Dismantling and reassembling a jet engine</td>
</tr>
<tr>
<td>6</td>
<td>Jet Engine – identification of components &amp; defects.</td>
</tr>
<tr>
<td>7</td>
<td>Jet Engine – NDT checks and dimensional checks</td>
</tr>
<tr>
<td>8</td>
<td>Engine starting procedures.</td>
</tr>
<tr>
<td>9</td>
<td>Aircraft wood gluing by single scarf and double scarf joint point.</td>
</tr>
<tr>
<td>10</td>
<td>Welded single &amp; double V-joints using MIG, TIG &amp; PLASMA welding.</td>
</tr>
<tr>
<td>11</td>
<td>Fabric and Riveted patch repairs.</td>
</tr>
<tr>
<td>12</td>
<td>Tube bending and flaring</td>
</tr>
<tr>
<td>13</td>
<td>Sheet metal forming.</td>
</tr>
<tr>
<td>14</td>
<td>Repairing of Acrylic sheets.</td>
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<tr>
<td>15</td>
<td>Repairing the composite panels.</td>
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</table>

**References:**

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<tr>
<th>BAN7L2</th>
<th>AVIONICS LABORATORY</th>
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<tr>
<td></td>
<td>Prerequisite – Basic Electricals and ElectronicsEngg&amp; Avionics</td>
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<tr>
<td></td>
<td>Course Designed by – Department of Aeronautical Engineering</td>
</tr>
</tbody>
</table>
**OBJECTIVES**
1. To learn and practice about basic digital electronic circuits like Adder, subtractor, multiplexer, demultiplexer, encoder, decoder etc.
2. To learn about timer, shift register and comparator circuits.
3. To understand the 8-bit and 16 bit operation and to learn mnemonic’s coding for 8-bit and 16-bit circuit.
4. To understand the concept of interface programming and analog to digital conversion.
5. To acquaint the concept of data buses, its configuration and remote terminal configuration.

**LIST OF EXPERIMENTS**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Addition/Subtraction of binary numbers.</td>
</tr>
<tr>
<td>2</td>
<td>Multiplexer/Demultiplexer Circuits.</td>
</tr>
<tr>
<td>3</td>
<td>Encoder/Decoder Circuits.</td>
</tr>
<tr>
<td>4</td>
<td>Timer Circuits, Shift Registers, Binary Comparator Circuits.</td>
</tr>
<tr>
<td>5</td>
<td>Addition and Subtraction of 8-bit and 16-bit numbers.</td>
</tr>
<tr>
<td>6</td>
<td>Sorting of Data in Ascending &amp; Descending order.</td>
</tr>
<tr>
<td>7</td>
<td>Sum of a given series with and without carry.</td>
</tr>
<tr>
<td>8</td>
<td>Greatest in a given series &amp; Multi-byte addition in BCD mode.</td>
</tr>
<tr>
<td>9</td>
<td>Interface programming with 4 digit 7 segment Display &amp; Switches &amp; LED’s.</td>
</tr>
<tr>
<td>10</td>
<td>Channel Analog to Digital Converter &amp; Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.</td>
</tr>
<tr>
<td>11</td>
<td>Study of Different Avionics Data Buses.</td>
</tr>
<tr>
<td>12</td>
<td>MIL-Std – 1553 Data Buses Configuration with Message transfer.</td>
</tr>
<tr>
<td>13</td>
<td>MIL-Std – 1553 Remote Terminal Configuration.</td>
</tr>
</tbody>
</table>

**References:**
1. Avionics Lab Manual, Department of Aeronautical Engineering, 2015

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**BAN7L3**

**AIRCRAFT DESIGN PROJECT II**

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</table>

Prerequisite – Flight Mechanics, Aircraft Structures I & II, Aerodynamics I & II, Aircraft Design Project I, Computer Aided Design and Analysis

Course Designed by – Department of Aeronautical Engineering

**OBJECTIVES**
1. To introduce to the student about the various kinds of loads acting on an airplane and about the detailed structural design of an aircraft
2. To enable the student to be able to estimate the loads on aircraft’s wing and fuselage
3. To enable the student to able to perform a detailed design of the aircraft’s wing and fuselage components
4. To enable the student to make a detailed design report and a layout of aircraft drawings
5. To enable the student to model the designed aircraft and perform a flow analysis and structural analysis

### COURSE CONTENT

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<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
<td>V-n diagram for the design study</td>
</tr>
<tr>
<td>2</td>
<td>Gust and maneuverability envelopes</td>
</tr>
<tr>
<td>3</td>
<td>Critical loading performance and final V-n graph calculation</td>
</tr>
<tr>
<td>4</td>
<td>Structural design study – Theory approach</td>
</tr>
<tr>
<td>5</td>
<td>Load estimation of wings</td>
</tr>
<tr>
<td>6</td>
<td>Load estimation of fuselage.</td>
</tr>
<tr>
<td>7</td>
<td>Balancing and Maneuvering loads on tail plane, Aileron and Rudder loads.</td>
</tr>
<tr>
<td>8</td>
<td>Detailed structural layouts.</td>
</tr>
<tr>
<td>9</td>
<td>Design of some components of wings, fuselage</td>
</tr>
<tr>
<td>10</td>
<td>Preparation of a detailed design report with drawings.</td>
</tr>
<tr>
<td>11</td>
<td>Preparation of model using computer aided design packages.</td>
</tr>
<tr>
<td>12</td>
<td>Preparation of structural analysis report for wing.</td>
</tr>
<tr>
<td>13</td>
<td>Preparation of structural analysis report for Fuselage.</td>
</tr>
<tr>
<td>14</td>
<td>Preparation of flow analysis report for wing.</td>
</tr>
<tr>
<td>15</td>
<td>Preparation of flow analysis report for fuselage.</td>
</tr>
</tbody>
</table>

### References:
2. Analysis and Design of Flight Vehicle Structures, E F Bruhn
3. CADD and CAA Lab Manuals, Department of Aeronautical Engineering, 2015

### Term Paper

<table>
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<tr>
<th>BAN7P1</th>
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<tr>
<td>Prerequisite – Professional Courses</td>
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<tr>
<td>Lab Manual Prepared by – Dept of Aeronautical Engineering</td>
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</tbody>
</table>
### OBJECTIVES
To teach the student the procedures and methodologies for understanding the literature survey and preparation for research paper.

