

AEC-801

FINITE ELEMENT METHODS

UNIT I INTRODUCTION TO FEM AND ITS APPLICABILITY

Review of mathematics: Matrix algebra, Gauss elimination method, Uniqueness of solution, Banded symmetric matrix and bandwidth. Structure analysis Two-force member element, Local stiffness matrix, coordinates transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix.

UNIT II ONE-DIMENSIONAL FINITE ELEMENT ANALYSIS

Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, General steps of FEM, Finite element model concept /Discretization, Derivation of finite elements equations using potential energy approach for linear and quadratic 1-D bar element and beam element, shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain.

UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS

Finite element formulation using three noded triangular (CST) element and four noded rectangular element, Plane stress and Plain strain problems, Shape functions, node numbering and connectivity, Assembly, Boundary conditions, Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation of stress and strain.

UNIT IV FINITE ELEMENT FORMULATION

Method of Weighted Residuals ,Collocation, Sub domain method, Least Square method and Galerkin's method, Application to one dimensional problems, one-dimensional heat transfer, etc. introduction to variation formulation (Ritz Method.)

UNIT V HIGHER ORDER ELEMENTS

Lagrange's interpolation formula for one and two independent variable, Convergence of solution, compatibility, element continuity, static condensation, p and h methods of mesh refinement, Aspect ratio and element shape, Application of FEM, Advantages of FEM, Introduction to concept of element mass matrix and Damping matrix in dynamic analysis, Calculation of natural frequencies and modes.

TEXT BOOK

1. Text Book of Finite Element Analysis, Seshu P., Prentice Hall India.
2. Finite Element Procedure in Engineering Analysis, Bathe K.J., Prentice Hall India.

REFERENCE BOOKS

1. An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw-Hill, New Delhi.
2. Concepts & Applications of Finite Element Analysis, Cook, Malkus, Plesha and Witt, Willey India, New Delhi.
3. Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall.

LIST OF EXPERIMENTS

1. Write flow chart of finite element steps.
2. Study and understand the convergence of the problem.
3. Solve stiffness matrix for bar, beam and frame problems using suitable boundary condition.
4. Plane stress and plane strain condition are used to understand 2d structures.
5. Analysis of beams and frames (bending problems)
6. Analysis of beams and frames (torsion problems)
7. Nodal analysis problem.
8. Heat transfer problems.
9. Problems leading to analysis of three dimensional solids.
10. Problems leading to analysis of axisymmetric solids.

AEC -802

AVIONICS

UNIT I INTRODUCTION

Need for avionics in civil and military aircraft and space systems – Integrated avionics and weapon systems – Typical avionics subsystems, design, technologies.

UNIT II PRINCIPLE OF DIGITAL SYSTEMS

Digital computer – Microprocessors – Memories.

UNIT III AVIONICS ARCHITECTURE

Avionics system architecture – Data buses – MIL – STD - 1553B – ARINC – 420 – ARINC – 629.

UNIT IV FLIGHT DECKS AND COCKPITS SYSTEM

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

UNIT V INTRODUCTION TO AVIONICS SYSTEMS

Communications systems- Navigation systems – Flight control systems – Radar –Electronic Warfare – Utility systems Reliability and maintainability – Certification.

TEXT BOOKS

1. Middleton, D.H., Ed., Avionics systems, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
2. Spitzer, C.R. Digital Avionics Systems, Prentice-Hall, Englewood Cliffs, N.J., U.S.A. 1987.

REFERENCES

1. Malvino, A.P. and Leach, D.P. Digital Principles and Applications, Tata McGraw-Hill, 1990.
2. Gaokar, R.S. Microprocessors Architecture-Programming and Applications, Wileyand Sons Ltd., New Delhi, 1990.

LIST OF EXPERIMENTS

1. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.
2. Study of Different Avionics Data Buses.
3. MIL-Std - 1553 Data Buses Configuration with Message transfer.
4. MIL-Std - 1553 Remote Terminal Configuration.
5. Multiplexer/ Demultiplexer Circuits.
6. Encoder/Decoder Circuits.
7. Timer Circuits, Shift Registers, Binary Comparator Circuits.
8. Addition and Subtraction of 8-bit and 16-bit numbers.
9. Greatest in a given series & Multi-byte addition in BCD mode.
10. Interface programming with 4 digit 7 segment Display & Switches & LED's

AEC -803(A)

INDUSTRIAL AERODYNAMICS

UNIT I ATMOSPHERIC WIND

Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height, Structure of turbulent flows.

