PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

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<thead>
<tr>
<th>PO#</th>
<th>Graduate Attribute</th>
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<tbody>
<tr>
<td>I.</td>
<td>To impart fundamental scientific principles for solving complex engineering problems in different domains of Aerospace engineering</td>
</tr>
<tr>
<td>II.</td>
<td>To train the students to have successful career in the field of Aerospace Engineering and allied domains, contributing to the global economy.</td>
</tr>
<tr>
<td>III.</td>
<td>To inculcate ethical values and professional integrity, enabling the students to grow and contribute to the world</td>
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PROGRAM OUTCOMES (POs)

<table>
<thead>
<tr>
<th>PO#</th>
<th>Graduate Attribute</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>Engineering knowledge</strong>: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
</tr>
<tr>
<td>2</td>
<td><strong>Problem analysis</strong>: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</td>
</tr>
<tr>
<td>3</td>
<td><strong>Design/development of solutions</strong>: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Conduct investigations of complex problems</strong>: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.</td>
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<tr>
<td>5</td>
<td><strong>Modern tool usage</strong>: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.</td>
</tr>
<tr>
<td>6</td>
<td><strong>The engineer and society</strong>: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.</td>
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<tr>
<td>7</td>
<td><strong>Environment and sustainability</strong>: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.</td>
</tr>
<tr>
<td>8</td>
<td><strong>Ethics</strong>: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</td>
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<tr>
<td></td>
<td><strong>Individual and team work</strong>: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</td>
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<tr>
<td>10</td>
<td><strong>Communication</strong>: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.</td>
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<tr>
<td>11</td>
<td><strong>Project management and finance</strong>: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.</td>
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<tr>
<td>12</td>
<td><strong>Life-long learning</strong>: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.</td>
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**PROGRAM SPECIFIC OUTCOMES (PSOs) - (3 to 4 statements)**

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<tr>
<th></th>
<th>1. Comprehend and analyze, real life problems and develop innovative solutions</th>
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<tr>
<td></td>
<td>2. Apply experimental and computational tools to solve problems in the domains of Aerodynamics, Aerospace Structures and Propulsion engineering</td>
</tr>
<tr>
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<td>3. Engage professionally, applying engineering, management and entrepreneurial practices</td>
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**PEO's – PO's & PSO's MAPPING:**

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**PEO**

**PO**

**PSO**
### SEMESTER I

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$^\dagger$ Skill Based Course

### SEMESTER II

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$^\dagger$ NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

$^\dagger$ Skill Based Course
### SEMESTER III

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<th>Course Code</th>
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#### PRACTICALS

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§ Skill Based Course

### SEMESTER IV

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§ NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.
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**TOTAL** 21 1 2 24 20

* Mandatory Course-I is a Non-credit Course (The candidate shall select one course from the list given under MC- I)

### SEMESTER VI

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**PRACTICALS**

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**TOTAL** - - - - 22

*Open Elective – I shall be chosen from the emerging technologies.

* Mandatory Course-II is a Non-credit Course (The candidate shall select one course from the list given under MC- II)

# NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA
### SEMESTER VII/VIII*

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*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

**Open Elective – II shall be chosen from the emerging technologies.

***Open Elective III and IV (Shall be chosen from the list of open electives offered by other Programmes).

# Elective - Management shall be chosen from the elective Management courses.

### SEMESTER VIII/VII*

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*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

TOTAL CREDIT: 166
# ELECTIVE - MANAGEMENT

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# MANDATORY COURSES I

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# MANDATORY COURSES II

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### Professional Elective Courses: Verticals

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<th>Vertical 3</th>
<th>Vertical 4</th>
<th>Vertical 5</th>
<th>Vertical 6</th>
<th>Vertical 7</th>
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<tbody>
<tr>
<td>Space Technology</td>
<td>Computational Engineering</td>
<td>Aerodynamics and Propulsion</td>
<td>Aerospace Structures</td>
<td>Satellite Technology</td>
<td>Diversified courses Group 1</td>
<td>Diversified courses Group 2</td>
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<tr>
<td>Cryogenics</td>
<td>Numerical Methods in Fluid Dynamics</td>
<td>Experimental Aerodynamics</td>
<td>Fatigue and Fracture Mechanics</td>
<td>Spacecraft Power Systems</td>
<td>High Temperature Materials</td>
<td>Boundary Layer Theory</td>
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<td>High Temperature Gas Dynamics</td>
<td>Computational Heat Transfer</td>
<td>High Speed Aerodynamics</td>
<td>Experimental Stress Analysis</td>
<td>Satellite Navigation and Control</td>
<td>Machining and Precision Manufacturing</td>
<td>Theory of Elasticity</td>
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<td>Launch Vehicle Aerodynamics</td>
<td>Finite Element Method</td>
<td>Industrial Aerodynamics</td>
<td>Composite Materials and Structures</td>
<td>Spacecraft Sensors and Instrumentation</td>
<td>Design of Non Breathing Engines</td>
<td>Structural Dynamics</td>
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<td>Space Missions</td>
<td>Grid Generation Techniques</td>
<td>Hypersonic Aerodynamics</td>
<td>Aerospace Materials</td>
<td>Spacecraft Dynamics</td>
<td>Smart Materials and Structures</td>
<td>Missile Guidance and Control</td>
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</tbody>
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**Registration of Professional Elective Courses from Verticals:**

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in Semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E./B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2021, Clause 4.10.
# Professional Elective Courses: Verticals

## Vertical 1: Space Technology

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## Vertical 2: Computational Engineering

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## Vertical 3: Aerodynamics and Propulsion

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### VERTICAL 5: SATELLITE TECHNOLOGY

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### GROUP 6: DIVERSIFIED COURSES GROUP 1

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**OPEN ELECTIVES**

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

### OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered other than Faculty of Information and Communication Engineering

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Total: 22  23  26  23  20  22  20  10  166
ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Complete details are available in clause 4.10 of Regulations 2021.