### LIST OF TASKS

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<tbody>
<tr>
<td>1</td>
<td><strong>PREPARING PROPOSAL</strong></td>
<td>Proposed Research Topic</td>
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<td>Purposes</td>
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<td></td>
<td>Background</td>
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<tr>
<td></td>
<td>Method: (suggested methods – develop your own to suit your research topic)</td>
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</tbody>
</table>
| 2 | **CONDUCTING LITERATURE REVIEW** | Exploring and Sharpening your Topic  
Evaluating Information  
Taking Notes and Keeping Records |
| 3 | **COMPLETING ANNOTATED BIBLIOGRAPHY** | Citing Your Sources and Avoiding Plagiarism  
Writing and Annotated Bibliography |
| 4 | **IDENTIFYING PROBLEM STATEMENT** | Meeting the Challenges of Research  
Developing New Information |
| 5 | **COMPLETING OUTLINE FOR THE RESEARCH** | Organizing Your Project into an outline  
Pick up your critique paper and begin editing and incorporate the suggestions from guide |
| 6 | **SUBMITTING FIRST DRAFT** | Drafting your Project  
Entering Conversations and Supporting Your Claims |
| 7 | **SUBMITTING WORKS CITED** | Create the individual citations  
Apply the formatting rules |
| 8 | **SUBMITTING FULL PAPER** | Revising, Editing, and Proofreading  
Designing and Presenting Your Project  
Conducting Research in the Disciplines  
Documenting Sources |

**REFERENCES:**
1. Website.
2. Printed Journals
Total Contact Hours – 18 hours per week

Prerequisite – Basic Subjects, Aerodynamics, Aircraft Structures, Aircraft Propulsion, Flight Mechanics, Engineering Mathematics

Course Designed by – Department of Aeronautical Engineering

**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.

### COMPREHENSION II

**BAN8C1**

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Total Contact Hours : Test will be conducted at the end of the semester

Prerequisite – All the courses upto eighth semester

Course Designed by – Dept. of Aeronautical Engineering

**OBJECTIVES**

- To provide a complete review of Aeronautical/Aerospace Engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

### CORE ELECTIVE-I

**BANE01**

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Total Contact Hours – 45

Prerequisite – Aircraft Systems

Course Designed by – Department of Aeronautical Engineering

**OBJECTIVES**

1. To acquaint the student with the fundamentals aspects of aircraft maintenance and repair.
2. To understand the maintenance and repair aspects of aircraft structures.
3. To understand the maintenance and repair aspects of primary aircraft systems.
4. To understand the maintenance and repair aspects of engine and fuel systems.
5. To understand the maintenance and repair aspects auxiliary systems and instruments.
## COURSE CONTENT

<table>
<thead>
<tr>
<th>UNIT I</th>
<th>FUNDAMENTAL ASPECTS OF AIRCRAFT MAINTENANCE AND REPAIR</th>
<th>9</th>
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<tbody>
<tr>
<td></td>
<td>Importance of aircraft maintenance and repair – CAR stipulations- Hazardous materials and safety practices- Earlier aircrafts with wood structures – Maintenance of fabric covered airplanes – Aircraft painting and markings</td>
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<table>
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<th>MAINTENANCE AND REPAIR OF AIRCRAFT STRUCTURES</th>
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<table>
<thead>
<tr>
<th>UNIT III</th>
<th>MAINTENANCE OF PRIMARY AIRCRAFT SYSTEM</th>
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<table>
<thead>
<tr>
<th>UNIT IV</th>
<th>MAINTENANCE OF ENGINE AND FUEL SYSTEM</th>
<th>9</th>
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<table>
<thead>
<tr>
<th>UNIT V</th>
<th>MAINTENANCE OF AUXILIARY SYSTEM AND INSTRUMENTS</th>
<th>9</th>
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<tbody>
<tr>
<td></td>
<td>Oxygen system, service and maintenance – Installation and maintenance of instruments – Testing instruments and systems – checking of a typical vacuum system.</td>
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### Text Books:

### References:

### ROCKETS AND MISSILES

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<tr>
<td>Prerequisite – Aerodynamics, Aircraft Stability and Control, Avionics, Aircraft Structural Materials and Composites</td>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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### OBJECTIVES

To learn about the aerodynamics and stability of Rockets and Missiles.

### Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

<table>
<thead>
<tr>
<th>COs / POs</th>
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<th>b</th>
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**COURSE CONTENT**

**UNIT I**  
ROCKET SYSTEMS  
9

Ignition system in rockets – types of igniters and igniter design considerations – injection system and propellant feed systems of liquid rockets and their design considerations – design considerations of liquid rocket thrust chambers – combustion mechanisms of liquid and solid propellants.

**UNIT II**  
AERODYNAMICS OF ROCKETS AND MISSILES  
9


**UNIT III**  
ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD  
9

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 burn out velocity and altitude – estimation of culmination time and altitude.

**UNIT IV**  
STAGING AND CONTROL OF ROCKETS AND MISSILES  
9

Design philosophy behind multistaging of launch vehicles and ballistic missiles – multistage vehicle optimization – stage separation techniques in atmosphere and in space – stage separation dynamics and lateral separation characteristics – various types of thrust vector control methods including secondary injection thrust vector control – numerical problems on stage separation and multistaging.

**UNIT V**  
MATERIALS FOR ROCKETS AND MISSILES  
9

Selection criteria of materials for rockets and missiles – materials for various airframe components and engine parts – materials for thrust control devices – various adverse conditions faced by aerospace vehicles and the requirement of materials to perform under these conditions.
Text Books:

Reference Books:
1. J.D.Mattingly, Elements of Propulsion - Gas Turbines and Rockets, AIAA Education series,2006,
3. www.propulsion-analysis.com/
4. www.rocket.com/design-and-analysis

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<th>BANE03</th>
<th>EXPERIMENTAL STRESS ANALYSIS</th>
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OBJECTIVES
1. To acquaint with the basics of measurement.
2. To understand the principle of extensometers, electrical resistance strain gauges and their application in stress analysis.
3. To understand the principle of photo elasticity and their application in stress analysis.
4. To learn brittle coating and moiré methods in stress analysis.
5. To acquaint with the non-destructive testing methods.