UNIT II WIND TURBINE

Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.

UNIT III VEHICLE AERODYNAMICS

Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and Hovercraft.

UNIT IV BUILDING AERODYNAMICS

Pressure distribution on low rise buildings, wind forces on buildings. Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics.

UNIT V AIR FLOW INDUCED VIBRATIONS

Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, galloping and stall flutter.

TEXT BOOKS

1. M. Sovran (Ed), "Aerodynamics and drag mechanisms of bluff bodies and road vehicles", Plenum press, New York, 1978.
2. P. Sachs, "Winds forces in engineering", Pergamon Press, 1978.

REFERENCES BOOKS

1. R.D. Blevins, "Flow induced vibrations", Van Nostrand, 1990.
2. N.G. Calvent, "Wind Power Principles", Charles Griffin & Co., London, 1979.

AEC 803(B)

AGILE MANUFACTURING

UNIT I AGILE MANUFACTURING

Definition, business need, conceptual frame work, characteristics, generic features. Enterprise, Strategies, integration of organization, workforce and technology, reference models, examples.

UNIT II INTEGRATION OF PRODUCT

Principles, Robust design approach, Approaches to enhance ability in manufacturing, Role of QFD, Managing people in agile organization, Approaches.

UNIT III APPLICATION OF AGILE MANUFACTURING AND SUPPLY CHAIN MANAGEMENT

Strategies, Management of complexities and information, flow, approaches, applications of multimedia to improve agility in manufacturing, system concepts. Principles, IT/IS concepts in supply chain management, enterprise integration and management in agile manufacturing, concepts, Agility, Adaptability and learners – comparison of concepts.

UNIT IV COMPUTER CONTROL OF AGILE MANUFACTURING

CAPP for Agile Manufacturing, Aggregate capacity planning and production line design / redesign in Agile manufacturing, Cellular manufacturing, concepts, examples, Strategies.

UNIT V DESIGN OF SKILL & KNOWLEDGE

Enhancing technology for Machine tool system, Resumption of design requirement geometry, definition, methods, decision support for selection of cutting parameters, design enhancements, parametric approach only. Strategic options in agile manufacturing, Role of standards.

TEXT BOOKS

1. A. Gunasekaran, Agile Manufacturing: The 21st Century Competitive Strategy ,1st Edition, 2001

REFERENCE BOOKS

1. Joseph C Montgomery and Lawrence O Levine, Transition to Agile Manufacturing, Jan 1996
2. David M Anderson and B Joseph, Agile Product Development for Mass Customization, McGraw-Hill, 1997.

AEC - 803 (C)

AIRCRAFT PRODUCTION

UNIT I INTRODUCTION

Function of process planning (Methods). Organizing for process is planning - place in production planning and control. Relationship with other departments. Tool engineering. Heat Treatment: Final and intermediary heat treatment operations carried out on aircraft materials (both ferrous and non-ferrous) and the equipment used, the importance of test pieces. Finishing by anodizing. General activities carried out in manufacturing and assembly shops, machine shop, sheet metal shop, welding shop, plastic shop and assembly shop.

UNIT II PROCESS SHOP

Theory of planting, finishing processes carried on aircraft materials - planting and finishing equipment. Jigs and Fixtures: Importance of special production tools used in manufacturing activity of various types of jigs and fixtures used in aircraft industry. Difference between jigs and fixtures. Design consideration. Choice of materials. Types of assembly fixtures such as table box, picture-frame, next and so on. Typical jigs for wings, fuselage and control surfaces, jigs and fixtures for turning, milling and drilling. Universal tooling.

UNIT III CUTTING TOOLS

Theory of metal cutting. Typical types of cutting tools used in the manufacturing shops, the advantages, of tipped tools. Ceramic tools, tool life, optimum cutting speeds and feeds, factors limiting speeds, feeds and cuts. New development in cutting tools, use of DBN Diamond, ceramics and coating on cutting tools
Inspection

UNIT IV GAUGES AND EQUIPMENT

Various inspection gauges in the manufacturing shops and their application. Fits. limits and tolerances, engineering reference systems, station and datum lines, chord and fuselage reference lines, lofting airfoils, use of templates, test equipment used in aircraft production, necessity for and importance of interchangeability media, application of inter-change-ability media viz., acceptance gauges, reference gauges, aperture gauges. Use of digital read out on measuring tools.

