## Mechanical Engineering
(IP/IEM/Auto/ME and Other allied branches)

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1. **Agile Manufacturing**: Definition, business need, conceptual framework, characteristics, generic features. Four Core concepts: Strategy driven approach-integrating organization, people technology, interdisciplinary design methodology.

Developing Agile Manufacturing: Enterprise design, System concepts as the basic manufacturing theory-joint technical & Organizational design and a model for the design of agile manufacturing enterprise. Enterprise design process insights into design processes, what is interdisciplinary design, main issues, simple design example.


**14 Hours**

**Industrial Robotics**: Robotics technology: Types of Robots, Robot Technology Levels, Robot geometric configurations and Technical Features, basic robot motions, Robot control systems, robot drive systems, Work-cell control and Interlocks, robot sensors, robot safety, robot-computer interface, industrial robot applications and benefits, robot programming and programming languages.

**06 Hours**


Development and implementation of an FMS: Planning phase, Integration, System configuration, FMS layouts, Simulation, FMS Project development steps. Project management, Equipment development, Host system development, planning, Hardware & Software development.


Automated Storages Systems: Storage system performance, AS/RS, Carousel storage system, WIP storage system, Interfacing handling storage with manufacturing, Problems.

Reference Books:
1. **Classification and Characteristics:** Metals, Non ferrous Metals and Ferrous Metals, classification of Ferrous Metals and Non Ferrous Metals, Types of Ceramics, Polymers and composites and classification of composites.

**General Properties and Structure:** Atoms, molecules bonds in solids, Crystalline - Defects in Metallic structure, Dislocations and plastic deformation - Strengthening mechanism - grain size, dislocation - Cold work, precipitation hardening, dispersion hardening - phase reactions, fatigue and Creep behaviour.

2. **Ferrous Alloys:** iron carbon equilibrium diagrams - Steels and cast irons - properties, structure, composition and applications transformation hardening steels - TIT diagrams - Heat treatment processes - Effect of alloying elements - High alloy steels, Stainless steel types, tool Steels, Manganese steels, heat resistant steels, HSLA, Managing steels.

**Non Ferrous Alloys:** Alloys of copper, Aluminium, nickel, magnesium, titanium, lead, tin, Zinc - composition, heat treatment, structure, properties and application.

3. **Polymers and Polymerizations:** Structure and properties of thermoplastics and thermosets – characteristics and Engineering Applications - property modifications - Mechanical and thermal behaviour – processing methods for polymer materials.


5. **Composites:** Definition - classification and characteristics of composite materials - Volume fraction - laminated composites particulate composites, fibrous composites - Types of reinforcements, their shape and size – production/processing and properties of fiber reinforced plastics, Metal Matrix composites and ceramic matrix composites – Engineering Applications.

**REFERENCE BOOKS:**


14PHDME003: Elements of Machine Design

1. Elasticity
Definition and Notation for forces and stresses, Components of stresses, Equations of Equilibrium, Specification of stress at a point. Stress invariants, Principal stresses and shear stresses and Mohr's diagram in three dimensions. Octahedral stresses, Decomposition of state of stress, Deviatoric & Spherical stress, Deformation, Strain Displacement relations, Strain components, State of strain at a point, Principal strain, Strain transformation, Compatibility equations, Cubical dilatation, Generalized Hooke's law in terms of engineering constants

2. Vibration
Basic concepts, Free vibration of single degree of freedom systems with and without damping, forced vibration of single DOF-systems, Natural frequency., Transient Vibration of single Degree-of freedom systems, Impulse excitation, Arbitrary excitation, Laplace transform formulation, Pulse excitation and rise time, Shock response spectrum, Shock isolation

3. Fatigue &Failure
High cycle and low cycle fatigue, Fatigue design models, Fatigue testing, Fatigue mechanisms, General S-N behavior, Factors influencing S-N behaviour, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S-N approach, Modes of mechanical failure, Review of failure theories for ductile and brittle materials including Mohr’s theory and modified Mohr’s theory, Yield surface for Isotropic materials

4. Fracture Mechanics

5. Plasticity
Plastic Stress-strain relations, St. Venant, von Mises, Prandtl-Roeuss equation, Isotropic and kinematic hardening, bilinear stress-strain relationship, power law hardening. Stages of plastic yielding- Incipient, elasto-plastic, fully plastic yielding, Application of plasticity to problems: Bending of beams, Torsion of rods

Reference Books

**Introduction and one-dimensional heat transfer**: The modes of heat transfer, the laws of heat transfer, problems Heat conduction in solids: Simple steady state problems in heat conduction, concept of thermal resistance, the critical radius problem, the differential equation of heat conduction, heat generation, two dimensional steady state heat conduction, unsteady state processes, extended surfaces- fins, other techniques for solving heat conduction problems, the finite difference method for steady state situations, the finite difference method for unsteady state situations, problems.