COURSE CONTENT

UNIT I | MEASUREMENTS AND EXTENSOMETERS | 9
---|---|---
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 | 9
---|---|---
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 | 9
---|---|---
Two dimensional photo elasticity, Photo elastic materials, Concept of light – photoelastic effects, stress optic law, Transmission and Reflection polariscopes, Interpretation of fringe pattern, Compensation and separation techniques, Introduction to three dimensional photo elasticity.

UNIT IV | BRITTLE COATING AND MOIRE METHODS | 9
---|---|---
Introduction to Moiré techniques, Brittle coating methods and Holography

UNIT V | NON – DESTRUCTIVE TESTING | 9
Fundamentals of NDT, Radiography, Ultrasonics, Eddy Current testing, Fluorescent Penetrant Testing, Acoustic Emission Technique,

**Text Books:**

**References:**

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<th>BANE04</th>
<th>EXPERIMENTAL AERODYNAMICS</th>
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**OBJECTIVES**
1. To understand the methods of low speed wind tunnel testing
2. To understand the methods of high speed wind tunnel testing
3. To acquire knowledge about measurement of pressure, velocity and temperature in flow fields
4. To understand the principles of flow visualization and analogue methods
5. To understand the principles of data acquisition and uncertainty analysis

**COURSE CONTENT**

**UNIT I | LOW SPEED WIND TUNNEL TESTING**

Low speed wind tunnels-Power losses in wind tunnel, energy ratio, Calibration, Flow angularity,Yaw Sphere, Yaw meter, Turbulence sphere, Pressure sphere, Wind tunnel balances, boundary correction, calculation of CL and CDforairfoils

**UNIT II | HIGH SPEED WIND TUNNEL TESTING**

High Speed wind tunnels- Blow down, Induction Type Tunnels, Losses in supersonic tunnels, Second throat, running time estimation, Hypersonic, transonic tunnels, Shock tunnels, Gun tunnels

**UNIT III | MEASUREMENT TECHNIQUES**

Pressure measurement, Hot wire anemometer, laser Doppler anemometer for turbulence and velocity measurements-Temperature measurement, Measurement of wall shear stress, Rotameters and Ultrasonic flow meters.

**UNIT IV | FLOW VISUALIZATION AND ANALOGUE METHODS**
UNIT V  DATA ACQUISITION AND UNCERTAINTY ANALYSIS  9
Measurement systems, data acquisition, signal conditioning, multiplexing, data conversion, uncertainty analysis

Text Books:

References:

CORE ELECTIVE-II

BANE05 HELICOPTER MAINTENANCE

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OBJECTIVES
1. To acquaint with the basic fundamental of helicopter concept.
2. To understand the concept of inspection and maintenance of main rotor system.
3. To understand the concept of inspection and maintenance of main rotor transmission.
4. To understand the concept of inspection and maintenance of power plant and tail rotor.
5. To acquaint with airframes and related systems

COURSE CONTENT

UNIT I  HELICOPTER FUNDAMENTALS  9
Basic directions – Ground handling, bearing – Gears.

UNIT II  INSPECTION AND MAINTENANCE OF MAIN ROTOR SYSTEM  9

UNIT III  INSPECTION AND MAINTENANCE OF MAIN ROTOR TRANSMISSION  9

UNIT IV  INSPECTION AND MAINTENANCE OF POWER PLANT & TAIL ROTOR  9
Fixed wing power plant modifications – Installation – Different type of power plant maintenance. Tail
UNIT V  AIRFRAMES AND RELATED SYSTEMS  9
Fuselage maintenance – Airframe Systems – Special purpose equipment.

Text Books:

References:

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<th>BANE06</th>
<th>SPACE MECHANICS</th>
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OBJECTIVES
1. To introduce to the student about the basic concepts in space mechanics and about the laws that govern motion in space
2. To enable the student to decide on the locations for satellite injections into the orbit and the various perturbations on satellites in space
3. To acquaint the student about the interplanetary trajectories and to select/design appropriate trajectory according to mission requirements
4. To introduce to the student about the trajectories for ballistic missiles
5. To familiarize the student about the different types of materials used in spacecrafts

COURSE CONTENT

UNIT I  BASIC CONCEPTS AND THE GENERAL N- BODY PROBLEM  9

UNIT II  SATELLITE INJECTION AND SATELLITE PERTURBATIONS  9

UNIT III  INTERPLANETARY TRAJECTORIES  9

UNIT IV  BALLISTIC MISSILE TRAJECTORIES  9

UNIT V  MATERIALS FOR SPACECRAFT  9
Space environment – peculiarities of space environment – effect of space environment on materials of
spacecraft structure – materials required for the construction of spacecraft – TPS for re-entry space vehicles.

Text Books:

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OBJECTIVES
1. To know about the role of Vibrations, vibration analysis and ideas about Aero elasticity in engineering and industry.
2. To make thorough understanding of single degree of freedom, Two degrees of freedom and multi degrees of freedom systems and deriving equations to solve for natural frequency.
3. To understand the Newton second Law, Energy method and know how to use it to solve single degree of freedom systems.
4. To understand the approximate methods to solve vibration engineering problems in Two degree and multi degree of freedom systems.
5. To understand the collars triangle and various aero elastic phenomena in the aircraft structural components.

COURSE CONTENT

UNIT I  SINGLE DEGREE OF FREEDOM SYSTEMS  9

UNIT II  MULTI DEGREES OF FREEDOM SYSTEMS  9
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 equations and application.

UNIT III  CONTINUOUS SYSTEMS AND APPROXIMATE METHODS  9

UNIT IV  ELEMENTS OF AEROELASTICITY  9

UNIT V  FLUTTER PHENOMENON  9

**Text Books:**

**References:**

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**OBJECTIVES**
1. To acquaint with the basics of rotating wing concept.
2. To understand the concept of hovering flight dynamics.
3. To understand the concept of forward flight dynamics.
4. To analyze the climb and descent performance.
5. To acquaint with ground effect machines.

**COURSE CONTENT**

**UNIT I**
**INTRODUCTION TO ROTATING WING CONCEPT**

**UNIT II**
**HOVERING FLIGHT DYNAMICS**
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**
**FORWARD FLIGHT DYNAMICS**
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**
Vertical flight-flow patterns surrounding the rotor-Power required in climb and descent- Descent speed calculations-Take-off techniques.
UNIT V  GROUND EFFECT MACHINES  9

Types – Hover height, lift augmentation and power calculations for plenum chamber and peripheral jet machines – Drag of hovercraft on land and water – Applications of hovercraft.