UNIT V PROCESS PLANNING

Definition of mass and batch production, various types of charting techniques viz., operation process chart, flow process chart etc., definition of planning breakdown and its importance, factors to be considered for process planning, comparison of methods, simple exercise on process planning - simple machine shop and sheet metal components. Different approaches in process planning during pre-production and production phases.

TEXT BOOKS

1. M L Begman. Manufacturing process, Media Promoters
2. ASTME, Tooling for Aircraft and Missile Manufacture

REFERENCE BOOKS

1. Sachs, Sheet Metal Fabrication
2. S C Keshu and K K Ganapathy, Aircraft Production Technology and Management, Interline 1993

AEC - 804 (A)

AIR NAVIGATION & COMMUNICATION

UNIT I INTRODUCTION

The Aircraft, Aids of Navigation VOR, ADF, ILS, MLS,GCA, DME, TACAN. Doppler and basics of inertial navigation inertial reference system, their limitations and uses. Weather, Air Traffic Control, communications, GPS, TACAS, ATC Interrogation Radar. The Earth: Its Form & Features: Principle Physical Features of the Earth, Latitude, Sidereal Time. The Seasons, Climate, Duration of daylight, Chart Projection for Air Navigation: The Round Earth on a Flat Chart. Properties obtainable in Projection. Distance on Sphere. Direction on a Sphere. The Lambert Projection. The Mccrator Projection, the Gnomonic Projection. The Stereographic Projection. Projections for Weather Charts. Calculation on Rhumb Line Tracks and distances.

UNIT II MAGNETISM

Review of the Elementary laws of magnetism. Terrestrial magnetism, Horizontal and vertical components of earth's magnetic field and their variation with latitude. Isogonic and agonic lines. Isoclinic lines. Aircraft Magnetism; Resolution into P,Q and R components, coefficients and deviation associated with them, compass course deviation.

UNIT III INSTRUMENTS

Units of measurement of distances and height. The function of navigational Instruments. The Speed Indicator. The Rate of Climb indicator. The Altimeter. The magnetic Compass. The Turn and Bank indicator. The Directional Gyro. The Artificial Horizon. Radio, Radar Altimeter, Mach meter, Fluxgate Compass ADI, HSI and RMI. Chart Reading : Distinctive Properties of Charts. The importance of chart reading. Topographic Information. Aeronautical Data. Legend and written Notes.

UNIT IV CELESTIAL NAVIGATION

Elements of Astronomy; the universe; Solar system, movements of earth, moon and planets, earth's orbit; Kepler laws, declination, altitude, azimuth etc. Practical Value, Accuracy, Simplicity, Basic principles. The Line of position. Celestial Coordinates. Determining the Greenwich Hour Angle (GHA) Determining the Local Hour Angle (LHA). A Line of position from Polaris. A Line of Position from an Unidentified Star. Radio Time Signals. Identification of Stars, Star Names, Brightness of Star. The planets. Motion of the Stars and Planets. The Practice of Celestial Navigation. Astro-Navigation instruments.

UNIT V THE PRACTICE OF NAVIGATION

Details of Navigation. Preparation of Charts for use in Flight Pilotage. Contact Instrument Flying. Future Air Navigation system(FANS), Cruise controls, Flight planning using charts and tables, Extended Range Operations, Aircraft Performance. Pressure Pattern Flying. Text Books and Reference

TEXT BOOKS

1. J E Hitercock, Navigation for Pilots, Airlife Publishing 1997
2. R B Underdown, Ground Studies for Pilots, Vol.3, Blackwell

REFERENCE BOOKS

1. Trevor Thom, Air Navigation, Airlife Publishing
2. A E Bramson and N H Birch, Radio Navigation for Pilots, Airlife Publishing 1984

AEC - 804 (B)

FUELS & COMBUSTION

UNIT I CHARACTERIZATION

Fuels –Types and Characteristics of Fuels –Determination of Properties of Fuels –Fuels Analysis – Proximate and Ultimate Analysis –Moisture Determination –Calorific Value –Gross & Net Calorific Values –Calorimetry–DuLong’s Formula for CV Estimation –Flue gas Analysis –Orsat Apparatus –Fuel, Ash Storage & Handling –Spontaneous Ignition Temperatures.