2. **Kinematics of Fluids**: Fluid properties, Methods of describing fluid motion - Lagrangian method, Eulerian method; translation, rotation and rate of deformation; stream lines, path lines and streak line; material derivative and acceleration; vorticity.

**Computational Fluid Dynamics**: Basic Concepts - Dimensionless form of equations; Simplified mathematical models; Hyperbolic, Parabolic & Elliptic systems. Properties of numerical solutions (Consistency, Stability, Conservation, Convergence and Accuracy) Finite Difference Methods - Discretisation; Boundary conditions; error propagation; Introduction to spectral methods; examples. Finite volume method - Surface & volume integrals; Interpolation & differentiation; Boundary conditions; Examples


**Psychometry**: Psychometry and psychometric properties. Relations, psychometric chart, psychometric processes. Requirements of comfort air conditioning, comfort chart, Design consideration. Summer air conditioning system, winter air conditioning.


**Reference Books:**
5. Dr. V. Ganesan, “Internal Combustion Engines”, Tata McGraw-Hil, 1995,
6. Dr.S.S.Thipse, “Alternate Fuels for IC Engines”, Jaico Publishing house, 2010,
14PHDME005: Newer Joining and Metal Removal Processes

1. Welding Symbols: Need for representing the welds, Basic weld symbols, Location of Weld, Supplementary symbols, Dimensions of welds, Examples. Distortion, methods to avoid distortion, Stresses in Joint Design, Welding and Cladding of dissimilar materials, overlaying and surfacing.

Welding Design: Introduction, Principles of sound welding design, Welding joint design. Welding positions, Allowable strengths of welds under steady loads, allowable fatigue strength, design of welds subjected to combined stresses, weld throat thickness, Numerical problems on welds under steady and combined loads.

Computer–Aided Welding Design: welding analysis, Engineering design vs welding design, perspectives in welding design, solution to welding design problem, Computer–Aided Welding Analysis(CAWA), Computer–Aided Welding Design(CAWD), use of interactive computer graphics.

2. Advanced Joining Methods:

Welding Automation: Concept, Operations and structure analysis, classification of welding automation, machine and automatic welding, flexible automated welding, economics of welding automation.

Inspection of Welds and Quality Control:
Destructive Tests, Non Destructive techniques like ‘X’ rays, Ultrasonic, Magnetic particle, Dye penetrant, Gamma ray inspection.
Quality Control in Welding: Introduction, Quality assurance v/s Quality control, Weld quality, Discontinuities in welds, their causes and remedies and Quality conflicts.


14 Hours
4. Chemical Machining: Introduction, fundamental principle types of chemical machining, Maskants, Etchants, Advantages and disadvantages, applications, chemical blanking, chemical milling (contour machining), Hydrogen embrittlement.

Plasma arc Machining: Introduction, Plasma, Generation of Plasma and equipment, Mechanism of metals removal, PAM parameters, process characteristics, types of torches, applications.


Ion Beam Machining: principle, equipment, working, sputtering rate, applications.


Reference Books:
1. Testing machines and sensors: types of Universal Testing machines and principles of operations, Machine stiffness, load and strain measurement. Calibration and verification of UTM.

Friction, wear and surface testing: Testing of sliding contact, damage, abrasive wear, adhesive wear, erosive wear. Testing and determination of surface characteristics of solid materials. (Surface roughness measurements)

Importance of calibration of Testing Instruments: Calibration methods and standards. Tests / experiments based on methods with active reference to various codes and standard for each test.


Microscopy: Optical microscope, scanning electron microscope. Preparation of Specimens for microscopic study.

Speed & Control of Testing Background, Developments in testing Machine Technology, Effects of testing rates on properties. Results before servo control, Results from servo controlled machines.


Lubrication & Determination of characteristics of lubricants: Introduction, Types of lubricants, characteristics of lubricants Methods of lubrication, four ball testing.