Text Books:

References:

CORE ELECTIVE-III

BANE09 AIRCRAFT ENGINE REPAIR AND MAINTENANCE  L  T  P  C
Total Contact Hours – 45
3 0 0 3
Prerequisite – Aircraft Systems
Course Designed by – Department of Aeronautical Engineering

OBJECTIVES
1. To know about the hydraulic, pneumatic, brake and landing gear systems principle, function of components, types and operation of typical system.
2. To study and differentiate conventional and modern aircraft control systems and engine control systems
3. To study about layout, components, functions of fuel, lubrication, starting, ignition systems of piston and jet engines.
4. To understand air-conditioning, air cycle, vapor cycle, oxygen, deicing, anti icing and fire protection systems of aero plane.
5. To study construction and operation of flight, navigation instruments and engine instruments installed in the aero plane.

COURSE CONTENT

UNIT I  INSPECTIONS AND TROUBLE SHOOTING OF PISTON ENGINES  9

Need for Inspection, maintenance and trouble shooting in Piston engine – Inspection of all 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 – Details of carburetion and injection systems for small and large engines – Ignition system components – Spark plug – Maintenance and inspection check to be carried out.

UNIT II  INSPECTION AND TROUBLE SHOOTING OF PROPELLER  9

Propeller theory - operation, construction assembly and installation -Pitch change mechanism-Propeller axially system- Damage and repair criteria - General Inspection procedures - Checks on constant speed propellers - Pitch setting, Propeller Balancing, Blade cuffs, Governor/Propeller operating conditions.

UNIT III  OVERHAULING OF PISTON ENGINES  9

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

UNIT IV  INSPECTION AND TROUBLE SHOOTING OF GAS TURBINE ENGINE  9

UNIT V  OVERHAULING OF GAS TURBINE ENGINES  9

Text Books:

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OBJECTIVES
1. To introduce to the student the basics of cryogenic systems and associated processes.
2. To acquaint the student with the propellants used in cryogenic technology.
3. To introduce the various equipments and accessories used in cryogenic rocket propulsion.
4. To familiarize the student to the different flow circuits and parts in a cryogenic engine.
5. To enable the student to understand about various challenges in implementing cryogenic rocket technology.

COURSE CONTENT

UNIT I  INTRODUCTION TO CRYOGENIC SYSTEMS  9

UNIT II  CRYO FUEL SYSTEMS  9

UNIT III  CRYO EQUIPMENTS AND ACCESSORIES  9

Mechanical and Thermal Properties of engineering materials at low temperatures; Compressors: types, construction and characteristics; Expansion machines: characteristics of reciprocating and turbine expanders, design of J-T expander; Heat exchangers: theory, types, design approaches and selection criteria, Irreversibilities in cryogenic Heat exchangers; Design of cryogenic storage vessels, transfer devices, insulation system, valves; Characteristics of cryogenic pumps, Instrumentation in cryogenic systems; Safety in cryogenic systems.

UNIT IV  CRYOGENIC ENGINES  9

Fluid circuits of various cryogenic engines and semi-cryogenic engines; Design of regeneratively cooled combustion chamber, film cooling, dump cooling, transpiration cooling and radiation cooling. Design of expansion nozzle- characteristics, Design of injector– hydraulic characteristics; Engine thrust and mixture ratio control, Igniters, Propellant tanks.

UNIT V  CHALLENGES IN CRYOGENIC ROCKET TECHNOLOGY  9

Problems in storage and handling of cryogenic propellants: safety aspects, Thermal protection systems for stage tanks, Thermal stratification- destratification, Geysering effect – geysering elimination, Zero “g” problems – restart mechanism.

Text Books:

References:

THEORY OF PLATES AND SHELLS  L  T  P  C

BANE11

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OBJECTIVES
1. To acquaint with the classical plate theory.
2. To analyze the plates of various shapes.
3. To learn the concept of Eigen value analysis.
4. To learn various numerical approximation method for plate analysis.
5. To acquaint the concept of shell structures.

UNIT I  CLASSICAL PLATE THEORY  9


UNIT II  PLATES OF VARIOUS SHAPES  9
Navier’s Method of Solution for Simply Supported Rectangular Plates – Levy’s Method of Solution for Rectangular Plates under Different Boundary Conditions – Annular Plates – Plates of other shapes.

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 Books:

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BANE12

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OBJECTIVES
1. To study the environment around hypersonic vehicles created by strong shock waves.
2. To introduce students to real gas effects caused by high temperature conditions.
3. To study pressure and heat transfer phenomena at the stagnation point of a hypersonic vehicle.
4. To study the distribution of pressure around a general vehicle shape.
5. To study the distribution of heat transfer and skin friction around a general vehicle shape.

COURSE CONTENT

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 inviscid 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**  
**VISCOS HYPERSONIC FLOW THEORY**  
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<td>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.</td>
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**UNIT IV**  
**VISCOS INTERACTIONS IN HYPERSONIC FLOWS**  
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<td>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.</td>
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**UNIT V**  
**INTRODUCTION TO HIGH TEMPERATURE EFFECTS**  
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<td>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.</td>
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**Text Books:**  

**NON MAJOR ELECTIVE-I**  
**BANE13**  
**AN INTRODUCTION TO COMBUSTION**  
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| Prerequisite – Fundamentals of Aerothermodynamics, Aircraft Propulsion |

**OBJECTIVES**  
1. To acquaint with the basics of combustion.  
2. To understand the combustion process in aircraft piston engines.  
3. To understand the combustion process in gas turbine engines.  
4. To understand the combustion process in scramjet engines.  
5. To understand the combustion process in rocket engines.  

**COURSE CONTENT**  
**UNIT I**  
**INTRODUCTION TO COMBUSTION**  
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**UNIT II**  
**COMBUSTION IN AIRCRAFT PISTON ENGINES**  
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<td>Introduction to combustion in aircraft piston engines – various factors affecting the combustion efficiency - fuels used for combustion in aircraft piston engines and their selection – detonation in piston engine combustion and the methods to prevent the detonation</td>
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</tbody>
</table>
# UNIT III: COMBUSTION IN GAS TURBINE ENGINES


# UNIT IV: COMBUSTION IN SCRAMJET ENGINES

Introduction to supersonic combustion – need for supersonic combustion for hypersonic air-breathing propulsion- supersonic combustion controlled by diffusion, mixing and heat convection – analysis of reactions and mixing processes - supersonic burning with detonation shocks - various types of supersonic combustors.