UNIT II SOLID FUELS & LIQUID FUELS

(a) Solid Fuels Types –Coal Family –Properties –Calorific Value –ROM, DMMF, DAF and Bone Dry Basis –Ranking –Bulk & Apparent Density –Storage –Washability –Coking & Caking Coals –Renewable Solid Fuels –Biomass –Wood Waste –Agro Fuels –Manufactured Solid Fuels.

(b) Liquid Fuels Types –Sources –Petroleum Fractions –Classification –Refining –Properties of Liquid Fuels: Calorific Value, Specific Gravity, Flash & Fire Point, Octane Number, Cetane Number –Alcohols –Tar Sand Oil –Liquefaction of Solid Fuels.

UNIT III GASEOUS FUELS

Classification –Composition & Properties –Estimation of Calorific Value –Gas Calorimeter –Rich & Lean Gas –Wobbe Index –Natural Gas –Dry & Wet Natural Gas –Stripped NG –Fouland Sweet NG –LPG –LNG –CNG –Methane –Producer Gas –Gasifiers –Water Gas –Town Gas –Coal Gasification –Gasification Efficiency –Non-Thermal Route –Biogas –Digesters –Reactions –Viability –Economics.

UNIT IV COMBUSTION: STOICHIOMETRY & KINETICS

Stoichiometry –Mass Basis and Volume Basis –Excess Air Calculation –Fuel & Flue Gas Compositions –Calculations –Rapid Methods –Combustion Processes –Stationary Flame –Surface or Flameless Combustion –Submerged Combustion –Pulsating & Slow Combustion Explosive Combustion –Mechanism of Combustion –Ignition & Ignition Energy –Spontaneous Combustion –Flame Propagation –Solid, Liquid and Gaseous Fuels Combustion –Flame Temperature –Theoretical, Adiabatic & Actual –Ignition Limits –Limits of Inflammability.

UNIT V COMBUSTION EQUIPMENTS

Coal Burning Equipments –Types –Pulverized Coal Firing –Fluidized Bed Firing –Fixed Bed and Recycled Bed –Cyclone Firing –Spreader Stokers –Vibrating Grate Stokers –Sprinkler Stokers –Traveling Grate Stokers –Oil Burners –Vaporizing Burners –Atomizing Burners –Design of Burners –Gas Burners –Atmospheric Gas Burners –Air Aspiration Gas Burners –Burners. Classification according to Flame Structures –Factors Affecting Burners & Combustion.

TEXT BOOKS

1. Samir Sarkar, “Fuels & Combustion”, Second Edition, Orient Longman, 1990
2. Bhatt, “Vora Stoichiometry”, Second Edition, Tata Mcgraw Hill, 1984

REFERENCES BOOKS

1. Blokh AG, “Heat Transfer in Steam Boiler Furnace”, Hemisphere Publishing Corp., 1988
2. Civil Davies, “Calculations in Furnace Technology”, Pergamon Press, Oxford, 1966
3. Sharma SP, Mohan Chander, “Fuels & Combustion”, Tata Mcgraw Hill, 1989

AEC - 804 (C)

MAINTENANCE OF RADIO & COMMUNICATION SYSTEMS

UNIT I ELECTRICAL CABLE AND RESISTORS

Basics of the application and identification of electrical cables used in Aircraft radio installation, crimping and soldering techniques, bonding continuity and insulation tests. Composition, performance (stability and tolerance) and limitations of the fixed resistors and varistors (carbon composition, carbon film, wire wound and metallic film).

UNIT 2 AC AND DC MEASURING INSTRUMENTS

Electrical power distribution systems, the operation and construction of static inverters, rotary inverters and transformer rectifier units. Basics of interference caused by electrical and ignition system to radio apparatus, methods of minimizing or suppressing such interference, bonding and screening.

UNIT III CONSTRUCTION AND IDENTIFICATION OF VARIOUS TYPES OF ANTENNAS

; the voltage and current distribution along antenna of various length; characteristics of ground planes. Very high frequency (VHF) and high frequency (HF) airborne communications; frequency bands allocation; the methods of propagation and the ranges expected, both day and night; calculation of approximate range of communication (line of sight) with given data. The performance levels expected and specifications of typical airborne HF and VHF communication systems; the principle of operation, installation practices and procedures, functioning of the operating controls and indications and maintenance of typical HF and VHF communication transceivers. Theory of operation, performance level and specifications of an Audio Integration System.