**REFERENCE BOOKS:**

5. Metals Handbook - ASM.  
7. ASM Vol Testing of materials  
14PHDAU001: Thermal Stream
1. Advanced Heat & Mass Transfer


Textbooks:

Reference Books:
2. Computational Fluid Dynamics

INTRODUCTION: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.


FORMULATIONS OF INCOMPRESSIBLE VISCOUS FLOWS: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

FINITE VOLUME METHOD: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

STANDARD VARIATIONAL METHODS: Linear fluid flow problems, steady state problems, Transient problems.

REFERENCES:

D. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications
E. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
G. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford University Press/2nd Edition
14PHDAU002:  Design Stream

1. Advanced Theory of Vibrations

**Single degree of freedom systems, two degree of freedom systems:** spring coupled, mass coupled, vibration absorbers, and vibration isolation.

**Multi degree of freedom systems:** Lagrange’s equation, close coupled and far coupled systems, dunker ley’s approximation method, rayleigh method, matrix method, matrix iteration, orthogonality principle, orthogonality, expansion theorem and modal analysis, stodola method, holzer method, galerkin method, rayleigh-ritz method, myklested – prohl method for far coupled systems, transfer matrix method

**Experimental methods in vibration analysis:** vibration instruments, vibration exciters, transducers and measurement devices, analyzers, vibration tests:- free and forced vibration tests.

**Vibration of continuous systems:** Transverse, flexural, torsional vibration of beams, timoshenko beam, Hamilton principle, vibration of plates, collocation method, myklested – prohl method.

**Transient vibrations:** Duhamel’s integral, method of step input, phase plane method, method of laplace transformation, drop test spectra by laplace transformations.

**Non linear vibrations:** Non-linear vibrations and superposition principle, examples of non linear vibrations, method of dealing with non linear vibrations, phase plane trajectories, method of direct integration, perturbation method, iteration method, Fourier series.

**Reference books:**

1. Theory of vibration with applications:- W. T. Thomson (PHI)
3. Mechanical vibration :- S. S. Rao (Addison Wesley)
4. Vibration and noise for Engineers :- Kewal Pujara (Dhanpat Rai and Co.)
5. Mechanical vibrations :- G. K. Grover and Nigam (Nem chand and sons )
6. An introduction to mechanical vibrations :- Steidel (John Wiley)
7. Elements of vibration analysis :- Meirovitch (TMH)
2. **Acoustics, Noise and Control**

Nature of sound, The wave equation, Plane waves and spherical waves, Impedance, power, intensity, directivity, Microphones, sound level meters, sound intensity probes, spectrum analyzers, Data processing: analog to digital conversion, FFT, windowing, sampling, Sound transmission and control, Human response to noise (OSHA standards), Room acoustics, Environmental noise, noise legislation

**Text book:**


**Reference book:**

14PHDAU003: Manufacturing Stream

1. Advanced Materials and Processing

Introduction and classification of structural and functional materials;

**High Temperature Materials:** Structure, Processing, mechanical behaviour and oxidation resistance of Stainless Steels, Ni- and Co- Based Superalloys, Aluminides and Silicides, Carbon-Carbon and Ceramic Composites;

**Shape-Memory Alloys:** Mechanisms of One-way and Two-way Shape Memory Effect, Reverse Transformation, Thermoelasticity and Psuedoelasticity, Examples and Applications; Bulk

**Metallic Glass:** Criteria for glass formation and stability, Examples and mechanical behaviour; **Nano-materials:** Classification, size effect on structural and functional properties, Processing and properties of nanocrystalline materials, thin films and multilayered coatings, single walled and multiwalled carbon nanotubes; Soft and hard magnetic materials for storage devices; Design and Processing;

**Piezoelectric Materials:** Crystal structure and mechanism, converse piezoelectricity, constitutive equation, examples and applications;

**Bio-materials:** Materials Selection for specific applications, Processing and Properties;

**Advanced Processes applied for Advanced Materials:** Single Crystal Growth, Rapid Solidification, Physical and Chemical Vapour Deposition of Thin Films, Laser Processing Methods.

**Text Books:**

A. G.W. Meetham and M.H. Van de Voorde: Materials for High Temperature Engineering

2. **Mechatronics Product Design**

Introduction to Mechatronics systems and components, Principles of basic electronics - Digital logic, number system logic gates, Sequence logic flip flop system, JK flip flop, D-flip flop.