**VERTICALS FOR MINOR DEGREE (In addition to the all the verticals of other programmes)**

<table>
<thead>
<tr>
<th>Vertical I</th>
<th>Vertical II</th>
<th>Vertical III</th>
<th>Vertical IV</th>
<th>Vertical V</th>
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<tr>
<td>Fintech and Block Chain</td>
<td>Financial Management</td>
<td>Foundations of Entrepreneurship</td>
<td>Principles of Public Administration</td>
<td>Statistics For Management</td>
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<tr>
<td>Fundamentals of Investment</td>
<td>Team Building &amp; Leadership Management for Business</td>
<td>Constitution of India</td>
<td>Datamining For Business Intelligence</td>
<td>Sustainable Agriculture and Environmental Management</td>
</tr>
<tr>
<td>Banking, Financial Services and Insurance</td>
<td>Creativity &amp; Innovation in Entrepreneurship</td>
<td>Public Personnel Administration</td>
<td>Human Resource Analytics</td>
<td>Sustainable Bio Materials</td>
</tr>
<tr>
<td>Introduction to Blockchain and its Applications</td>
<td>Principles of Marketing Management For Business</td>
<td>Administrative Theories</td>
<td>Marketing And Social Media Web Analytics</td>
<td>Materials for Energy Sustainability</td>
</tr>
<tr>
<td>Fintech Personal Finance and Payments</td>
<td>Human Resource Management for Entrepreneurs</td>
<td>Indian Administrative System</td>
<td>Operation And Supply Chain Analytics</td>
<td>Green Technology</td>
</tr>
<tr>
<td>Introduction to Fintech</td>
<td>Financing New Business Ventures</td>
<td>Public Policy Administration</td>
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<td>Environmental Quality Monitoring and Analysis</td>
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<td>Integrated Energy Planning for Sustainable Development</td>
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<td>Energy Efficiency for Sustainable Development</td>
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(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)
### VERTICAL 1: FINTECH AND BLOCK CHAIN

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
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### VERTICAL 2: ENTREPRENEURSHIP

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### VERTICAL 3: PUBLIC ADMINISTRATION

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### VERTICAL 4: BUSINESS DATA ANALYTICS

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### VERTICAL 5: ENVIRONMENTAL SUSTAINABILITY

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<tr>
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This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity
Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering /Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

*Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.*

References:
Guide to Induction program from AICTE
OBJECTIVES:

- To improve the communicative competence of learners
- To learn to use basic grammatical structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners’ ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I  INTRODUCTION TO EFFECTIVE COMMUNICATION

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C’s of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

UNIT 1  INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Why/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II  NARRATION AND SUMMATION

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing -- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes & suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III  DESCRIPTION OF A PROCESS / PRODUCT

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV  CLASSIFICATION AND RECOMMENDATIONS

Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal ( chart , graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V  EXPRESSION

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS
LEARNING OUTCOMES:
At the end of the course, learners will be able

- To use appropriate words in a professional context
- To gain understanding of basic grammatical structures and use them in right context.
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS:
1. English for Engineers & Technologists  Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.

MA3151 MATRICES AND CALCULUS L T P C
3 1 0 4

COURSE OBJECTIVES:
- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT - I MATRICES 9 + 3
UNIT - II DIFFERENTIAL CALCULUS 9 + 3

UNIT - III FUNCTIONS OF SEVERAL VARIABLES 9 + 3

UNIT - IV INTEGRAL CALCULUS 9 + 3
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

UNIT - V MULTIPLE INTEGRALS 9 + 3

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to:
- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools in solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS:
3. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :
COURSE OBJECTIVES

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I  MECHANICS


UNIT II  ELECTROMAGNETIC WAVES

- The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III  OSCILLATIONS, OPTICS AND LASERS


UNIT IV  BASIC QUANTUM MECHANICS

- Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS

- The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch’s theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

COURSE OUTCOMES

After completion of this course, the students should be able to

- Understand the importance of mechanics.
- Express their knowledge in electromagnetic waves.
- Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
- Understand the importance of quantum physics.
- Comprehend and apply quantum mechanical principles towards the formation of energy bands.

**TEXT BOOKS:**
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

**REFERENCES:**

**CY3151 ENGINEERING CHEMISTRY**

**COURSE OBJECTIVES:**
- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

**UNIT I WATER AND ITS TREATMENT**

**UNIT II NANOCHEMISTRY**
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.
UNIT III PHASE RULE AND COMPOSITES
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION

UNIT V ENERGY SOURCES AND STORAGE DEVICES
Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles – working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

COURSE OUTCOMES
At the end of the course, the students will be able:
- To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To apply the knowledge of phase rule and composites for material selection requirements.
- To recommend suitable fuels for engineering processes and applications.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

REFERENCES:
GE3151  PROBLEM SOLVING AND PYTHON PROGRAMMING  

L T P C
3 0 0 3

COURSE OBJECTIVES:
- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I  COMPUTATIONAL THINKING AND PROBLEM SOLVING  

UNIT II  DATA TYPES, EXPRESSIONS, STATEMENTS
Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III  CONTROL FLOW, FUNCTIONS, STRINGS
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elf-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV  LISTS, TUPLES, DICTIONARIES
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V  FILES, MODULES, PACKAGES
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter’s age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS
COURSE OUTCOMES:
Upon completion of the course, students will be able to
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

REFERENCES:
5. https://www.python.org/
TEXT-CUM-REFERENCE BOOKS

1. துறுத்து சதுப்பு - தொழில் பரப்புக்குரிய - தொகுதி, பிள்மலை (எசுப்பிள்மலை: துறுத்து வளர்ப்புக்குரிய காலப்பொறியில் கஞ்சி பகுதியில் பொறியில் காலம்).
2. சுந்தரம் நோய் - சிவகார் விளை, காலகத்து. (எசுப்பிள்மலை).
3. பிள்மலை - குன்று விளக்குமுனை கால காலங்கள் துறுத்து காலங்கள் (எசுப்பிள்மலை: துறுத்து பிள்மலை).
4. சுற்றுத்தியாவு - பழுதலூர் கலை (எசுப்பிள்மலை)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
UNIT II  
HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE  
3

UNIT III  
FOLK AND MARTIAL ARTS  
3

UNIT IV  
THINAI CONCEPT OF TAMILS  
3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V  
CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE  
3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலொறு - மக்களும் பண்பொடும் - மக்க. பிள்மள (தவளியீடு:தமிழ்நொடுப்பொடநூல் மற்றும் கல்வியியல் பணி கழகம்).
2. கணினித் தமிழ் - முமனவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. தொல்லியல் தமிழ் - மவட்டங்கள் தமிழ் கல்விகள் (தவளியீடு).
4. பொருள் - கல்விகள் நொகரிகம் (ததொல்லியல் துமறதவளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motobike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building – operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter’s age validity, student mark range validation)
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems.
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.
TEXT BOOKS:

REFERENCES:
5. https://www.python.org/

BS3171           PHYSICS AND CHEMISTRY LABORATORY               L   T   P   C
PHYSICS LABORATORY: (Any Seven Experiments)

COURSE OBJECTIVES:
- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young’s modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS
COURSE OUTCOMES:
Upon completion of the course, the students should be able to
- Understand the functioning of various physics laboratory equipment.
- Use graphical models to analyze laboratory data.
- Use mathematical models as a medium for quantitative reasoning and describing physical reality.
- Access, process and analyze scientific information.
- Solve problems individually and collaboratively.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pHmetry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na₂ CO₃ as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
   - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler’s method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by lodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
13. Preparation of nanoparticles (TiO₂/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES:
- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To analyse and determine the composition of alloys.
- To learn simple method of synthesis of nanoparticles
- To quantitatively analyse the impurities in solution by electroanalytical techniques

TEXT BOOK:
OBJECTIVES:
- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students’ English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I  INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions( filling out a bank application for example).

UNIT II  NARRATION AND SUMMATION
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III  DESCRIPTION OF A PROCESS / PRODUCT
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)- talking about precautions.

UNIT IV  CLASSIFICATION AND RECOMMENDATIONS
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress-talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V  EXPRESSION
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking – making predictions- talking about a given topic-giving opinions-understanding a website-describing processes

LEARNING OUTCOMES:
At the end of the course, learners will be able
- To listen and comprehend complex academic texts
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

ASSESSMENT PATTERN
- One online / app based assessment to test listening /speaking
- End Semester ONLY listening and speaking will be conducted online.
- Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.
OBJECTIVES:
- To engage learners in meaningful language activities to improve their reading and writing skills.
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT I  MAKING COMPARISONS  6
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

UNIT II  EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING  6
Reading - Reading longer technical texts—Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III  PROBLEM SOLVING  6
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNIT IV  REPORTING OF EVENTS AND RESEARCH  6

UNIT V  THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY  6
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

TOTAL : 30 PERIODS

OUTCOMES:
At the end of the course, learners will be able
- To compare and contrast products and ideas in technical texts.
- To identify cause and effects in events, industrial processes through technical texts.
- To analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.
- To report events and the processes of technical and industrial nature.
- To present their opinions in a planned and logical manner, and draft effective resumes in context of job search.

TEXT BOOKS:
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
REFERENCES:

ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.

MA3251 STATISTICS AND NUMERICAL METHODS

COURSE OBJECTIVES:
• This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
• To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
• To introduce the basic concepts of solving algebraic and transcendental equations.
• To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
• To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.
UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:

REFERENCES:

PH3251 MATERIALS SCIENCE

COURSE OBJECTIVES:
- To make the students to understand the basics of crystallography and its importance in studying materials properties.
- To understand the electrical properties of materials including free electron theory, applications of quantum mechanics and magnetic materials.
- To instil knowledge on physics of semiconductors, determination of charge carriers and device applications
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.
UNIT I  CRYSTALLOGRAPHY

UNIT II  ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS

UNIT III  SEMICONDUCTORS AND TRANSPORT PHYSICS

UNIT IV  OPTICAL PROPERTIES OF MATERIALS

UNIT V  NANOELECTRONIC DEVICES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the students should be able to
- know basics of crystallography and its importance for varied materials properties
- gain knowledge on the electrical and magnetic properties of materials and their applications
- understand clearly of semiconductor physics and functioning of semiconductor devices
- understand the optical properties of materials and working principles of various optical devices
- appreciate the importance of functional nanoelectronic devices.

TEXT BOOKS:
REFERENCES:

BE3251  BASIC ELECTRICAL AND ELECTRONICS ENGINEERING   L   T   P   C
                                                 3   0   0   3

COURSE OBJECTIVES:
- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring instruments

UNIT I    ELECTRICAL CIRCUITS
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws – Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state).
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT II   ELECTRICAL MACHINES

UNIT III  ANALOG ELECTRONICS

UNIT IV   DIGITAL ELECTRONICS
Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)

UNIT V    MEASUREMENTS AND INSTRUMENTATION

TOTAL: 45 PERIODS
COURSE OUTCOMES:
After completing this course, the students will be able to
1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines
3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of digital electronics
5. Explain the operating principles of measuring instruments

TEXT BOOKS:

REFERENCES:

GE3251 ENGINEERING GRAPHICS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I PLANE CURVES
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.
UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
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 traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING 6+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Layout of views - Freehand sketching of multiple views from pictorial views of objects. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+12
Sectioning of above 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. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12
Principles of isometric projection — isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method. Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

TOTAL: (L=30; P=60) 90 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
- Use BIS conventions and specifications for engineering drawing.
- Construct the conic curves, involutes and cycloid.
- Solve practical problems involving projection of lines.
- Draw the orthographic, isometric and perspective projections of simple solids.
- Draw the development of simple solids.

TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

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.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

GE3252 தமிழ் ரும் மதொழில்நுட்பம் L T P C
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அலகு I வடிவறமப்பு படமது மநசவும் பொறனத் மதொழில்நுட்பம்: 3

அலகு II வடிவமமப்பு மற்றும் கட்டுமொனங்கள் மற்றும் வீட்டுப் பொருட்களில் வடிவமமப்பு - பொருட்களின் விவரங்கள் - மொமல்லபுச் சிற்பங்களும், மகொவில்களும் - மெொழர் கொலக்களும் - மெொழர் கொலட்டுப் புருமுக்களும் - சிலப்பதிகொரத்தில் மணிகளின் வமககள்.

அலகு III உற்பத்திமுறு நுட்பம்: 3

கப்பல் கட்டும் கமல் - உமலொகவியல் - இரும்மபதுகள், எஃகு - பரளொன்றுகள் இரும்மபதுகள் - கல்மணிகள், கணேணி மணிகள் - சுடுமண் மணிகள் - எலும்புத்துண்டுகள் - சிலப்பதிகொரத்தில் மணிகளின் வமககள்.
TEXT-CUM-REFERENCE BOOKS

1. சாலையை வரையிட்டு - பார்வை பல்கலைக் கழகம் - கல்வியியல் பணிகள் கழகம் (தமிழீடு: சாலையை வரையிட்டு - பார்வை பல்கலைக் கழகம் - கல்வியியல் பணிகள் கழகம்).

