AEC-701
ROCKETS AND MISSILES

UNIT-I ROCKETS SYSTEM

Types of Ignition System in rockets and types of Igniters – Igniter Design. Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines. Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems–Propellant Slash and Propellant Hammer–Elimination of Geysering Effect in Missiles–Combustion System of Solid Rockets.

UNIT-II AERODYNAMICS OF ROCKETS AND MISSILES

Airframe Components of Rockets and Missiles – Forces Acting on a Missile While Passing Through Atmosphere– methods of Describing Aerodynamic Forces and Moments – Lateral Aerodynamic Moment – Lateral Damping Moment and Longitudinal Moment of a Rocket – lift and Drag Forces – Drag Estimation – Body Upwash and Downwash in Missiles.

UNIT-III MOTION IN SPACE AND GRAVITATIONAL FIELD

One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields–description of Vertical, Inclined and Gravity Turn Trajectories– Determination of range and Altitude Simple Approximations to Burnout Velocity.

UNIT-IV STAGING AND CONTROL

Rocket Vector Control – Methods – Thrust determination – SITVC – Multistaging of rockets – Vehicle Optimization – Stage Separation Dynamics – Separation Techniques.

UNIT-V MATERIALS USED FOR ROCKETS AND MISSILES

Selection of Materials –Special Requirements of Materials to Perform under Adverse Conditions.

TEXT BOOKS

1. Sutton G. P, “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 1993.
2. Cornelisse, J.W., “Rocket Propulsion and Space Dynamics”, J.W., Freeman & Co. Ltd., London, 1982.

REFERENCES

1. Mathur, M., and Sharma, R.P., “Gas Turbines and Jet and Rocket Propulsion”, Standard Publishers, New Delhi 1998.
2. Parker, E. R., “Materials for Missiles and Spacecraft”, McGraw-Hill Book Co. Inc., 1982.
3. M. J. Zucrow, “Missile Propulsion”, John Wiley & sons.
4. H. S. Mukunda, “Understanding Aerospace Chemical Propulsion”, Interline Publishing Company Bangalore.

LIST OF EXPERIMENT

1. Determination of heat of combustion of Liquid fuels
2.To determine flash point and fire point of diesel, Pensky-Martins Apparatus.
3.To determine the effect of temperature on Kinematic Viscosity of glycerin by Redwood Viscometer.
4. Proximate Analysis of wax and coke.
5. To determine the calorific value of solid fuel using Bomb Calorimeter.

AEC-702
COMPUTATIONAL FLUID DYNAMICS

UNIT-I FUNDAMENTAL OF COMPUTATIONAL FLUID DYNAMICS

Introduction - Basic Equations of Fluid Dynamics - Incompressible In viscid flows: Source, vortex and doublet panel, methods - lifting flows over arbitrary bodies. Mathematical properties of Fluid Dynamics Equations -Elliptic, Parabolic and Hyperbolic equations - Well posed problems - Discretization of partial Differential Equations -Transformations and grids.

UNIT-II PANEL METHODS

Introduction to Panel Methods – Source panel method – Vortex panel method – advantages of Panel Methods and Applications.

UNIT-III DISCRETIZATION

Boundary layer Equations and methods of solution -Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation –Stability properties of explicit and implicit methods - Conservative upwind discretization for Hyperbolic systems.

UNIT-IV FINITE ELEMENT TECHNIQUES

Finite Element Techniques in Computational Fluid Dynamics; introduction - Strong and Weak Formulations of a Boundary Value Problem-Strong formulation–Weighted Residual Formulation-Galerkin Formulation - Weak Formulation – Variational Formulation - Piecewise defined shape functions - Implementation of the FEM.

UNIT-V FINITE VOLUME TECHNIQUES

Finite Volume Techniques - Cell Centered Formulation - ~ Lax - Vendor off Time Stepping - Runge - Kutta Time Stepping - Multi - stage Time Stepping -Accuracy- Cell Vertex Formulation - Multistage Time Stepping - FDM -like Finite Volume Techniques - Central and Up-wind Type Discretizations - Treatment of Derivatives.