Microprocessors and their applications - Microcomputer computer structure/microcontrollers, Integrated circuits - signal conditioning processes, various types of amplifiers, low pass and high pass filters.


Actuators, Pneumatic and hydraulic systems, Mechanical actuation system. Electrical actuation system. Other Electrical/Electronic hardware in Mechatronic system.

Principles of Electronic system communication, Interfacing, A.D. and D.A.converters. Software and hardware principles and tools to build mechatronic systems., Basic system models mathematical models, mechanical and other system Building blocks.


Design and selection of Mechatronics systems namely sensors line encoders and revolvers, stepper and servomotors Ball screws, solenoids, line actuators and controllers with application to CNC system, robots, consumer electronics products etc, Design of a Mechatronic Product using available software CAD packages MATLAB and SIMULINK.

**Reference Books:**

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

**Text Books:**

**REFERENCE BOOKS:**
- Aerodynamics for Engineering students: E L Houghton and P W Carpenter, Edward Arnold publication, 1993
14PHDAE002: Computational Fluid Dynamics, Combustion and Heat Transfer

Unit-I
Introduction to Computational Fluid Dynamics (CFD) and modeling of flow; Summary of governing equations; Conservation form of equations; Well-posed and ill-posed problems. Discretization of the equations; Truncation and Round-off error; Explicit and Implicit approaches; Concepts of numerical or artificial viscosity; Different boundary conditions. Application of Finite Difference methods to wave equations, Laplace equations and Burgers equation; Stability considerations.

Unit-II
Numerical methods for boundary layer type equations, Navier-Stokes equations; Outline of MAC and SIMPLE algorithms. Grid generation; Concepts of Finite volume methods. Solution of Flow with coupled heat transfer (forced and natural convection); Outline of Reactive flow (combustion) and multi-phase flow. Introduction of a commercial CFD package (FLUENT)

Unit-III

Unit -IV

Unit -V
Forced convection external flows: laminar and turbulent boundary layers on flat surfaces; heat transfer to cylinders, spheres, tube banks and packed beds; impinging jets. Forced convection internal flows: laminar and turbulent flow through circular and noncircular ducts, fully developed flow, hydrodynamically and thermally developing flows, Free convection boundary layer equations, Heat exchangers: overall heat transfer coefficient; cocurrent and countercurrent flow

TEXT BOOKS:

REFERENCE BOOKS:
14PHDAE003: Flight Dynamics and Control

Unit -I
Basic concepts of stability and control. Static longitudinal stability and control. Equations of equilibrium and stability. Contributions of major components, Stick - fixed stability, Control, effectiveness, hinge moments and effect of freeing the stick. Control forces and gradients, Effect of manoeuvres, Critical conditions for longitudinal stability and control

Unit-II
Static directional and lateral stability and control, Contributions of major components to directional stability and its desirable level, Directional control. Critical conditions for rudder design., Dihedral effect and contributions of major components to it. Lateral control. Design of control surfaces and aerodynamic balancing.

Unit-III

Unit-IV
Modes of motion and simplification, Effect of freeing the stick, Characteristic equation for lateral and direction of dynamic stability, Spiral divergence and Dutch roll, Miscellaneous topics. Stability after stall. Response. Automatic control

Unit-V
Characteristic roots of a jet airplane, Longitudinal, Lateral and self-adaptive autopilots-General philosophy and orientational control systems, Non-linear Effects

TEXTBOOKS

REFERENCES
14PHDAE004: Structural Dynamics and Aero-elasticity

Unit-I

Unit-II

Unit-III

Unit-IV
Introduction Aero elastic Problems, Deformation of Structures and Influence Coefficients, Energy Method, Classification and Solution of Aero elastic Problems, Static Aero elasticity, Divergence of 2-D airfoil and Straight Wing, Aileron Reversal, Control Effectiveness, Wing loading and deformations, Swept Wing.

Unit-V
Dynamic Aero elasticity, Dynamic/Flutter model of 2-D Airfoil, Unsteady Aerodynamics,2-D and 3-D Supersonic flow, Subsonic flow (Kernal Function Approach), Theodorsen Theory, Finite State Model, Flutter Calculation, U-g Method, P-k Method, Exact Treatment of Bending - Torsion Flutter of Uniform Wing, Flutter Analysis by Assumed Mode Method, Panel Flutter.