# UNIT V: COMBUSTION IN ROCKET ENGINES


## Text Books:

## References:

## Course Information

<table>
<thead>
<tr>
<th>BANE14</th>
<th>PRINCIPLES OF TURBO MACHINERY IN AIR BREATHING ENGINES</th>
<th>L</th>
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<td>Prerequisite – Aircraft Propulsion</td>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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## Objectives
1. To familiarize the student on the working principle of air breathing engines
2. To enable the student to be able to design axial flow compressors and fans based on the operating requirements
3. To student should be able to design axial flow turbines based on the operating requirements
4. To acquaint the student about the designing procedure for centrifugal compressors
5. To enable the student to design radial flow turbines based on operating conditions

## Course Content

<table>
<thead>
<tr>
<th>UNIT I</th>
<th>INTRODUCTION TO TURBOMACHINERIES</th>
<th>5</th>
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<tbody>
<tr>
<td></td>
<td>Introduction - Blades and flow - Work input and output - Dynamic scaling – Losses and Efficiency</td>
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<tr>
<th>UNIT II</th>
<th>AXIAL FLOW COMPRESSORS AND FANS</th>
<th>13</th>
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</thead>
</table>
Radial Equilibrium Equation; Design of compressor blades; 2-D blade section design: Airfoil Data; Axial Flow Track Design; Axial compressor characteristics; Multi-staging of compressor characteristics; Transonic Compressors; Shock Structure Models in Transonic Blades; Transonic Compressor Characteristics; 3-D Blade shapes of Rotors and Stators; Instability in Axial Compressors; Loss of Pressure Rise; Loss of Stability Margin; Noise problem in Axial Compressors and Fans

**UNIT III**  
**AXIAL FLOW TURBINES**  
9

Turbine Blade 2-D (cascade) analysis Work Done; Degree of Reaction; Losses and Efficiency; Flow Passage; Subsonic, transonic and supersonic turbines, Multi-staging of Turbine; Exit flow conditions; Turbine Cooling; Turbine Blade design – Turbine Profiles: Airfoil Data and Profile construction

**UNIT IV**  
**CENTRIFUGAL COMPRESSORS:**  
9

Elements of centrifugal compressor/fan; Inlet Duct Impeller; Slip factor; Concept of Rothalpy; Modified work done; Incidence and lag angles; Diffuser; Centrifugal Compressor Characteristics; Surging; Chocking; Rotating stall; Design

**UNIT V**  
**RADIAL TURBINE:**  
9

Thermodynamics and Aerodynamics of radial turbines; Radial Turbine Characteristics; Losses and efficiency; Design of radial turbine

**Text Books:**
1. Nicholas Cumpsty, Compressor Aerodynamics, 2004, Kreiger Publications, USA.

**References:**
2. NASA-SP-290, Axial Flow Turbines, 2002 (re-release), NTIS, USA.
5. B Lakshminarayana; Fluid Mechanics and Heat Transfer in turbomachineries, Â 1995, USA.

**Course Design: BANE15**

<table>
<thead>
<tr>
<th>NANO SCIENCE TECHNOLOGY</th>
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Prerequisite – Engineering Physics, Fundamentals of Structural Mechanics

Course Designed by – Department of Aeronautical Engineering

**OBJECTIVES**
1. To acquaint with the fundamentals of viscous flow.
2. To learn the different regime of viscous flow and its solution.
3. To understand the concept of laminar boundary layer.
4. To understand the concept of turbulent boundary layer.
5. To acquaint the concept of compressible boundary layer.

**COURSE CONTENT**

**UNIT I**  
**INTRODUCTION**  
9

Introduction to nano scale materials - atomic & molecular size. Scientific revolutions-nanotechnology application area. Scope of nano science and technology
UNIT II  NANOSTRUCTURES AND DIMENSIONS 9
Classification of nanostructures-zero, one, two and three dimensional nanostructures. Size Dependency in Nanostructures-quantum size effects in nanostructures. Chemistry of tailored nano shapes.

UNIT III  NANOMATERIAL SYNTHESIS 9

UNIT IV  NANOMATERIAL PROPERTIES 9
Surface to volume ratio. Surface properties of nanoparticles. Mechanical, optical, electronic, magnetic, thermal and chemical properties of nanomaterials. Size dependent properties-size dependent absorption spectra. Shape impact.

UNIT V  PHYSICAL PROPERTIES OF NANOSTRUCTURED MATERIALS 9

Text Books:

References:
UNIT III  CHARACTERISTICS OF AIRCRAFT TYPES  9
Long-endurance, Long-range Role Aircraft – Medium-range, Tactical Aircraft - Close-range/Battlefield Aircraft - MUAV Types - MAV and NAV Types - UCAV - Novel Hybrid Aircraft Configurations - Research UAV

UNIT IV  COMMUNICATIONS NAVIGATION  9
Communication Media - Radio Communication - Mid-air Collision (MAC) Avoidance - Communications Data Rate and Bandwidth Usage - Antenna Types NAVSTAR Global Positioning System (GPS) - TACAN - LORAN C - Inertial Navigation - Radio Tracking - Way-point Navigation

UNIT V  CONTROL AND STABILITY  9

Text Books:
1. Reg Austin., Unmanned Aircraft Systems, John Wiley and Sons., 2010

References:

NON MAJOR ELECTIVE-II

<table>
<thead>
<tr>
<th>BANE17</th>
<th>BOUNDARY LAYER THEORY</th>
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<td>Prerequisite – Maths</td>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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OBJECTIVES
1. To acquaint with the fundamentals of viscous flow.
2. To learn the different regime of viscous flow and its solution.
3. To understand the concept of laminar boundary layer.
4. To understand the concept of turbulent boundary layer.
5. To acquaint the concept of compressible boundary layer.