TEXT BOOK

1. Fletcher, C.A.J., “Computational Techniques for Fluid Dynamics”, Vols. I and II, Springer - Verlag, Berlin, 1988.
2. “Computational Fluid Dynamics”, T. J. Chung, Cambridge University Press, 2002.

REFERENCES

1. John F. Wendt (Editor), “Computational Fluid Dynamics - An Introduction”, Springer – Verlag, Berlin, 1992.
2. Charles Hirsch, “Numerical Computation of Internal and External Flows”, Vols. I and II, John Wiley & Sons, New York, 1988.
3. Klaus A Hoffmann and Steve T. Chiang. “Computational Fluid Dynamics for Engineers”, Vols. I & II Engineering Education System, P.O. Box 20078, W. Wichita, K.S., 67208 – 1078 USA, 1993.
4. Anderson, John D., “Computational Fluid Dynamics”, McGraw-Hill, 1995.

LIST OF EXPERIMENT

1. Introduction to Modeling and Simulation Software to Aerodynamic problems.
2. Solution for the one dimensional wave equations using explicit method of Lax Using Finite Difference Method (code development)
3. Solution for the one dimensional Heat Conduction Equation using Explicit Method using Finite Difference Method (Code Development)
4. Generation of the Algebraic Grid (Code Development)
5. Generation of the Elliptic Grids (Code Development)
6. Numerical Simulation of flow over an airfoil using commercial software Packages.
7. Numerical Simulation of supersonic flow over a Wedge using commercial Software packages.
8. Numerical Simulation of flat Plate Boundary Layer using commercial Software packages.
9. Numerical Simulation of laminar flow through pipe using commercial Software packages.
10. Numerical Simulation of flow past cylinder using Commercial Software packages.

AEC-703
AIRCRAFT DESIGN

UNIT-I PRELIMINARIES

Aircraft Design Requirements, specifications, role of users. Aerodynamic and Structural Consideration, Importance of weight. Airworthiness requirements and standards. Classifications of airplanes. Special features of modern airplane. Air Loads in Flight: Symmetrical measuring loads in flight, Basic flight loading conditions, Load factor, Velocity - Load factor diagram, gust load and its estimation, Structural limits.

UNI-II AIRPLANE WEIGHT ESTIMATION

Weight estimation based on type of airplane, trends in wing loading, weight-estimation based on mission requirements, iterative approach. Basic Wing Design: Selection of airfoil selection, influencing factors. Span wise load Distribution and plan form shapes of airplane wing. Stalling take-off and landing Considerations. Wing drags estimation. High lift devices. Structural Design: Cockpit and aircraft passenger cabin layout for different categories, types of associated structure, features of light airplanes using advanced composite materials. Structural aspects of design of airplane, Bending moment and shear force diagram. Design principles of all metal stressed skin wing for civil and military applications.

UNIT-III LANDING GEARS

Different kinds of landing gears, and associated arrangement for civil and military airplanes. Preliminary calculations for locating main and nose landing gears.

UNIT-IV INTEGRATION OF STRUCTURE AND POWER PLANT

: Estimation of Horizontal and Vertical tail volume ratios. Choice of power plant and various options of locations, considerations of appropriate air-intakes. Integration of wing, fuselage, empennage and power plant. Estimation of center of gravity.

UNIT-5 INTRODUCTION OF ADVANCED CONCEPTS:

Supercritical Wings, relaxed static Stability, controlled configured vehicles, V/STOL aircraft and rotary wing vehicles. Design and layout of flying controls and engine controls.

TEXT BOOK

1. Daniel P Raymer, Aircraft Design: A conceptual approach, AIAA Series, 1992.
2. John D Anderson (Jr.), Airplane Performance and Design, mcgraw Hill.

REFERENCE BOOKS

1. L M Nicholal, Fundamentals of airplane Design, Univ. Of Dayton DHIO.
2. Aircraft Design K.D.Wood, Johnson Publishing Company.