2. குடும்பத் தமிழ் - பார்வை பல்கலைக் கழகம் (தமிழீடு: குடும்பத் தமிழ் - பார்வை பல்கலைக் கழகம்).

3. கீழடியை வரையிட்டு - வாழக்கால விளக்கங்கள் - தமிழ் வழிகையளவுக் கூடு நிறுவனம் (தமிழீடு: கீழடியை வரையிட்டு - வாழக்கால விளக்கங்கள் - தமிழ் வழிகையளவுக் கூடு நிறுவனம்).

4. போர்ந்தை ஆண்டுக்கு சாலையை வரையிட்டு (தமிழீடு: போர்ந்தை ஆண்டுக்கு சாலையை வரையிட்டு).

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)


UNIT I WEAVING AND CERAMIC TECHNOLOGY
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.
UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தாமஸ் மார்சூலோனா - மார்சூலோனா பம்பான் ஠ோசேஸ் (தமிழில்: தமிழக மார்சூலோனா பம்பான் ஠ோசேஸ்
2. கணினித் தமிழ் - முமனவர் இல்.சுந்தரம். (தமிழில்: பிரசுரம்).
3. கீழடி - மவமகநதிகமர நொகரிகம் (ததொல்லியல் தவளியீடு)
4. பொருநோன் - ஆற்றங்கமர நொகரிகம். (ததொல்லியல் தவளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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# NCC Credit Course Level 1

## (Army Wing) NCC Credit Course Level - I

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## NCC General

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## National Integration and Awareness

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## Personality Development

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## Leadership

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## Social Service and Community Development

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**Total: 30 Periods**
# NCC CREDIT COURSE LEVEL 1*

NX3252  (NAVAL WING) NCC CREDIT COURSE LEVEL - I

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## NATIONAL INTEGRATION AND AWARENESS

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## PERSONALITY DEVELOPMENT

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## LEADERSHIP

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## SOCIAL SERVICE AND COMMUNITY DEVELOPMENT

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TOTAL: 30 PERIODS
NCC CREDIT COURSE LEVEL 1*

(AIR FORCE WING) NCC CREDIT COURSE LEVEL – I

NX3253  L  T  P  C

NCC GENERAL  6
NCC 1 Aims, Objectives & Organization of NCC  1
NCC 2 Incentives  2
NCC 3 Duties of NCC Cadet  1
NCC 4 NCC Camps: Types & Conduct  2

NATIONAL INTEGRATION AND AWARENESS  4
NI 1 National Integration: Importance & Necessity  1
NI 2 Factors Affecting National Integration  1
NI 3 Unity in Diversity & Role of NCC in Nation Building  1
NI 4 Threats to National Security  1

PERSONALITY DEVELOPMENT  7
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving  2
PD 2 Communication Skills  3
PD 3 Group Discussion: Stress & Emotions  2

LEADERSHIP  5
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code  3
L 2 Case Studies: Shivaji, Jhasi Ki Rani  2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT  8
SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth  3
SS 4 Protection of Children and Women Safety  1
SS 5 Road / Rail Travel Safety  1
SS 6 New Initiatives  2
SS 7 Cyber and Mobile Security Awareness  1

TOTAL : 30 PERIODS
COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump

d) Laying pipe connection to the delivery side of a pump.

e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing.
b) Planing and c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:
a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket

b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater
GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:
  a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
  b) Practicing gas welding.

BASIC MACHINING WORK:
  a) (simple)Turning.
  b) (simple)Drilling.
  c) (simple)Tapping.

ASSEMBLY WORK:
  a) Assembling a centrifugal pump.
  b) Assembling a household mixer.
  c) Assembling an airconditioner.

SHEET METAL WORK:
  a) Making of a square tray

FOUNDRY WORK:
  a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:
  a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:
  a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:
  a) Study an elements of smart phone..
  b) Assembly and dismantle of LED TV.
  c) Assembly and dismantle of computer/ laptop

TOTAL = 60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.
COURSE OBJECTIVES:
- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To train the students to use DSO for measurements.

LIST OF EXPERIMENTS
1. Verification of ohms and Kirchhoff’s Laws.
2. Load test on DC Shunt Motor.
3. Load test on Self Excited DC Generator
4. Load test on Single phase Transformer
5. Load Test on Induction Motor
6. Characteristics of PN and Zener Diodes
7. Characteristics of BJT, SCR and MOSFET
8. Half wave and Full Wave rectifiers
9. Study of Logic Gates
10. Implementation of Binary Adder and Subtractor
11. Study of DSO

TOTAL: 60 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
1. Use experimental methods to verify the Ohm’s and Kirchhoff’s Laws.
2. Analyze experimentally the load characteristics of electrical machines
3. Analyze the characteristics of basic electronic devices
4. Use DSO to measure the various parameters

OBJECTIVES
- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I
Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition, discussing progress toward goals, talking about experiences, talking about past events, Writing: writing emails (formal & semi-formal).

UNIT II
Speaking: discussing news stories, talking about frequency, talking about travel problems, discussing travel procedures, talking about travel problems, making arrangements, discussing plans and decisions, discussing purposes and reasons, understanding common technology terms, Writing: writing different types of emails.

UNIT III
Speaking: discussing predictions, describing the climate, discussing forecasts and scenarios, talking about purchasing, discussing advantages and disadvantages, making comparisons, discussing likes
and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV
Speaking: discussing the natural environment-describing systems-describing position and movement-explaining rules-( example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V
Speaking: describing things relatively-describing clothing-discussing safety issues( making recommendations) talking about electrical devices-describing controlling actions- Writing: job application( Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES
- Speak effectively in group discussions held in a formal/semi formal contexts.
- Write emails and effective job applications.

Assessment Pattern
- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.

MA3351    TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS  L T P C
            3 1 0 4

OBJECTIVES
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I    PARTIAL DIFFERENTIAL EQUATIONS  9+3
Formation of partial differential equations –Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II    FOURIER SERIES  9+3
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.