TEXT BOOKS:

REFERENCE BOOKS:
14PHDAE005: Aerospace Materials and Processes

UNIT I
Introduction:
Aircraft Materials: Desirable properties, Metallic, non-metallic materials and alloys, Composites and Introduction to smart materials, Aerospace super Alloys, comparison of material properties and applications in aircraft components, experimental material characteristics under various loading conditions- tension test, compression test, flexure test, hardness test, fracture test, drop-weight impact test, fatigue, shear and creep test.

UNIT II:
Theory of metal cutting, Shaping and Planing Machines, Broaching process, Finishing and other processes: lapping and honing operations principles, super finishing process, Polishing, buffing operation and applications, operation of laser beam, plasma arc machining ultrasonic machining abrasive jet machining water jet machining electron beam machining, electron discharge machining and plasma arc machining.

UNIT III
Principle of numerical control in manufacturing, CNC-programming based machining procedure and software coding.
Sheet Metal and welding: Sheet metal operations, shearing, punching, routing and forming, diffusion bonding. Welding Technology: Types of welding processes, resistance welding, submerged arc welding, atomic hydrogen welding, electron beam welding and special purpose welding processes. Weld jigs

UNIT IV
Surface Treatment & Finishing Processes: Purpose of surface treatment, typical surface finish / treatment cycle for commonly used aircraft materials, protective treatment for aluminium alloys, steel, titanium.

UNIT V

TEXT BOOKS:

REFERENCE MATERIALS:
14PHDAE006: Aerospace Structures and Structural Design

Unit-I
Introduction to Aircraft Structures: Structural components, materials, Loads on an aircraft; V-n diagram,
Basic elasticity: Static equilibrium, Planar and space trusses, Concept of stress and strain,
Stress resultants for slender members, Bending of symmetrical sections, Bending of unsymmetrical sections, Sectional properties, Bending of slender structures: Deflection analysis, Temperature effects.

Unit II
Shear of beams: Shear of open sections, Shear centre, Shear of closed section beams, Torsion of solid and hollow circular sections, Concept of shear flow, Torsion of open sections, Concept of warping, Torsion of single-celled and multi-celled closed sections, Stress state in slender members: Combined state of stress, Idealized sections, Analysis of idealized sections, Deflection analysis. Tapered sections

Unit-III
Design awareness: Philosophies of design against fatigue: i.e. safe-life, fail-safe and damage tolerance. Fatigue analysis: The traditional S-N curve approach: calculation of crack initiation life; mean stress effect, notch effect, and other influential factors; Palmgren-Miner's cumulative damage rule and fatigue analysis under variable amplitude loadings.

Unit-IV
Aircraft fatigue loads: Atmospheric turbulence, manoeuvre, landing and ground loads; determination of cumulative frequency load distribution; typical aircraft load spectra, Basic Theory of Linear Elastic Fracture Mechanics (LEFM): fracture toughness, energy release rate; plastic zone at the crack tip, calculation of residual strength for a component containing cracks; prediction of fatigue crack growth using the Paris law and Forman's formula.

Unit-V
Damage tolerant design methods; fatigue monitoring in flight/service; inspection methods: CAA and FAA Regulations and their relationship to Airworthiness Certification.
Potential Energy methods for structures and their use in Finite Elements, FE method for continua illustrated with membrane and shell elements, Accuracy considerations: higher order elements, Isoparametric elements,

TEXT BOOKS

REFERENCES
14PHDIEM001: Operations Management


System Design and Capacity: Introduction, Manufacturing and service systems, Design and systems capacity, Capacity planning.

3. Forecasting Demand: Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Moving Average methods, Exponential smoothing, Trend adjusted Exponential Smoothing, Regression and correlation methods, Application and control of forecasts-Mean Absolute Deviation, BIAS, Tracking Signal.


Material and Capacity Requirements Planning: Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.
5. **Scheduling and Controlling Production Activities**: Introduction, PAC, Objectives and Data requirements, Loading –Finite and Infinite Scheduling methodology, priority sequencing, capacity control.