LIST OF EXPERIMENTS

To introduce and develop the basic concept of aircraft design. Each student is assigned with the design of an Airplane for given preliminary specifications. The following are the Assignments to be carried out:

1. Comparative configuration study of different types of airplanes.
2. Comparative study on specification and performance details of aircraft.
3. Preparation of comparative data sheets.
4. Work sheet layout procedures.
5. Comparative graphs preparation and selection of main parameters for the design.
6. Preliminary weight estimations, selection of main parameters.
7. Power plant selection, Airfoil selection, Wing tail and control surfaces.
8. Preparation of layouts of balance diagram and three view drawings.
9. Estimation of various Drags.
10. Detailed performance calculations and stability estimates.

AEC - 704 (A)
HYDRAULICS AND PNEUMATICS

UNIT I INTRODUCTION TO HYDRAULIC POWER AND PUMPS

Review of fluid mechanics, Pascal's Law, structure of hydraulic control system. pumps: pumping theory, pump classification, gear pumps- external and internal type, vane pumps- simple, balanced, pressure compensated types, piston pumps- radial and axial (both swash plate and bent axis type), pump performance. Hydraulic Actuators and Motors: Linear hydraulic actuators - single acting, double acting, tandem cylinder, telescopic rod cylinder, mechanics of hydraulic cylinder loading, cylinder cushioning, hydraulic rotary actuators, hydrostatic transmission – open and close circuit, performance of hydraulic motor.

UNIT II CONTROL COMPONENTS IN HYDRAULIC SYSTEMS

directional control valves (DCV), constructional features, center configuration in 4/3 DC open, closed, tandem, regenerative, floating center configuration, actuation of DCVs- manual, mechanical, solenoid, and indirect actuation, relays for the solenoid operation, check valve, pilot check valve, pressure control valves – direct and pilot operated types, pressure reducing valve, flow control valves fixed throttle, and variable throttle, throttle check valve, pressure compensated flow control valve- relief and reducing type.

UNIT III HYDRAULIC CIRCUIT DESIGN AND ANALYSIS

control of single and double acting hydraulic cylinder, regenerative circuit, counter balance valve application, cylinder sequencing circuits, cylinder synchronizing circuits, speed control of hydraulic cylinder – meter in and meter out, speed control of hydraulic motors, relay circuit design for the operation of solenoid directional control valve- single and double solenoid relay circuit .

UNIT IV INTRODUCTION TO PNEUMATIC CONTROL

choice of working medium, characteristics of compressed air, structure of pneumatic control system , supply, signal generators, signal processor, final control elements , actuators, production of compressed air – compressors - reciprocating and rotary type, preparation of compressed air – driers, filters, regulators, lubricators, distribution of compressed air – piping layout.

UNIT V ACTUATORS AND CONTROLS

Pneumatic Actuators , Valves: linear cylinder – types, conventional type of cylinder – working, directional control valve, shuttle valve, quick exhaust value, twin pressure valve, direct and indirect actuation of pneumatic cylinder, memory valve, time delay valve. Pneumatic circuits and logic circuits: supply air and exhaust air throttling, will dependent circuits, travel dependent controls – types – construction – practical applications, cylinder sequencing circuits, travel step diagrams, practical examples involving two or three cylinders, use of logic functions – OR, AND, NOR, NAND,YES, NOT functions in pneumatic applications, practical examples involving the use of logic functions.

TEXT BOOK

1 Andrew Parr, Hydraulics and Pneumatics, Butterworth-Heinemann, 2nd Edition, 1999

REFERENCE BOOKS

1 Andrew Parr, Hydraulics and Pneumatics: A Technician's and Engineer's Guide 3rd Edition,

AEC - 704 (B)
GUIDANCE AND NAVIGATION

UNIT -I INTRODUCTION

Introduction Concepts of navigation, guidance and control. Introduction to basic principles. Air data information. Radar Systems Principle of working of radar. MTI and Pulse Doppler radar. Moving target detector. Limitation of MTI performance. MTI from a moving platform (AMTI).

UNIT -II TRACKING WITH RADAR

Mono pulse tracking. Conical scan and sequential lobbing. Automatic tracking with surveillance radar (ADT). Other Guidance Systems Gyros and stabilized platforms. Inertial guidance and Laser based guidance. Components of Inertial Navigation System. Imaging Infrared guidance. Satellite navigation. GPS.