UNIT III   APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  9+3
Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).
UNIT IV FORUER TRANSFORMS  
9+3

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS  
9+3

TOTAL: 60 PERIODS

OUTCOMES
Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
- To make the student understand the quantitative analysis of machine and processes for transformation of energy and between work and heat.
- To make the student understand the Laws of thermodynamics, would be able to quantify through measurement of related factors.
- To apply the thermodynamic properties, energies and their interactions in real time problems.
- To develop basic concept of air cycle, gas turbine engines and heat transfer.
- To analyse different types of heat transfer.
- To identify the different components of Jet Engines.

UNIT I  FUNDAMENTAL CONCEPT AND FIRST LAW  9
Concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, internal energy, enthalpy, specific heat capacities and heat transfer, SFEE, application of SFEE to jet engine components, First law of thermodynamics, relations between pressure, volume and temperature for various processes, Zeroth law of thermodynamics.

UNIT II  SECOND LAW AND ENTROPY  9

UNIT III  AIR STANDARD CYCLES  9
Otto, Diesel, Dual, Ericsson, Atkinson, Stirling and Brayton cycles - Air standard efficiency – Mean effective pressure.

UNIT IV  FUNDAMENTALS OF VAPOUR POWER CYCLES  9
Properties of pure substances – solid, liquid and vapour phases, phase rule, p-v, p-T, T-v, T-s, h-s diagrams, p-v-T surfaces, thermodynamic properties of steam - calculations of work done and heat transfer in non-flow and flow processes - standard Rankine cycle, Reheat and Regeneration cycle. Heat rate, Specific steam consumption, Tonne of refrigeration.

UNIT V  BASICS OF PROPULSION AND HEAT TRANSFER  9
Classification of jet engines - basic jet propulsion arrangement – Engine station number, thrust equation – Specific thrust, SFC, TSFC, specific impulse, actual cycles, isentropic efficiencies of jet engine components, polytropic efficiency, conduction in parallel, radial and composite wall, Basics of convective and radiation heat transfer.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
- CO1: Apply the laws of thermodynamics in real time problems.
- CO2: Demonstrate the principal operation of piston engines and jet engines.
- CO3: Demonstrate the efficiency of different air standard cycles.
- CO4: Determine the heat transfer in different conditions of working medium.
- CO5: Solve heat transfer problems in complex systems.
- CO6: Solve problems related to conduction convention and radiation.

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COURSE OBJECTIVES:

1. To introduce the students about properties of the fluids, behaviour of fluids under static conditions.
2. To impart basic knowledge of the dynamics of fluids and boundary layer concept.
3. To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends.
4. To expose to the significance of boundary layer theory and its thicknesses.
5. To expose the students to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

UNIT I   FLUID PROPERTIES AND FLOW CHARACTERISTICS  10+3
Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation - Flow characteristics - Eulerian and Lagrangian approach - Concept of control volume and system - Reynold’s transportation theorem - Continuity equation, energy equation and momentum equation - Applications.

UNIT II   FLOW THROUGH PIPES AND BOUNDARY LAYER  9+3
Reynol’d’s Experiment - Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness.

UNIT III  DIMENSIONAL ANALYSIS AND MODEL STUDIES  8+3
Fundamental dimensions - Dimensional homogeneity - Rayleigh’s method and Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.

UNIT IV   TURBINES  9+3

UNIT V   PUMPS  9+3
Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies – Velocity triangles - Work done by the impeller - Performance curves - Reciprocating pump working principle - Indicator diagram and its variations - Work saved by fitting air vessels - Rotary pumps.

TOTAL: 60 PERIODS

OUTCOMES: On completion of the course, the student is expected to be able to

1. Understand the properties and behaviour in static conditions. Also to understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics
2. Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. Also to understand the concept of boundary layer and its thickness on the flat solid surface.
3. Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies
4. Explain the working principles of various turbines and design the various types of turbines.
5. Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps
TEXT BOOKS:

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Low (1) ; Medium (2) ; High (3)
COURSE OBJECTIVES:
1. Ability to think, Analyse and solve Engineering Problems expected from the course.
2. Ability to understand stress and strain concepts related to deformable bodies.
3. To enable understanding of the behaviour and response of materials and to allow the student to carry out easy and moderate level structural analysis of basic structural members.
4. To familiarize with the different methods used for beam deflection analysis.
5. To impart knowledge to the students on how structural elements are sized and to enable the student to gain knowledge in how stresses are developed and distributed internally.

UNIT I CONCURRENT AND NON-CONCURRENT 12
Introduction, Concept of FBD, Coplanar Concurrent force system, Moments, Coplanar Non-Concurrent force system and Support Reactions – Application Problems.

UNIT II SHEAR FORCE AND BENDING MOMENT, SECOND AREA MOMENT PROBLEMS 12
Analysis of Simple Truss, Shear Force and Bending Moment Diagrams, C.G. and M.I of Plane areas.

UNIT III AXIAL BAR AND MATERIAL MODULUS 12

UNIT IV BEAM BENDING AND TORSION 12
Axially loaded members, Statically indeterminate structures, Thermal effects, misfits, and Pre-strains. Torsion of circular bar, Transmission of power by circular shafts. Stresses in beams, Pure bending and Nonuniform bending, Design of beams for bending stresses, Shear stresses in beams of rectangular cross section.

UNIT V STRESS TRANSFORMATION, DEFLECTION OF BEAM AND BUCKLING OF COLUMN 12
Plane stress, Principal stresses, Mohr’s circle and Hooke’s law for plane stresses. Spherical and Cylindrical pressure vessels. Deflection of beams, Column buckling.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon completion of the course, Students will be able to
CO1: Clear understanding of mechanical behaviour of materials.
CO2: Knowledge of different structural members and load types.
CO3: Design members under axial loading.
CO4: Design member under torsion loading.
CO5: Calculate beams deflections.

TEXT BOOKS:
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Low (1) ; Medium (2) ; High (3)

AS3301 ELEMENTS OF AEROSPACE ENGINEERING

OBJECTIVES:

- Use the standard atmosphere tables and equations.
- Find lift and drag coefficient data from NACA plots.
- Apply the concept of static stability to flight vehicles.
- Describe the concepts of stress, strain, Young’s modulus, Poisson’s ratio, yield strength.
- Demonstrate a basic knowledge of dynamics relevant to orbital mechanics.