**Single Machine Scheduling**: Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule.

**Flow –Shop Scheduling**: Introduction, Johnson’s rule for ‘n’ jobs on 2 and 3 machines, CDS heuristic.

**Job-Shop Scheduling**: Types of schedules, Heuristic procedure, scheduling 2 jobs on ‘m’ machines.

**Text Books:**
2. Productions & operations management by Adam & Ebert.
3. Pannerselvam. R., Production and Operations Management, PHI.

**References:**
14PHDIEM002: Total Quality Management

1. Introduction: BUSINESS EVOLUTION


Developing a Unique Organizational Capability: Four Practical Revolutions in Management, Evolution of Our Understanding, Four Levels of Practice

2. The First Revolution: CUSTOMER FOCUS

Change in the Work Concept: Market-in, Customers, Philosophy-in and Philosophy-out

Evolution of Customer Focus and Its Challenges: Three Stages of Customer Focus, Customer Concerns, Integration of Concerns, Individualizing Customers

The Second Revolution: CONTINUOUS IMPROVEMENT

Improvement as a Problem-Solving Process: Management by Process, WV Model of Continuous Improvement, Continuous Improvement of Processes for All Types of Work, Continuous Improvement and the Scientific Method

3. Managing Existing Processes

Process Discovery and Management: Thinking In Terms of Process, Process Discovery, Process Control and Variation: A Typical Example of (Mishandling) Variation, Making the Most of Variation, Process Control and Process Improvement
Reactive Improvement and the 7 Steps Method; Identifying the Problem, Standard Steps and Tools, The 7 Steps: A Case Study, The 7 QC Tools

Management Diagnosis of the 7 Steps of Reactive Improvement: General Guidelines for Managers Diagnosing a QI Story, Step-by-Step Guidelines for Managers Diagnosing a QI Story, Case Study for Diagnosis of the 7 Steps, Run PDCA and Develop Skill


Planning Projects or Tasks: The 9 Steps Compared with the 7 Steps, The 9 Steps Mobilization at Teradyne, A Teradyne Illustration of the 9 Steps Use, Relationship of the 9 Steps to Other Methods

Proactive Improvement: Collecting Data for Proactive Improvement, Language Data and Use of Semantics, Toward Standard Tools and Steps for Proactive Improvement, Customer Visitation as a Method of Collecting Proactive Improvement Data

Applying Proactive Improvement to Develop New Products; Develop Understanding of Customers’ Needs and Environment, Convert Understanding Into Requirements, Operationally Define Requirements for Downstream Development, Generating Concepts and Selecting the Concept, Expanding View of WV Model and Proactive Improvement

4. The Third Revolution: TOTAL PARTICIPATION

Engagement and Alignment of Organization Members: Engaged Employees for a Rapidly Changing World, Explicit Joining of Improvement and Routine Work, Processes and People

Coordinating Behavior; Societal Networking Case Study of the CQM Study Group on Conversation, Expansion of the Principles of Semantics, Some Types and Models of Conversations Leading Change: Technical Skill, Human Skill, Conceptual Skill
Self-Development: Lessons from the Non-business World, Local Improvement in Absence of a Supportive Environment, The Bottom Line

Team Skill Development: Teamwork Skill, Some Fundamentals, Some Types of Teams substantially, Models for Team Development

Phase-In: Orientation Phase, Empowerment Phase, Alignment Phase, Evolution of the Parallel Organization, Common Patterns of Phase-In

U.S. Focused Strategies for Phase-In: Benchmarking, Six Sigma, Cycle-Time Reduction

Hoshin Management: Hoshin Management and Its Parts, Management by Objectives and Conventional Business Planning, Hoshin Management at Analog Devices

Leading Process Improvement: Modeling Personal Improvement, Employee Development at NIMS, Company Strategies, Individual Practice of CAPD by Managers’ case studies

The Practice of Breakthrough: Process versus Business Breakthrough, Case Studies and a Model of Business Breakthrough, Biggest Obstacle to Business Breakthrough, Integration of Ideas

5. The Fourth Revolution: SOCIETAL NETWORKING

Networking and Societal Diffusion: Regional and National Networking The Japanese Model, Taking a Lesson from Japan—CQM, Comparison of National Methods, Use of Indirect Influence

Ongoing Integration of Methods: Applying Idealized Design to Hoshin Management, Structural Process Improvement Case Study, SerVend Case Study

Reference Books:


5. **Networks Technique in Project Management**: PERT/CPM Analysis – Administrative aspects of Capital Investment.