UNIT -III DYNAMIC ANALYSES

Transfer Functions Input-output Transfer function. Basic altitude reference. Concepts of Open loop and Close Loop. Missile Control System Guided missile concept. Roll stabilization. Control of aerodynamic missile. Missile parameters for dynamic analysis. Missile autopilot schematics. Acceleration command and root locus.

UNIT -IV MISSILE GUIDANCE

Missile Guidance Proportional navigation guidance; command guidance. Comparison of guidance system performance. Bank to turn missile guidance.

UNIT -V CONTROL SYSTEMS

Integrated Flight/Fire Control System Director fire control system. Tracking control laws. Longitudinal flight control system. Lateral flight control system. Rate of change of Euler angle, Auto Pilot.

TEXT BOOK

1.Pierre T. Kabamba, Anouck R. Girard, Fundamentals of Aerospace Navigation and Guidance (Cambridge Aerospace Series) 1st Edition.

REFERENCE BOOKS

1.D. Biezad, Integrated Navigation and Guidance Systems (AIAA Education Series

AEC - 704 (C)
FLIGHT TESTING

UNIT -I INTRODUCTION

Sequence, Planning and governing regulations of flight testing. Aircraft weight and center of gravity, flight testing tolerances. Method of reducing data uncertainty in flight test data - sources and magnitudes of error, avoiding and minimizing errors. Flight test instrumentation: Planning flight test instrumentation, Measurement of flight parameters. Onboard and ground based data acquisition system. Radio telemetry.

UNIT -II PERFORMANCE FLIGHT TESTING

Range, endurance and climb: Airspeed – in flight calibration. Level flight performance for propeller driven aircraft and for Jet aircraft - Techniques and data reduction. Estimation of range, endurance and climb performance. Performance flight testing -take-off, landing, turning flight: Maneuvering performance estimation. Take-off and landing - methods, procedures and data reduction.

UNIT -III STABILITY AND CONTROL

Longitudinal and maneuvering Static & dynamic longitudinal stability: - methods of flight testing and data reduction techniques. Stick free stability methods. Maneuvering stability methods & data reduction.

UNIT -IV STABILITY AND CONTROL IN LATERAL AND DIRECTIONAL

Lateral and directional Lateral and directional static & dynamic stability: - Coupling between rolling and yawing moments. Steady heading slide slip. Definition of Roll stability. Adverse yaw effects. Aileron reversal. Regulations, test techniques and method of data reduction.

UNIT -V FLYING QUALITIES

MIL and FAR regulations. Cooper-Harper scale. Pilot Rating. Flight test procedures. Hazardous flight testing: Stall and spin- regulations, test and recovery techniques. Test techniques for flutter, vibration and buffeting

TEXT BOOK

Ralph D. Kimberlin, Flight Testing of Fixed Wing Aircraft (AIAA Education Series) Hardcover – 31 Jul 2003

REFERENCES BOOK

Vaughan Askue, Flight Testing Homebuilt Aircraft 1st Edition

AEC - 705 (A)
REFRIGERATION & AIR CONDITIONING

UNIT I INTRODUCTION

Introduction to Refrigeration – Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification – Nomenclature – ODP & GWP.

UNIT II VAPOUR COMPRESSION REFRIGERATION SYSTEM

Vapor compression cycle: p-h and T-s diagrams – deviations from theoretical cycle – subcooling and super heating- effects of condenser and evaporator pressure on COP- multipressure system – low temperature refrigeration – Cascade systems – problems. Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.

UNIT III OTHER REFRIGERATION SYSTEMS

Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration – Magnetic – Vortex and Pulse tube refrigeration systems**.**

UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams**.**

UNIT V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls.

TEXT BOOK

1 Arora, C.P., “Refrigeration and Air Conditioning”, 3rd edition, McGraw Hill, New Delhi, 2010.

REFERENCES BOOK

1. Roy J. Dossat, “Principles of Refrigeration”, 4th edition, Pearson Education Asia, 2009.
2. Stoecker, W.F. and Jones J. W., “Refrigeration and Air Conditioning”, McGraw Hill, New Delhi, 1986.
3. ASHRAE Hand book, Fundamentals, 2010 4. Jones W.P., “Air conditioning engineering”, 5th edition,Elsevier Butterworth-Heinemann, 2001

AEC - 705 (B)
AEROSPACE QUALITY ASSURANCE

UNIT -I QUALITY CONTROL

Definitions of quality, quality control and inspection, difference between quality control and inspection. Drawbacks of inspection. Concept of total quality control, quality characteristic, variables and attributes. Collection and organizing data. Histograms, measurement of variability.