UNIT IV BATTERY

Working principles and testing of Lead Acid and Nickel Cadmium and Silver Zinc batteries Principles, Characteristics and operation of the under mentioned systems: Automatic Direction Finder (ADF) Systems, Very High Frequency (VHF) Omni, Directional Range System.

UNIT V BASIC RADIO SYSTEMS

Instrument Landing Systems, Weather Radar Systems, Microwave Devices, Air Traffic Control (ATC) Transponder System, Omega Navigation System, Radio Altimeter Systems, Cockpit Voice Recorder. Distance Measuring Equipment, Doppler Navigation System, Microwave Landing System, GPWS, Emergency Locator Transmitters. Computers, Simulators. Flight Control Systems. Basics of state-of-the-art communication and navigation systems. Principles of Satellite Communications and its application to aircraft.

TEXT BOOKS

1. RF Hansforde, Heywood and Company London: Radio Aids to Civil Aviation.
2. George Kennedy: Electronic Communication System, McGraw Hill
3. Brian Kendal: Manual of Avionics, Blackwell.

REFERENCE BOOKS

1. Dennis Reddy and John Cooler: Electronic Communication, Prentice Hall of India, New Delhi.
2. J. Powell: Aircraft Radio Systems, Himalayan Books

AEC - 805 (A)

RENEWABLE ENERGY SOURCES

UNIT I INTRODUCTION

Energy demand growth and supply: Historical Perspectives; Fossil fuels: Consumption and Reserve ; Environmental Impacts of Burning of Fossil fuels ; Sustainable Development and Role of Renewable Energy.

UNIT II SOLAR ENERGY

Solar geometry; Primary and Secondary Solar energy and Utilization of Solar Energy. Characteristic advantages and disadvantages. Low temperature applications: solar water heating, space heating, drying. Solar concentrators and tracking; Dish and Parabolic trough concentrating generating systems, Central tower solar thermal power plants; Solar Ponds. Basic principle of power generation in a PV cell ; Band gap and efficiency of PV cells ; Manufacturing methods of mono- and poly-crystalline cells ; Amorphous silicon thin film cells, Single and multi-junction cells ; Application of PV ; Brief outline of solar, PV stand-alone system design ; Storage and Balance of system.

UNIT III WIND ENERGY SYSTEMS

Types of turbines, Coefficient of Power, Betz limit, Wind electric generators, Power curve; wind characteristics and site selection; Wind farms for bulk power supply to grid; Potential of wind electricity generation in India and its current growth rate.

UNIT IV BIOMASS AND GEOTHERMAL ENERGY

Biomass-Sources and Characteristics; Wet biogas plants; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems; Maintenance of gasifiers. Geothermal sites in India; High temperature and Low temperature sites ; Conversion technologies- Steam and Binary systems ; Geothermal power plants.

UNIT V OCEAN ENERGY

Tidal power plants, single basin and two basis plants, Variation in generation level, Ocean Thermal Electricity Conversion (OTEC) ; Electricity generation from Waves : Shoreline and Floating wave systems.

TEXT BOOKS

1. Twidell J and Weir T., Renewable Energy Resources, Taylor & Francis
2. Godfrey Boyle, Renewable energy, Oxford Press.

REFERENCES BOOKS

1. V.V.N. Kishore, Renewable Energy engineering and Technology: Principles and Practice, TERI Press.
2. Rai G.D., Non-Conventional Energy Sources, Khanna publication

AEC - 805 (B)

CYBER SECURITY

UNIT I COMPUTER ORGANIZATION & ARCHITECTURE AND OPERATING SYSTEMS

Computer Organization, Architecture, Operating Systems, Process Management, CPU Scheduling, I/O Memory Management, file systems and deadlocks. LAN, MAN, WAN, ISO/OSI seven layer architecture.

Unit II INFORMATION SECURITY FUNDAMENTALS

Background, Importance, statistics, national and international scenarios. Identification and authentication, confidentiality, privacy, integrity, non-repudiation. Goals of security: prevention, detection and recovery. E-commerce security. Critical Infrastructure Protection.