**REFERENCE BOOKS:**

3. **Project Management** – Dennis Lock.
1. **JIT – Introduction** – The spread of JIT Movement, some definitions of JIT, core Japanese practices of JIT, Creating continuous Flow Manufacture, Enabling JIT to occur, Basic elements of JIT, Benefits of JIT.

**Just in Time Production** – Primary purpose, profit through cost reduction, Elimination of over production, Quality control, Quality Assurance, Respect for Humanity, Flexible work Force, JIT Production Adapting to changing production Quantities, process layout for shortened lead Times, Standardization of operation, Automation.

2. **Sequence and scheduling used by suppliers:** Monthly and daily Information. Sequenced withdrawal system by sequenced schedule table, problems and counter measures in applying the Kanban system to sub contractors.

**Toyota Production System** – The philosophy of TPS, Basic Frame work of TPS, Kanban, Determining the Number of Kanban in Toyota Production System.

- Kanban Number under Constant Quantity Withdrawal System.
- Constant Cycle, Non-constant Quantity Withdrawal System. Supplier Kanban and the Sequence Schedule for Use by Suppliers.
- Later Replenishment System by Kanban.
- Sequenced Withdrawal System.
- Circulation of the Supplier Kanban within Toyota.

Production Smoothing in TPS, Production Planning, Production Smoothing

Adaptability to Demand Fluctuations, Sequencing Method for the Mixed Model Assembly Line to Realize Smoothed Production of Goal.
3. **Just-in-Time Production** with Total Quality Control just in time concept, cutting lot sizes, cutting set-up times, cutting purchase order costs, the JIT cause-Effect chain, Scrap/Quality Improvements, Motivational effects, Responsibility effects, small Group improvement Activities, withdrawal of Buffer Inventory, the total Quality Control Concept.

4. **Total Quality Control-Introduction**-Total Quality Control concepts, responsibility, learning from the west, TQC concepts categorized, Goals, Habit of improvement, perfection, Basics, process control, Easy to see Quality control as facilitator, small lot sizes, Housekeeping, Less than full capacity scheduling, Daily machine checking, Techniques and Aids, Exposure of problems, Fool proof Devices, Tools of Analysis, QC Circles, TQC in Japanese-owned US Electronics plant, TQC in Japanese-owned Automotive plants.

5. **Plant Configurations: Introduction**-ultimate plant configuration, job shop Fabrication, Frame Welding, Forming Frame parts from Tubing, Dedicated production lines, overlapped production, the daily schedule, Forward Linkage by means of Kanban, physical merger of processes, Adjacency, mixed Models, Automated production Lines, Pseudo Robots, Robots, CAD and Manufacturing, Conveyors and stacker Cranes, Automatic Quality Monitoring.

**REFERENCE BOOKS:**

2. **Toyota Production system – An integrated approach to just in time** – Yasuhiro Monden
3. **Lean Thinking** – By James Womack.
5. **Just in time manufacturing** – Kargoanker


3. **Planning and Managing Inventories in a Supply Chain**: Review of inventory concepts. Trade promotions, Managing multi-echelon cycle inventory, safety inventory determination. Impact of supply uncertainty aggregation and replenishment policies on safety inventory. Optimum level of product availability; importance factors. Managerial levers to improve supply chain profitability.

4. **Sourcing, Transportation and Pricing Products**: Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration.

4. **Sourcing, Transportation and Pricing Products**: Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade-off in transportation design. Tailored transportation, Routing and scheduling in
transportation. International transportation. Analytical problems. Role Revenue Management in the supply chain, Revenue management for: Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts.

5. Coordination and Technology in the Supply Chain: Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships.

Coordination and Technology in the Supply Chain: The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain, The E-business framework, E-business in practice. Case discussion.

Emerging Concepts: Reverse Logistics; Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six Sigma in Supply Chains.

REFERENCE BOOKS:


Going Backwards Reverse Logistics Trends and Practices -Dr. Dale S. Rogers, Dr. Ronald S. Tibben-Lembke, University of Nevada, Reno, Center for Logistics Management
1. Introduction to Human Resources: Importance of Human Resources – Human Resource Planning, Job Analysis and Methods

2. Recruitment – Recruiting Sources: Recruiting Efforts with possible constraint – ability to attract incumbents.


REFERENCE BOOKS:
2. Personnel principles and policies for modern manpower – Yoder Prentice Hall India.