



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**  
**SCHEME FOR THE ACADEMIC YEAR 2017-18**

**VII SEMESTER B.E. INDUSTRIAL ENGINEERING AND MANAGEMENT**

Course Code										Course Title	Teaching Department	Credits					Contact Hrs/Wk
												L	T	P	S	Total	
1	7	I	E	7	D	C	E	R	P	ENTERPRISE RESOURCE PLANNING	IEM	3	0	1	2	6	5
1	7	I	E	7	D	C	T	Q	M	TOTAL QUALITY MANAGEMENT	IEM	3	0	0	0	3	3
1	7	I	E	7	D	E				ELECTIVE –IV	IEM	3	0	0	0	3	3
1	7	I	E	7	D	E				ELECTIVE-V	IEM	2	1	0	0	3	3
1	7	I	E	7	D	E				ELECTIVE –VI	IEM	3	0	0	0	3	3
1	7	I	E	7	I	E				INSTITUTION ELECTIVE- I	IEM	3	0	0	0	3	3
1	7	I	E	7	D	C	P	W	I	PROJECT WORK-PHASE- I	IEM	1	0	1	2	4	3
										<b>Total</b>		<b>18</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>25</b>	<b>23</b>

L-Lecture Hours/Week, 1 Credit=1hour, P -Practical Hours/Week, 1 Credit=2Hours, T- Tutorial Lecture Hours/Week, 1Credit =1 hour, S-Self-Study to be added to contact Hrs. / Week, CIE-Continuous Internal Evaluation, SEE-Semester End Examination (of 3 hours duration)

**ELECTIVE-IV**

17IE7DEDFM	Design for Manufacturability
17IE7DEIDE	Industrial Design & Ergonomics
17IE7DESMD	System Dynamics
17IE7DENCM	Non-Conventional Machining

**ELECTIVE – V**

17IE7DECOO	Combinatorial Optimization
17IE7DEAIE	Artificial Intelligence & Expert Systems
17IE7DETOC	Theory of Constraints
17IE7DEIEX	Industrial Experimentation

**ELECTIVE-VI**

17IE7DELNM	Lean Manufacturing
17IE7DEMIS	Management Information System
17IE7DEHRM	Human Resource Management
17IE7DERLE	Reliability Engineering

**INSTITUTIONAL ELECTIVE-I**

17IE7IEDBM	Data Base Management System
17IE7IEHRM	Human Resource Management
16MD7IE1OR	Operations Research
17IE7IEPDD	Product Design & Development
17IE7IEAIM	Automation in Manufacturing
17IE7IESS	Six Sigma
17IE7IESMA	Simulation Modelling and Analysis



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<b>Course</b>	<b>ENTERPRISE RESOURCE PLANNING</b>	<b>Course Code</b>	<b>17IE7DCERP</b>
<b>Credits</b>	<b>06</b>	<b>L-T-P-S</b>	<b>3-0-1-2</b>

**Prerequisites:** Nil.

**UNIT - 1**

**INTRODUCTION TO ERP:**

Introduction, Evolution of ERP, What is ERP?, Reasons for the growth of the ERP market, the advantages of ERP, Why do Many ERP Implementations Fail? Why are ERP packages being used now?

**ENTERPRISE AN OVERVIEW:** Introduction, Integrated Management Information, Business modeling, Integrated Data Model. **6Hrs**

**UNIT - 2**

**ERP AND RELATED TECHNOLOGIES:** Introduction, Business Process Reengineering, Management Information System, Decision Support System, Executive Information Systems, Data Warehousing, Data Mining, On-line Analytical Processing, Supply Chain Management. **6Hrs**

**ERP- MANUFACTURING PERSPECTIVE:** Introduction, ERP.CAD/CAM, Materials Requirements Planning, Bill of Material, Closed Loop MRP.Manufacturing Resource Planning, Distribution Requirements Planning. **6Hrs**

**UNIT - 3**

**KANBAN:** JIT and Kanban, Product Data Management, Benefits of PDM, Make-to-order, and Make-to Stock, Assemble to order, Engineer to order, Configure-to order.

**ERP MODULES:** Introduction, Finance, Plant Maintenance, Quality Management, Materials Management. **6Hrs**

**UNIT – 4**

**BENEFITS OF ERP:** Introduction, Reduction of Lead time, On-time shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Decision making capability. **6Hrs**

**UNIT – 5**

**ERP IMPLEMENTATION LIFE CYCLE:** Pre-evaluations Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation of Team Training, Testing, Going Live, End user Training, Post implementation **Vendor, Consultants and Users:** Introduction, In-house implementation Pros and Cons, Vendors, Consultants, End-users.