UNIT -II STATISTICS CONTROL

Frequency distribution, normal or Gaussion distribution relative frequency, change and assignable causes, meaning of state statistical control measures of location and dispersions. Control charts for individual measurements, average and range interpretation of control charts, calculation of control limits, standard deviation. Test of significance of means. Regression analysis. Definition of process capability, specification, inter-relationship of tolerance, fits and clearances, chance errors of measurement, procedures for studying process capability of machines and processes.

UNIT -III Total quality control

Organizing for quality control of incoming material, control of process, evaluation of product and quality audit. Quality control organization: Manpower requirements, Solutions, testing and training. Improving quality mindedness: Seminar, appraisal talks, inplant training, exhibitions, posters, vendor relations. Vendor quality rating. Selection of vendors. Establishing of Vendor Quality Standards. Exchange of information. Inspection of vendor material, technical assistance to vendor.

UNIT -IV MEASUREMENTS & NDT

Conflict in measurements, maintaining accuracy of instruments, design of measuring equipment, accuracy of inspection. Non Destructive Tests for both metallic and non metallic material by radiography ultrasonic methods, magnetic particle inspection eddy current, dye penetrant and visual inspection, acoustic emission etc. Defect investigation and analysis.

UNIT -V METROLOGY

Knowledge of instruments and devices of accurate physical dimensional checks covering linear measurements, intricate geometric shapes, contours and profiles. Internal and external diameters of screw threads etc and gear testing. Measuring surface roughness, flatness and clearance between mating surfaces.

TEXT BOOKS

1. T R Banga, N K Agarwal and S C Sharma, IE and M Science, Khanna Publishers
2. Ravi Shankar, Industrial Engineering and Management, Galgotia
3. John S Oakland and Roy F Followell, Statistics Process Control, EWP

REFERENCE BOOKS

1. Dinesh Kumar, Industrial Engineering Management, Galgotia
2. J M Juran and F M Gryna, Quality Planning and Analysis, Tata McGraw Hill
3. S Dalela, Mansoor Ali, IE and MS, Standard Publishers

AEC - 705 (C)
OPTIMISATION TECHNIQUES

UNIT -I INTRODUCTION

Non-linear programming. Mathematical fundamentals. Numerical evaluation of gradient. Unconstrained Optimization: One dimensional, single variable optimization. Maximum of a function. Unimodal-Fibonacci method. Polynomial based methods.

UNIT -II UNCONSTRAINED MINIMIZATION:

Multivariable functions. Necessary and sufficient conditions for optimality. Convexity. Steepest Descent Method - Convergence Characteristics. Conjugate Gradient Method. Linear programming -Simplex Method.

UNIT -III CONSTRAINED MINIMIZATION

Non-linear programming. Gradient based methods. Rosens`s gradient, Zoutendijk`s method, Generalized reduced gradient, Sequential quadratic programming. Sufficient condition for optimality.

UNIT -IV DIRECT SEARCH METHODS

Direct search methods for nonlinear optimization. Cyclic coordinate search. Hooke and Jeeves Pattern search method. Generic algorithm. Discrete And Dynamic Programming: Integer and discrete programming. Branch and bound algorithm for mixed integers. General definition of dynamic programming problem. Problem modeling and computer implementation. Shortest path problem.

UNIT -V OPTIMIZATION APPLICATION:

Transportation problem. Transportation simplex method. Network problems. Maximum flow in networks. General definition of dynamic programming. Problem modeling and computer implementation. Finite Element Based Optimization : Parameter optimization using gradient methods - Derivative calculation. Shape optimization. Topology optimization of continuum structures.