UNIT I STANDARD ATMOSPHERE

History of aviation – standard atmosphere - pressure, temperature and density altitude.

UNIT II AERODYNAMICS

Aerodynamic forces – Lift generation Viscosity and its implications - Shear stress in a velocity profile - Lagrangian and Eulerian flow field - Concept of a streamline – Aircraft terminology and geometry - Aircraft types - Lift and drag coefficients using NACA data.

UNIT III PERFORMANCE AND PROPULSION

Viscous and pressure drag - flow separation - aerodynamic drag - thrust calculations -Thrust/power available and thrust/power required.

UNIT IV AIRCRAFT STABILITY AND STRUCTURAL THEORY


UNIT V SPACE APPLICATIONS

History of space research - spacecraft trajectories and basic orbital manoeuvres - six orbital elements - Kepler’s laws of orbits - Newton’s law of gravitation.

TOTAL: 45 PERIODS
OUTCOMES:
- Illustrate the history of aviation & developments over the years
- Ability to identify the types & classifications of components and control systems
- Explain the basic concepts of flight & Physical properties of Atmosphere
- Identify the types of fuselage and constructions.
- Distinguish the types of Engines and explain the principles of Rocket

TEXT BOOKS:

REFERENCE:

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

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AS3302  FLIGHT SYSTEMS  L T P C  3 0 0 3

OBJECTIVES:
- To describe the principle and working of flight systems and instruments.
- To interpret the basics of guided missile systems.
- To outline the basics of spacecraft systems.
- To learn the concepts of engine systems
- To make students aware of flight control systems

UNIT I  FLIGHT CONTROL SYSTEMS  9
UNIT II  FLIGHT SYSTEMS
9
Hydraulic systems, Components – Hydraulic system controllers – Modes of operation –
Pneumatic systems – Working principles – Typical Air pressure system – Brake system –
Typical Pneumatic power system, Components – Landing Gear systems – Classification –
Shock absorbers – Retractive mechanism – Rocket Separation mechanism.

UNIT III  ENGINE SYSTEMS
9
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  GUIDED MISSILE SYSTEMS
9
Introduction – Airframe – Propulsion System – Types of Control Systems – Gyroscope and
its types – Roll and Lateral Control System – Fin Actuation Servos – Roll and Lateral
Autopilot – Guidance System.

UNIT V  SPACECRAFT SYSTEMS
9
Basics: Structure – Power – Thermal - Communications and Data Handling - Propulsion
System - Attitude Stabilisation and Control.

TOTAL = 45 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
• Describe the controls and operation of an aircraft.
• Interpret how the aircraft systems are maintained.
• Explain the systems available in the aircraft engines.
• Classify the systems available in a missile.
• Describe the basics of systems available in a spacecraft.

TEXT BOOKS:

REFERENCES:
2004.
2. “General Hand Books of Airframe and Powerplant Mechanics”, U.S. Dept. of
Transportation, Federal Aviation Administration, The English Book Store, New Delhi,
1995.
OBJECTIVES:

- To study the mechanical properties of materials when subjected to different types of loading.
- To study how to improve the material properties.
- To understand the nature of materials under microscopic Examination

STRENGTH OF MATERIALS

LIST OF EXPERIMENTS
1. Tension test on a mild steel rod
2. Double shear test on Mild steel and aluminum rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
10. Tempering - Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples

OUTCOMES:

- Analyse the Hardness and Tensile strength of the given material
- Examine the deformation and torsion strength of the given material
- Analyse the compression and shear strength of the given materials

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

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<td>Universal Tensile Testing machine with double 1 shear attachment –</td>
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<td>Torsion Testing Machine (60 NM Capacity)</td>
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<td>Spring Testing Machine for tensile and compressive loads (2500N)</td>
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<td>Metallurgical Microscopes</td>
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<td>Muffle Furnace (800C)</td>
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</table>
THERMODYNAMICS LABORATORY

OBJECTIVE:
- To study the engine types and its performance
- To understand the importance of heat transfer and its application.
- To understand the fuel properties.

LIST OF EXPERIMENTS
1. Performance test on a 4-stroke engine
2. Valve timing of a 4-stroke engine and port timing of a 2-stroke engine
3. Determination of effectiveness of a parallel flow heat exchanger
4. Determination of effectiveness of a counter flow heat exchanger
5. Determination of heating value of a fuel
6. Determination of specific heat of solid
7. Determination of thermal conductivity of solid.
8. Determination of thermal resistance of a composite wall.
9. COP test on a vapour compression refrigeration test rig
10. COP test on a vapour compression air-conditioning test rig

TOTAL: 60 PERIODS

OUTCOMES:
- Perform test on diesel/petrol engine
- Determine the properties of the fuels.
- Analyze the heat transfer properties of solid and composite walls

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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CO2 3 2 2 - 2 1 1 1 2 3 3 2 2 3 2 2 2 2
CO3 3 3 2 1 2 1 - 2 3 1 1 1 2 1 2 6 1 1

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<td>1.</td>
<td>4 stroke twin cylinder diesel engine</td>
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<td>2.</td>
<td>Cut section model of 4 stroke diesel engine and cut section model of 2 stroke petrol engine</td>
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<td>3.</td>
<td>Parallel and counter flow heat exchanger test rig</td>
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<td>Bomb Calorimeter</td>
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<td>5.</td>
<td>Vapour compression refrigeration test rig</td>
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<td>6.</td>
<td>Vapour compression air-conditioning test rig</td>
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<td>7.</td>
<td>Conductive heat transfer set up</td>
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<td>8.</td>
<td>Composite wall</td>
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</table>
COURSE OBJECTIVE:
- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices.
- Also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

LIST OF EXPERIMENTS

A. FLOW MEASUREMENT
1. Verification of Bernoulli’s theorem
2. Flow through Orifice/Venturi meter
3. Friction factor for flow through pipes
4. Impact of jet on fixed plate

B. METACENTRE
5. Determination of metacentric height

C. PUMPS
6. Characteristics of Centrifugal pump
7. Characteristics of Gear pump
8. Characteristics of Submersible pump
9. Characteristics of Reciprocating pump

D. TURBINES
10. Characteristics of Pelton wheel turbine
11. Characteristics of Francis turbine

TOTAL : 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to

CO1 Verify and apply Bernoulli equation for flow measurement like Orifice/Venturi meter.
CO2 Measure friction factor in pipes and compare with Moody diagram and verify momentum conservation law.
CO3 Determine the performance characteristics of Rotodynamic pumps.
CO4 Determine the performance characteristics of positive displacement pumps.
CO5 Determine the performance characteristics of turbines.

