

AIRCRAFT MATERIALS

DETAILED SYLLABUS

OBJECTIVES

It aims at enabling the student to understand & analyze various types of materials for use in aircraft industry.

UNIT- I INTRODUCTION TO AIRCRAFT MATERIALS

SELECTION OF MATERIALS- Introduction: Importance, factors influencing selection- Availability, cost, -Reliability and compact ability- Engineering Consideration- Strength- Weight- Working properties- Joining properties- Fatigue strength- Mechanical or physical properties of Materials- Stress- Strain- Tensile strength- Elastic limit- Proportional limit- Proof stress- Yield strength- Yield point- Elongation- Reduction of area- Modulus of Elasticity- Stiffness- Resilience- Toughness- Hardness- Brittleness- Malleability- Ductility- Elasticity- Density- Fusibility- Conductivity

UNIT- II AIRCRAFT MATERIALS AND THEIR PROPERTIES

Commonly used Aircraft materials and their properties- Steel- Constituents of steel: Basic constituents, their affect on steel- Types of Steel: Brief descriptions of- Plain carbon steel- Alloy steel- Low alloy steel- High alloy steel- High-speed tool steels- Stainless steels- Types of stainless steels: Brief description of composition, properties of- Steel numbering system- SAE (Society of Automobile Engineering) steel numbering system- Copper and its alloys:- Importance and basic need for copper alloys for aircrafts- Different Types of copper alloys- Brass- Muntz steel- Manganese Bronze- Naval Brass- Red boran- Bronze-, Gunmetal- Aluminium Bronze-, Nickel alloys: - Importance and basic need for nickel alloys for aircrafts- Inconel- Monel- K-monel- Aluminum Alloys:-Classification of aluminum alloys- Non Heat treatable Alloys and their properties- Formability-Weldability- Resistance to corrosion- Heat Treatable Alloys and their properties:-- Formability of alloys- Weld ability- Titanium Alloys and their properties- Super alloys and their properties:-- Nickel base super alloys- Cobalt base alloys- Iron base super Alloys

UNIT III: COMPOSITE AND OTHER MATERIALS

COMPOSITE, MATERIALS:- Introduction to composite materials- Classification of Composites-, First level of classification (with respect to matrix constituents)-,Second level of classification (with respect to reinforcement form of fiber in composite) Comparison of

composite materials with metal Advantages of composites Commonly used fibers Matrix and functions of matrix in a composite material- Carbon matrix, Metallic Matrices and ceramic matrices- Joining of composites:- Mechanically fastened joints- Adhesive or bonded joints- Defects of composites- Prepeg Defects- Manufacturing defects- In-service Defects- Environmental defects- OTHER MATERIALS- Glass, Plastics and Rubber- Shatter proof glass- Tempered glass- Thermoplastics and thermosets- Use of rubber in Aircraft

UNIT- IV CORROSION AND ITS PREVENTION

Introduction and Conditions for corrosion- Development of corrosion: general process of corrosion- Factors influencing corrosion- Forms of corrosion- Uniform corrosion- Pitting corrosion- Galvanic corrosion- Material selection- metallic, non metallic, metal purification- Coatings- metallic, inorganic, organic- Design- Drainage, stress avoidance, Avoiding dissimilar metal Avoiding Crevices, Avoiding exposure to air- Environmental control- Temperature- Velocity- Oxygen- Concentration- Inhibition- Cleaning- Medium change

UNIT- V MATERIAL FAILURES AND TESTING

Introduction to material failures (material and components)- Fracture, types of fracture (ductile and brittle)- Fatigue, Definition, Explanation of fatigue, Relation between number of cycles of operation and Fatigue failure- Factors affecting fatigue, Component design, Nature of environment- MATERIALS DESTRUCTIVE TESTING- Introduction and various testing methods in brief:- Tension testing- Determination of elastic limit- Proof- stress determination- Yield point determination- Divider method- Drop of beam method- Hardness testing: methods available are:- Brinell hardness- Rockwell hardness- Vickers or diamond pyramid Hardness- Shore scleroscope Hardness testing- Bending Tests:-Introduction- Impact tests: Standard impact tests, IZOD tests , Charpy test- Fatigue testing- NON DESTRUCTIVE TESTING(NDT)- Introduction and Purpose- Types of Defects: inherent, processing and service- N D T methods:, Surface Inspection Techniques, Penetration test, Magnetic Particle Test- Internal Inspection Techniques, Radiography Test, Ultrasonic Test, Eddy current Test

UNIT- VI INTRODUCTION TO ADVANCED MATERIALS

Advanced Materials- Thermo plastics- Aluminium Lithium Alloy- Shape memory Alloys- Ceramics- Nano materials.

TEXT BOOKS

Aircraft materials and processes. By. George Titterton

Diploma, Anna University-UG, PG., HSC & SSLC

Notes

Syllabus

Question Papers

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REFERENCES

1. Aircraft materials and processes. By. George Titterton
2. FAA publication AC65 9A
3. Advanced Composites By. Cyndy Foreman