COURSE CONTENT

UNIT I  FUNDAMENTAL EQUATIONS OF VICOUS FLOW  9
Fundamental equations of viscous flow, Conservation of mass, Conservation of Momentum-Navier-Stokes equations, Energy equation, Mathematical character of basic equations, Dimensional parameters in viscous flow, Non dimensionalising the basic equations and boundary conditions, vorticity considerations, creeping flow, boundary layer flow

UNIT II  SOLUTIONS OF VICOUS FLOW EQUATIONS  9
Solutions of viscous flow equations, Couette flows, Hagen–Poisuelle flow, Flow between rotating concentric cylinders, Combined Couette-Poiseuille Flow between parallel plates, Creeping motion, Stokes solution for an immersed sphere, Development of boundary layer, Displacement thickness, momentum and energy thickness.

UNIT III  LAMINAR BOUNDARY LAYER EQUATIONS  9
Laminar boundary layer equations, Flat plate Integral analysis of Karman – Integral analysis of energy equation – Laminar boundary layer equations – boundary layer over a curved body-Flow separation-similarity solutions, Blasius solution for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature profiles for constant plate temperature –Reynold’s analogy, Integral equation of Boundary layer – Pohlhausen method – Thermal boundary layer calculations

UNIT IV  TURBULENT BOUNDARY LAYER EQUATIONS  9
Turbulence-physical and mathematical description, Two-dimensional turbulent boundary layer equations — Velocity profiles – The law of the wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent boundary layer on a flat plate – Boundary layers with pressure gradient, Eddy Viscosity, mixing length, Turbulence modeling

UNIT V  COMPRESSIBLE BOUNDARY LAYER EQUATIONS  9
Compressible boundary layer equations, Recovery factor, similarity solutions, laminar supersonic Cone rule, shock-boundary layer interaction

Text Books:

References:

BANE18  FATIGUE AND FRACTURE MECHANICS  L  T  P  C
Total Contact Hours – 45
Prerequisite – Fundamentals of Structural Mechanics
Course Designed by – Department of Aeronautical Engineering

OBJECTIVES
1. To familiarize the student about the basic terminologies of fatigue and fracture mechanics
2. To enable the student to grasp the various statistical tools used in fatigue analysis
3. To acquaint the student about the physical processes taking place during fatigue
4. To introduce to the student about the mechanism taking place during fracture
5. To make the student realize about the importance of fatigue and fracture mechanics in aerospace industry

COURSE CONTENT

UNIT I  FATIGUE OF STRUCTURES  9

UNIT II  STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR  9
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  9
Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces.

UNIT IV  FRACTURE MECHANICS  9

UNIT V  FATIGUE DESIGN AND TESTING  9
Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

Text Books:

References:

<table>
<thead>
<tr>
<th>BANE19</th>
<th>HIGH TEMPERATURE MATERIALS</th>
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<td>Prerequisite – Fundamentals of Structural Mechanics</td>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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OBJECTIVES
1. To acquaint the student with the fundamentals of creep.
2. To make the student understand about design with creep resistance.
3. To familiarize the student about fracture, cracks and their mechanics.
4. To introduce to the student about oxidation and corrosion in hot environments.
5. To acquaint the student with various super alloys and other materials.

COURSE CONTENT

UNIT I  CREEP  9
Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate.

UNIT II  DESIGN FOR CREEP RESISTANCE  9
Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.
UNIT III  FRACTURE
Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, and ductile 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.

Text Books:

References:

NON MAJOR ELECTIVE-III

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<th>BANE20</th>
<th>WIND ENERGY</th>
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<td>Prerequisite – Aerodynamics I</td>
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<tr>
<td>Course Designed by – Department of Aeronautical Engineering</td>
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</table>

OBJECTIVES
1. To familiarize the student about the fundamentals about wind energy and the various measurements associated with it
2. To acquaint the student with the aerodynamics of wind turbines
3. To introduce to the student about the components of wind turbines and the gear coupled generators
4. To introduce to the student about the direct rotor coupled generators
5. To accustom the student to the control systems and monitoring systems for wind turbines

COURSE CONTENT

UNIT I  WIND ENERGY FUNDAMENTALS & WIND MEASUREMENTS
UNIT II  AERODYNAMICS THEORY & WIND TURBINE TYPES  9
Airfoil terminology, Blade element theory, Blade design, Rotor performance and dynamics, Balancing
technique (Rotor & Blade), Types of loads; Sources of loads Vertical Axis Type, Horizontal Axis,
Constant Speed Constant Frequency, Variable speed Variable Frequency, Up Wind, Down Wind, Stall
Control , Pitch Control, Gear Coupled Generator type, Direct Generator Drive /PMG/Rotor Excited Sync
Generator

UNIT III  GEAR COUPLED GENERATOR WIND TURBINE COMPONENTS
AND THEIR CONSTRUCTION  9
Electronics Sensors /Encoder /Resolvers, Wind Measurement : Anemometer & Wind Vane, Grid
Synchronization System, Soft Starter, Switchgear [ACB/VCB], Transformer, Cables and assembly,
Compensation Panel, Programmable Logic Control, UPS, Yaw & Pitch System : AC Drives, Safety Chain
Circuits, Generator Rotor Resistor controller (Flexi Slip), Differential Protection Relay for Generator,
Battery/Super Capacitor Charger & Batteries/ Super Capacitor for Pitch System, Transient Suppressors /Lightning Arrestors, Oscillation & Vibration sensing

UNIT IV  DIRECT ROTOR COUPLED GENERATOR  9
Excited Rotor Synch. Generator / PMG Generator, Control Rectifier, Capacitor Banks, Step Up / Boost
Converter ( DC-DC Step Up), Grid Tied Inverter, Power Management, Grid Monitoring Unit (Voltage
and Current), Transformer, Safety Chain Circuits

UNIT V  MODERN WIND TURBINE CONTROL & MONITORING SYSTEM  9
Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines,
Wind Turbine Monitoring with Error codes, SCADA & Databases: Remote Monitoring and Generation
Reports, Operation & Maintenance for Product Life Cycle, Balancing technique (Rotor & Blade), FACTS
control & LVRT & New trends for new Grid Codes.