REFERENCES:

<table>
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<tr>
<th>PO/PSO</th>
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<tr>
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<td>CO1: M</td>
<td>CO2: H</td>
</tr>
<tr>
<td>PO2 Problem analysis</td>
<td>CO1: M</td>
<td>CO2: H</td>
</tr>
<tr>
<td>PO3 Design / development of solutions</td>
<td>CO1: L</td>
<td>CO2: L</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates; widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD:
Hours
Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL:
Hours
Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc..)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

**MS POWERPOINT:**

**Hours**
Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

**TOTAL: 30 PERIODS**

**OUTCOMES:**
On successful completion the students will be able to

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.
OBJECTIVES

- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.

UNIT I VECTOR CALCULUS

Gradient and directional derivative – Divergence and curl – Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral – Area of a curved surface – Volume integral – Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT II ANALYTIC FUNCTION

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions $w = z + c$, $a$, $z^2$ - Bilinear transformation.

UNIT III COMPLEX INTEGRATION


UNIT IV LAPLACE TRANSFORMS


UNIT V ORDINARY DIFFERENTIAL EQUATIONS


OUTCOMES:

Upon successful completion of the course, students should be able to:

- Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem.
- Appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate line, surface and volume integrals in simple coordinate systems.
- Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities.
- Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
TEXT BOOKS

REFERENCES

AS3401 AERODYNAMICS

OBJECTIVES:

- To recall the governing equations of fluid mechanics.
- To understand the behaviour of airflow over bodies with particular emphasis on aerofoil sections in the incompressible and compressible flow regime.
- To introduce the Navier Stroke equations and its application
- To make the student understand the concept of vorticity, irrotationality, theory of airfoil and wing sections.
- To illustrate the conformal transformation and to extend the wing theory.
- To compare the interactions of shocks and expansion waves in fluid flow.

UNIT I INTRODUCTION TO LOW-SPEED FLOW
Incompressible Bernoulli’s equation – circulation and vorticity – Green’s lemma and Stoke’s theorem – barotropic flow – Kelvin’s theorem.

UNIT II TWO DIMENSIONAL FLOWS
Basic flows – Source, Sink, Free and Forced Vortex, Uniform, and Parallel Flow and their combinations – Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows.

UNIT III CONFORMAL TRANSFORMATION

UNIT IV AIRFOIL AND WING THEORY
UNIT V  
SHOCKS AND EXPANSION WAVES  

9


OUTCOMES:
On successful completion of this course, the student will be able to

- Calculate the airspeed, static and dynamic pressure of the flow at any point using Continuity and Bernoulli equations.
- Illustrate the effect of airflow on an aircraft and its components using the laws of physics and fundamental mathematical methods
- Solve lift generation problems using aerofoil theories
- Apply the conformal transformation and its application to fluid flow problems
- Examine the fluid flow characteristics over aerofoils, wings, and airplanes.
- Examine the shock phenomenon and fluid waves.

TEXT BOOKS:

REFERENCES:

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<th>PO1</th>
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<th>PO3</th>
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COURSE OBJECTIVES:

Of this course are

1. To provide the students an understanding of linear static analysis of determinate and indeterminate aircraft structural components.
2. To introduce the advanced concepts in the stress analysis of beams.
3. To impart knowledge and enable the student work out a variety of problems in structural analysis applying energy principles.
4. To impart knowledge on column theory and practical column design.
5. To allow the student to differentiate between various failures theories and appropriately apply a failure theory in design.

UNIT I BEAM & TRUSS ANALYSIS

Built-Up Beams – Composite Beams – Transformed-Section Method – Types of Statically Indeterminate Beams – Use of The Principle of Superposition – Analysis of Continuous Beams – Clapeyron’s 3-Moment equation – Plane Frame Analysis – Truss Analysis in 2-D & 3-D.

UNIT II ENERGY METHODS


UNIT III BUCKLING OF COLUMNS


UNIT IV FAILURE ANALYSIS


UNIT V DESIGN OF JOINTS


TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, Students will be able to

CO1: Solve problems in Beam & Frame Analysis.
CO3: Solve problems in column buckling and carry out stability analysis.
CO4: Use appropriate failure theories for structural mechanics problems.
CO5: Design different types of Joint under different loading conditions.
| CO1 | 3  | 3  | 2  | 3  | 2  | -  | 1  | -  | -  | 1  | 3  | 3  | 1  | 1  |
| CO2 | 3  | 3  | 2  | 1  | 1  | -  | 1  | -  | -  | 1  | 3  | 3  | 1  | 1  |
| CO3 | 3  | 3  | 2  | 2  | 2  | -  | 1  | -  | -  | 1  | 3  | 3  | 1  | 1  |
| CO4 | 3  | 3  | 2  | 3  | 1  | -  | 2  | -  | -  | 1  | 3  | 3  | 1  | 1  |
| CO5 | 3  | 3  | 2  | 3  | 2  | 1  | 1  | -  | -  | 1  | 3  | 3  | 1  | 1  |
| Avg. | 3  | 3  | 2  | 2.4 | 1.6 | 0.2 | 1.2 | -  | -  | -  | 1  | 3  | 3  | 1  | 1  |

**TEXT BOOKS:**

**REFERENCES:**

**AS3403**

**AEROSPACE PROPULSION - I**

**OBJECTIVES:**
- To understand the principles of operation of aircraft propulsion systems.
- To extend the performances of aircraft propulsion systems.
- To introduce the working of different types of compressors and solve complex problems
- To introduce the working of different types of turbines and solve complex problems
- To understand the combustion process in Jet Engines
- To understand the basics of integral ram-rocket and its performance.

**UNIT I**

**SUBSONIC AND SUPERSONIC INTAKES**


**UNIT II**

**CENTRIFUGAL AND AXIAL FLOW COMPRESSORS**

Principle of operation – Work done and pressure rise – diffuser – Compressibility effects – non-dimensional quantities for plotting compressor characteristics – Centrifugal compressor characteristics.
Basic operation – Elementary theory – Factors affecting stage pressure ratio – Blockage in the compressor annulus – Degree of reaction – Three-dimensional flow – Calculation of stage performance – Compressibility effects – Axial compressor characteristics.