TEXT BOOK

1. George Leitmann, Optimization Techniques, Volume 51st Edition, ISBN: 9780080955131,Academic Press

REFERENCES BOOK

1. Foulds, L. R., Optimization Techniques an Introduction, springer

AEC - 706 (A)
MICRO AND SMART SYSTEMS TECHNOLOGY

UNIT I INTRODUCTION

Microsystems versus MEMS, Why micro fabrication?, smart materials, structures and systems, integrated Microsystems, applications of smart materials and Microsystems.

UNIT II MICRO SENSORS ACTUATORS, SYSTEMS AND SMART MATERIALS

Silicon capacitive accelerometer, piezoresistive pressure sensor, conduct metric gas sensor, an electrostatic combo-drive, a magnetic micro relay, portable blood analyzer, piezoelectric inkjet print head, micro mirror array for video projection, smart materials and systems.

UNIT III MICROMACHINING TECHNOLOGIES

silicon as a material for micro machining, thin film deposition, lithography, etching, silicon micromachining, specialized materials for Microsystems, advanced processes for micro fabrication.

UNIT IV MODELING OF SOLIDS IN MICROSYSTEMS

Bar, beam, energy methods for elastic bodies, heterogeneous layered beams, bimorph effect, residual stress and stress gradients, Poisson effect and the anticlastic curvature of beams, torsion of beams and shear stresses, dealing with large displacements, In-plane stresses. Modeling of coupled electromechanical systems: electrostatics, Coupled Electro-mechanics: statics, stability and pull-in phenomenon, dynamics. Squeezed film effects in electro mechanics.

UNIT V INTEGRATION OF MICRO AND SMART SYSTEMS

Integration of Microsystems and microelectronics, microsystems packaging, case studies of integrated Microsystems, case study of a smart-structure in vibration control. Scaling effects in Microsystems: scaling in: mechanical domain, electrostatic domain, magnetic domain, diffusion, effects in the optical domain, biochemical phenomena.

Text book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, “Micro and smart systems”, Wiley India, 2010.

REFERENCES BOOK

1. Vijay K. Varadan K. J. Smart Material Systems and MEMS: Design and Development Methodologies 2006,ISBN:9780470093610

AEC - 706 (B)
TOTAL QUALITY MANAGEMENT

UNIT I INTRODUCTION

Time Management, Stress Management, Goals and Career Planning – Interpersonal interaction. Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques, Basic concepts of Total Quality Management, Principles of TQM, Leadership Concepts, Role of Senior Management, Quality Council, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

UNIT V MANGEMEMENT

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

TEXT BOOK

1 Dale H. Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES BOOK

2 James R. Evans & William M. Lidsay, “The Management and Control of Quality”, (5thEdition), “Total Quality Management”, Butterworth Heinemann Ltd., 1989

AEC - 706 (C)
NONDESTRUCTIVE TESTING

UNIT I OVERVIEW OF NDT

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, various physical characteristics of materials and their applications in NDT, Visual inspection.

UNIT II SURFACE NDE METHODS

Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications.

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING

Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations.

UNIT IV ULTRASONIC TESTING AND ACOUSTIC EMISSION

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique V Principle, AE parameters, Applications.

UNIT V RADIOGRAPHY

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films – graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography.

TEXT BOOKS

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu ¡§Practical Non-Destructive Testing¡¨, Narosa Publishing House, 2009.
2. Ravi Prakash, ¡§Non-Destructive Testing Techniques¡¨, 1st revised edition, New Age International Publishers, 2010

REFERENCES BOOKS

1. ASM Metals Handbook,¡¨Non-Destructive Evaluation and Quality Control¡¨, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, Introduction to Non-destructive testing: a training guide¡¨, Wiley, 2nd Edition New Jersey, 2005
3. Charles, J. Hellier Handbook of Non-destructive evaluation¡¨, McGraw Hill, New York 2001.

AEC- 707
INDUSTRIAL TRAINING -II

Objectives of the course Industrial Training -II are:

- To provide students with a comprehensive experience for applying the knowledge gained
- so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on
- solutions of small industrial problems/Training.
- To give students an opportunity to assimilate real life work in industry.
- To adapt students for latest development and to handle it with proper industry standard.