Text Books:

References:

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<tr>
<th>BANE21</th>
<th>SATELLITE TECHNOLOGY</th>
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<td>Prerequisite – Basic Electrical and Electronics, Engineering Mechanics</td>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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OBJECTIVES
1. To introduce to the student about different types of satellites and their functions
2. To accustom the student to the governing equations of motion and orbital mechanics
3. To acquaint the student to the structure of the satellites and the components used and their thermal
   protection
4. To familiarize the student about the control system for spacecraft
5. To enable the student to understand about the power system in a satellite and the various bus electronics used

**COURSE CONTENT**

<table>
<thead>
<tr>
<th>UNIT I</th>
<th>INTRODUCTION TO SATELLITE SYSTEMS</th>
<th>9</th>
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<tbody>
<tr>
<td>Common satellite applications and missions – Typical spacecraft orbits – Definitions of spin the three axis stabilization-space environment – Launch vehicles – Satellite system and their functions (structure, thermal, mechanisms, power, propulsion, guidance and control, bus electronics).</td>
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<th>UNIT II</th>
<th>ORBITAL MECHANICS</th>
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<tr>
<td>Fundamental of flight dynamics – Time and coordinate systems – Orbit determination and prediction – Orbital maneuvers – GPS systems and application for satellite/orbit determination – Ground station network requirements.</td>
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<th>UNIT III</th>
<th>SATELLITE STRUCTURES &amp; THERMAL CONTROL</th>
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<tr>
<td>Satellite mechanical and structural configuration: Satellite configuration choices, launch loads, separation induced loads, deployment requirements – Design and analysis of satellite structures – Structural materials and fabrication – The need of thermal control: externally induced thermal environment – Internally induced thermal environment - Heat transfer mechanism: internal to the spacecraft and external heat load variations – Thermal control systems: active and passive methods.</td>
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<th>UNIT IV</th>
<th>SPACECRAFT CONTROL</th>
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<tbody>
<tr>
<td>Control requirements: attitude control and station keeping functions, type of control maneuvers – Stabilization schemes: spin stabilization, gravity gradient methods, 3 axis stabilization – Commonly used control systems: mass expulsion systems, momentum exchange systems, gyro and magnetic torque - Sensors star and sun sensors, earth sensor, magnetometers and inertial sensors</td>
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<th>UNIT V</th>
<th>POWER SYSTEM AND BUS ELECTRONICS</th>
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<tr>
<td>Solar panels: Silicon and Ga-As cells, power generation capacity, efficiency – Space battery systems – battery types, characteristics and efficiency parameters – Power electronics. Telemetry and telecommand systems: Tm &amp; TC functions, generally employed communication bands (UHF/VHF, S, L, Ku, Ka etc), their characteristics and applications- Coding Systems – Onboard computer- Ground checkout Systems.</td>
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**Text Books:**

**References:**

**BANE22**

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<tr>
<th>AIRCRAFT RULES AND REGULATIONS CAR I &amp; II</th>
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Prerequisite – Professional Courses
# OBJECTIVES
1. To familiarize the student about the CAR series A & B
2. To familiarize the student about the CAR series C & D
3. To familiarize the student about the CAR series E & F
4. To familiarize the student about the CAR series L & M
5. To familiarize the student about the CAR series T & X

## COURSE CONTENT

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<tr>
<td>C.A.R series 'A'</td>
<td>procedure for civil air worthiness Requirements and responsibility operators vis-a-vis Air Worthiness directorate</td>
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<tr>
<td>C.A.R. series “B”</td>
<td>issue approval of cockpit check list, MEL, CDL - Deficiency list (MEL &amp; CDL); preparation and use of cockpit check list and emergency check list.</td>
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<td>C.A.R series 'C'</td>
<td>defect recording, monitoring, investigation and reporting - Defect recording, reporting, investigation, rectification and analysis; Flight report; Reporting and rectification of defects observed on aircraft; Analytical study of in-flight readings &amp; recordings; Maintenance control by reliability Method.</td>
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<tr>
<td>C.A.R. series 'D'-aircraft maintenance programmes</td>
<td>Reliability Programme (Engines); Aircraft maintenance programme&amp; their approval - On condition maintenance of reciprocating engines; TBO - Revision programme; Maintenance of fuel and oil uplift and consumption records - Light aircraft engines; Fixing routine maintenance periods and component TBOs - Initial &amp; revisions.</td>
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<td>C.A.R. series 'E'</td>
<td>approval of organizations - Approval of organizations in categories A, B, C, D, E, F, &amp; G; Requirements of infrastructure at stations other than parent base.</td>
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<tr>
<td>C.A.R. series 'F'</td>
<td>air worthiness and continued air worthiness - Procedure relating to registration of aircraft; Procedure for issue / revalidation of Type Certificate of aircraft and its engines / propeller; Issue / revalidation of Certificate of Airworthiness; Requirements for renewal of Certificate of Airworthiness</td>
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<tr>
<td>C.A.R. series 'L'</td>
<td>aircraft maintenance engineer – licensing - Issue of AME License, its classification and experience requirements, Complete Series 'L'.</td>
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<tr>
<td>C.A.R. series 'M'</td>
<td>Mandatory Modifications / Inspections.</td>
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<tr>
<td>C.A.R. series 'T'</td>
<td>flight testing of aircraft - Flight testing of (Series) aircraft for issue of C of A; Flight testing of aircraft for which C or A had been previously issued.</td>
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<tr>
<td>C.A.R. series 'X'</td>
<td>miscellaneous requirements - Registration Markings of aircraft; Weight and balance control of an aircraft; Provision of first aid kits &amp; Physician's kit in an aircraft; Use furnishing materials in an aircraft; Concessions; Aircraft log books; Document to be carried on board on Indian registered aircraft; Procedure for issue of taxy permit; Procedure for issue of type approval of aircraft components and equipment including instruments.</td>
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OPEN ELECTIVE-I

BBA001

PRINCIPALS OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR

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Total Contact Hours – 45

Prerequisite – Professional Courses

Course Designed by – Department of Management Studies

OBJECTIVES
1. To acquaint the student about the management, various types of management function and structure.
2. To give insight of various methods of management of organization and managerial aspects.
3. To acquaint the student with various functions of organizational behavior.
4. To get exposure regarding its applications and recent developments of group dynamics and trade union
5. To help the student understand about the professional ethics and social responsibilities.

COURSE CONTENT

UNIT I

NATURE OF MANAGEMENT


UNIT II

MANAGEMENT PROCESS


UNIT III

ORGANIZATION STRUCTURE


UNIT IV

ORGANIZATIONAL BEHAVIOUR

9
UNIT V GROUP BEHAVIOUR


Text Books:

References:
4. https://www.extension.harvard.edu

UNIT I INTRODUCTION

Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft, airport: airline management and organization – levels of management, functions of management, Principles of organization planning the organization – chart, staff departments & line departments.