**UNIT III**

**AXIAL AND RADIAL FLOW TURBINES**

UNIT IV  COMBUSTION CHAMBERS AND NOZZLES


UNIT V  RAMJET PROPULSION


OUTCOMES:

On successful completion of this course, the student will be able to

- Calculate the forces produced by aircraft propulsion systems using control volume and momentum equation.
- Solve complex problems in compressors used in aircraft.
- Solve complex problems in turbines used in aircraft
- Determine the phenomena which characterize the fluid dynamic behaviour of air-breathing propulsion systems.
- Determine the approximate use parameters of an existing gas turbine engine.
- Model ramjet operations, features, and problems associated with it.

TEXT BOOKS:


REFERENCES:


<table>
<thead>
<tr>
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<td>CO5</td>
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<td>CO6</td>
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TOTAL = 45 PERIODS
COURSE OBJECTIVES:
1. To understand the principles in the formation of mechanisms and their kinematics.
2. To learn the basic concepts of toothed gearing and kinematics of gear trains.
3. To study the effect of friction in different machine elements.
4. To analyse the forces and torque acting on simple mechanical systems.
5. To understand the importance of balancing and vibration.

UNIT I KINEMATIC ANALYSIS IN SIMPLE MECHANISMS AND CAMS 9

UNIT II TOOTHED GEARING AND GEAR TRAINS 9

UNIT III FRICTION ASPECTS IN MACHINE COMPONENTS 9

UNIT IV STATIC AND DYNAMIC FORCE ANALYSIS 9

UNIT V BALANCING OF ROTATING MASSES AND VIBRATION 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Design the linkages and the cam mechanisms for specified output motions.
CO2: Determine the gear parameters of toothed gearing and speeds of gear trains in various applications.
CO3: Evaluate the frictional torque in screw threads, clutches, brakes and belt drives.
CO4: Determine the forces on members of mechanisms during static and dynamic equilibrium conditions.
CO5: Determine the balancing masses on rotating machineries and the natural frequencies of free and forced vibratory systems

TEXT BOOK

REFERENCES
GE3451          ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

UNIT I          ENVIRONMENT AND BIODIVERSITY

UNIT II          ENVIRONMENTAL POLLUTION

UNIT III          RENEWABLE SOURCES OF ENERGY

UNIT IV          SUSTAINABILITY AND MANAGEMENT
Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V           SUSTAINABILITY PRACTICES

TOTAL: 30 PERIODS
TEXT BOOKS:
5. Bradley, A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.

REFERENCE BOOKS:

AS3411 LOW AND HIGH SPEED AERODYNAMICS LABORATORY

OBJECTIVES:
• To study experimentally the aerodynamic forces on different bodies at low and high speeds.
• To predict different aerodynamic propulsion used in aero application
• To study airfoil and wing characteristics

LIST OF EXPERIMENTS:
1. Calibration of subsonic wind tunnel.
2. Illustrate the Pressure distribution over smooth and rough cylinder.
3. Illustrate the Pressure distribution over symmetric aerofoils.
4. Illustrate the Pressure distribution over cambered aerofoils & thin aerofoils.
5. Measure the forces acting on a model using wind tunnel balance.
6. Demonstrate the flow over a flat plate at different angles of incidence.
7. Show the flow visualisation studies in low speed flows over cylinders.
8. Show the flow visualisation studies in low speed flows over aerofoil with different angle of incidence.
10. Show the Supersonic flow visualization with Schlieren system.

TOTAL: 60 PERIODS
OUTCOMES:
On successful completion of this course, the student will be able to:

CO1: Experiment with the wind tunnel for wall effect, blockage and support interference on the measurements as well as determining the uncertainty in the measurement technique.

CO2: Determine the pressure distribution and forces acting over aerodynamical models.

CO3: Explain flow over the aerodynamical model through flow visualisation.

CO4: Illustrate the limits and usefulness of the experimental approach.

CO5: Demonstrate the experimental findings in clear oral and concise report.

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<td>Wind Tunnel</td>
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<td>2</td>
<td>Wings of various aerofoil sections</td>
<td>2 Nos. each</td>
<td>3, 4</td>
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<tr>
<td>3</td>
<td>Angle of incidence changing mechanism</td>
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<tr>
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<td>Multiple Manometer stands</td>
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<td>Wooden Models of Three-Dimensional bodies</td>
<td>2 Nos. each</td>
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<tr>
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<td>Hele-Shaw apparatus, Smoke Tunnel, Water flow channel</td>
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<td>Wooden models of cone, wedge and blunt body</td>
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<td>configurations of suitable size for flow visualization in a</td>
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<td>15</td>
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OBJECTIVE:
- To experimentally study the unsymmetrical bending of beams,
- To find the location of shear centre
- To obtain the stresses in circular discs and beams using photo elastic techniques
- To calibration of photo-elastic materials and study on vibration of beams.

LIST OF EXPERIMENTS:
1. Unsymmetrical bending of beams.
2. Find the shear centre location for open sections.
3. Find the shear centre location for closed sections.
4. Experiment the constant strength beam.
5. Draw the flexibility matrix for cantilever beam.
6. Beam with combined loading.
8. Stresses in circular discs and beams using photo-elastic techniques.
10. Experiment with the Wagner beam – Tension field beam.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- Evaluate the effects of bending in the aerospace structures.
- Explain the shear centre of the aerospace structures.
- Compare the photo-elastic techniques on the aerospace structures.
- Justify the experimental findings in clear oral and concise report.

LIST OF EQUIPMENTS
(For a batch of 30 students)

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<td>1, 2, 3</td>
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<td>Weights 2 Kg</td>
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<td>Strain indicator and strain gauges</td>
<td>One set</td>
<td>4, 5, 6</td>
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<td>8</td>
<td>Photo – elastic apparatus</td>
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<td>7, 8</td>
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<td>9</td>
<td>Amplifier</td>
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<td>Exciter</td>
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<td>Pick – up</td>
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<td>Oscilloscope</td>
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<td>14</td>
<td>Hydraulic Jack</td>
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