Unit III SECURITY THREATS AND VULNERABILITIES

Overview of security threats, various kinds of threats; Authentication-weak passwords. Insecure internet connection-internet cookies, viruses and other infections. Security of hard drives, security of laptops; sniffers, backdoors and Trojans. Buffer overflow and other programming bugs. Common attacks-DoS, man-in-the-middle, brute force attacks.

UNIT IV OVERVIEW OF SECURITY PRINCIPLES

Security policies and procedures, International standards, Security consideration of OS-OS hardening-Internet protocols and security: SSL/TLS, IP Security, Application layer security-Access Control: Physical, Logical and Biometric-Tools and Techniques: Firewalls, Antivirus, IDS, Log analysis, Cryptography, steganography-Security Infrastructure: PKI, VPN, Digital signature-Network scanners, vulnerability scanners-Device Security-Cloud computing security, Database security.

UNIT V CYBER CRIMES

Cyber crimes, Cyber crime Investigation, and Cyber forensic tools. Cyber Laws.Information Technology Act, Cyber laws and cyber-crime investigation. Social networks and analysis.

TEXT BOOKS

- 1.Thomas Calabres and Tom Calabrese, "Information Security Intelligence:Cryptographic Principles & Application", Thomson Delmar Learning, 2004.
- 2.Bernadette H Schell, Clemens Martin, "Cyber Crime", ABC-CLIO Inc, California,2004.
- 3.Swidorski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.
- 4.William Stallings and Lawrie Brown, "Computer Security: Principles and Practice",Prentice Hall, 2008.

REFERENCE BOOKS

1. Silberschatz A, Galvin P, Gagne G, "Operating Systems Concepts", John Wiley & Sons,Singapore,2006.
2. Principles and Practices of Information Security byMichael.E. Whiteman and Herbert .J.Mattord.
3. Cyber Laws by Aparna Viswanathan.
- 4.Joseph M Kizza, "Computer Network Security", Springer Verlag, 2005

AEC - 805 (C)

CRYOGENIC ENGINEERING

UNIT I-INTRODUCTION

Insight on Cryogenics –Properties of Cryogenic fluids –Material properties at Cryogenic Temperatures – Applications of Cryogenics in Space Programs –Superconductivity –CryoMetallurgy –Medical applications.

UNIT II-LIQUEFACTION CYCLES

Carnot Liquefaction Cycle –F.O.M. and Yield of Liquefaction Cycles –Inversion Curve –JouleThomson Effect –Linde Hampson Cycle –Precooled Linde Hampson Cycle –Claudes Cycle Dual Cycle –Ortho-Para hydrogen conversion –Eollins cycle –Simpson cycle –CriticalComponents in Liquefaction Systems.

UNIT III-SEPARATION OF CRYOGENIC GASES

Binary Mixtures –T-C and H-C Diagrams –Principle of Rectification –Rectification Column Analysis – McCabe Thiele Method –Adsorption Systems for purification.

UNIT IV-CRYOGENIC REFRIGERATORS

J.T.Cryocoolers –Stirling Cycle Refrigerators –G.M.Cryocoolers –Pulse Tube Refrigerators Regenerators used in Cryogenic Refrigerators –Dilution refrigerators –Magnetic Refrigerators.

UNIT V-HANDLING OF CRYOGENS

Cryogenic Dewar –Cryogenic Transfer Lines –Insulations used in Cryogenic Systems –Instrumentation to measure Flow –Level and Temperature

TEXT BOOKS

1. Klaus D. Timmerhaus and Thomas M. Flynn, "Cryogenic Process Engineering", Plenum Press, 1989.
2. Randall F. Barron, "Cryogenic Systems", McGraw-Hill, 1985.

REFERENCES BOOKS

1. Scott R.B., "Cryogenic Engineering", Van Nostrand and Co., 1962.
2. Herald Weinstock, "Cryogenic Technology", 1969.
3. Robert W. Vance, "Cryogenic Technology", Johnwiley & Sons, Inc.,

AEC- 806

INDUSTRIAL TRAINING PROJECT-II

The focus of the Industrial Training Project-II is on preparing a working system or some design or Understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any).

AEC- 807
GENERAL PROFICIENCY

This course objective is to develop the ability to handle all the tasks associated with the job and Ethics refers to behavior that adheres to societal norms and human conscience. In other words, a way of working that is honest and transparent.