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


UNIT III  PRINCIPLES OF AIRLINES SCHEDULING

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipments and types of schedule – hub & spoke scheduling, advantages / disadvantages & preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT IV  AIRCRAFT RELIABILITY

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

UNIT V  TECHNOLOGY IN AIRCRAFT MAINTENANCE

Airlines scheduling (with reference to engineering) – Product support and spares – Maintenance sharing – Equipments and tools for aircraft maintenance – Aircraft weight control – Budgetary control.

Text Books:

References:
2. Wilson & Bryon, “Air Transportation”.

AEROSPACE BIO – MEDICAL AND LIFE SUPPORT ENGINEERING

<table>
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<tr>
<th>BANE24</th>
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<tr>
<td>Prerequisite – Basic Electrical and Electronics</td>
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<td>Course Designed by – Department of Aeronautical Engineering</td>
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OBJECTIVES
1. To apply engineering methods to the study of astronaut adaptation to reduced gravity environments.
2. To use analytical techniques, such as structural idealizations, control theory, electrical circuit, and mechanical system analogs to model astronaut performance.
3. To enable quantitative assessment of the effectiveness of countermeasures.
4. To consider the socio-political implications for advanced technological R&D (e.g., space policy, health policy, international collaboration).
5. To teach, perform outreach, and demonstrate mastery of a chosen engineering concept.
# COURSE CONTENT

<table>
<thead>
<tr>
<th>UNIT I</th>
<th>INTRODUCTION</th>
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</thead>
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<tr>
<td></td>
<td>Physiological problems associated with human space flight – review of terminologies</td>
<td></td>
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<tr>
<td>UNIT II</td>
<td>BIO – MECHANICS IN SPACE FLIGHT</td>
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<td>Bone Mechanics, Muscle Mechanics, Musculoskeletal Dynamics, and the Cardiovascular System during space flight – their equations of motion</td>
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<tr>
<td>UNIT III</td>
<td>BIO – MECHANICAL MODELING</td>
<td>9</td>
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<td></td>
<td>Structural idealizations – mechanical and electrical modeling of muscle groups – musculoskeletal groups – joints, electrical analogies to model astronaut performance</td>
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<tr>
<td>UNIT IV</td>
<td>LIFE SUPPORT SYSTEMS</td>
<td>9</td>
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<tr>
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<td>Onboard environment control systems – waste product management and recycling system – bio – monitoring and control</td>
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<tr>
<td>UNIT V</td>
<td>EXTRA – VEHICULAR ACTIVITY</td>
<td>9</td>
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<td>Extra Vehicular activity – challenges – specialties of space suits – life support system for EVA</td>
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**Text Books:**

**References:**

## OPEN ELECTIVE-II

<table>
<thead>
<tr>
<th>BBA008</th>
<th>TOTAL QUALITY MANAGEMENT</th>
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**OBJECTIVES**
1. To introduce to the student about the basic terms related to quality and concepts of quality management
2. To familiarize the student about the basic principles of total quality management
3. To acquaint the student with the basic statistical tools used in process control
4. To introduce to the student about the various tools used in implementing and checking total quality management
5. To familiarize the student about the different quality systems used in auditing the quality of a company/industry/organization

**COURSE CONTENT**

<table>
<thead>
<tr>
<th>UNIT I</th>
<th>INTRODUCTION</th>
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</table>

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

<table>
<thead>
<tr>
<th>UNIT II</th>
<th>TQM PRINCIPLES</th>
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<tr>
<th>UNIT III</th>
<th>STATISTICAL PROCESS CONTROL (SPC)</th>
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The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

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<tr>
<th>UNIT IV</th>
<th>TQM TOOLS</th>
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<th>UNIT V</th>
<th>QUALITY SYSTEMS</th>
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**Text Books:**

**References:**
OBJECTIVES
1. To introduce to the student about the aerodynamics taking place in the atmosphere
2. To familiarize the student about the aerodynamics of flow over bluff bodies and its effect on those bodies
3. To acquaint the student about the various mechanisms and procedures by which energy can be extracted from the wind
4. To accustom the student about the aerodynamics of flow around buildings, towers and bridges and also about ventilation and architectural aerodynamics
5. To familiarize the student about the loads on a structure due to wind and the resulting vibrations and their calculations

COURSE CONTENT

UNIT I | ATMOSPHERIC BOUNDARY LAYER 9
Atmospheric circulation - Local winds - Terrain types - Mean velocity profiles - Power law and logarithm law - wind speeds - Turbulence profiles - Roughness parameters - Simulation techniques in wind tunnels

UNIT II | BLUFF BODY AERODYNAMICS 9
Boundary layers and separation - Two dimensional wake and vortex formation - Strouhal and Reynolds numbers - Separation and reattachments - Power requirements and drag coefficients of automobiles - Effects of cut back angle - Aerodynamics of trains.

UNIT III | WIND ENERGY COLLECTORS 9
Horizontal and vertical axis machines - Energy density of different rotors - Power coefficient - Betz coefficient by momentum theory.

UNIT IV | BUILDING AERODYNAMICS 9
Pressure distribution on low rise buildings - Wind forces on buildings - Environmental winds in city blocks - Special problems of tall buildings - Building codes - Ventilation and architectural aerodynamics

UNIT V | FLOW INDUCED VIBRATIONS 9
Vortex shedding, lock & effects of Reynolds number on wake formation in turbulent flows - Across wind galloping - Wake galloping - Along wind galloping of circular cables - Oscillation of tall structures and launch vehicles under wind loads - Stall flutter.

Text Books:

References:
OBJECTIVES
1. To introduce to the student about the various heterogeneous materials.
2. To accustom the student to the mechanics of heterogeneous materials.
3. To acquaint the student to the structure of particulate, fibrous and cellular solids and their properties.
4. To familiarize the student about the hierarchical structure in heterogeneous materials.
5. To enable the student to understand various design considerations in application of heterogeneous materials.

COURSE CONTENT

UNIT I
INTRODUCTION

UNIT II
STRUCTURE OF HETEROGENEOUS MATERIALS

UNIT III
PARTICULATE, FIBROUS AND CELLULAR SOLIDS

UNIT IV
HIERARCHICAL STRUCTURE

UNIT V
DESIGN CONSIDERATIONS


**Text Books:**

**References:**