**FUTURE DIRECTION IN ERP:** Introductions, New Markets, New Channels, Faster Implementation Methodologies, Business models and BAPIs, Convergence on Windows NT, Application Platforms, New business segments, web enabling, market snapshot **10 Hrs**



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**UNIT 6**

**LABORATORY EXPERIMENTS:**

1. Process of customer orders under seasonal
2. Processing of unseasonable customer with blanket orders.
3. Generating Bill of Materials for Various Engineering Designs
4. Creating Item Master for various Engineering Designs
5. Performing inventory transactions
6. Conduction of Vendor Evaluation/Rating exercise
7. MRP - II Generating of Various reports for confirmed orders
8. Processing MRP for seasonal and parametric runs
9. Creating Purchase order for Items
10. Creating Work order for Items
11. Creating Quotation process for Items
12. Creating Payment reconciliation.

**ERP- ASSESSMENT OF SELF STUDY:**

Student group of 5 members will submit assignments in ERP at the end of the course featuring the extension of current learning in the course. The faculty shall suggest/assign various tasks to enhance curiosity and learning under the following topics (not limited to)

1. Developing technical documents concerning the ERP process
2. Executing Case studies in industry related activities
3. Modeling a system process for ERP
4. Identify critical success factors for effective implementation
5. Any other interesting topics featuring current and relevant technologies

**TEXT BOOKS:**

1. **Enterprise Resource Planning**, -Alexis Leon, Tata Mc Graw Hill Publishing Company Ltd., 1999,
2. **Manufacturing Planning and Control Systems**, Thomas E. Vollmann, William L. Berry, D. Clay Why bark Irwin/McGraw-Hill, - Technology & Engineering, 1997

**REFERENCE BOOKS:**

1. **ERP: Making It Happen: The Implementers'**, Guide to Success with Enterprise Resource Planning by Thomas F. Wallace, Michael H. Kremzar Wiley, 2002
2. **Concepts in Enterprise Resource Planning**, Ellen Monk, Bret Wagner Cengage Learning, 4th Edition Inc USA, 2012
3. **Production and Operations Management: Manufacturing and Services**, Richard B. Chase, Nicholas J. Aquilano, F. Robert Jacobs, Irwin Professional Publishing, 8th Edition, 1998
4. **A Guide to ERP Benefits, Implementation and Trends**, Prof LinekeSneller RC Book boon



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**COURSE OUTCOMES**

<b>CO1</b>	Have understood business functions and business processes, concepts of ERP, importance of ERP, benefits and risk factors of ERP implementation
<b>CO2</b>	Able to establish relationship between ERP and other technologies
<b>CO3</b>	Known about the functional modules of ERP software
<b>CO4</b>	Understood the basics of ERP implementation, Package selection, transition strategies, implementation process
<b>CO5</b>	Able to differentiate between consultants and vendors in ERP implementation process and had knowledge about future directions and trends in ERP

**SCHEME OF EXAMINATION:** Five Questions to be set with one question from each unit carrying 20 marks each. Any three units will have an internal choice

Question Paper: One Question to be set from each unit and Two Questions will be set from the unit 2& 5. Student will answer any 5 questions selecting at least one from each unit.

**ASSESSMENT**

Continuous Internal Evaluation (CIE) includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

Semester End Examination (SEE)-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



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**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>TOTAL QUALITY MANAGEMENT</b>	<b>Course Code</b>	<b>17IE7DCTQM</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT - 1**

**Introduction: BUSINESS EVOLUTION**

The Evolution of the Customer Satisfaction Concept: Evolution of Customer Satisfaction Methods, Evolution of Company Integration, Continuing Evolution.

Survival in a Rapidly Changing World: Practice Systematic Development of Skill, Treat Management as a Coherent System, Focus on People and Their Purposes, Integrate Best Practices, Financial Benefit

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

**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 **7 Hrs**

**UNIT -2**

**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

**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



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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

Process Management Mobilization Case Study: Introduction to the Teradyne Mobilization story

Introduction of the 7 Steps, Experience Using the 7 Steps, Improving Mobilization, Process Discovery and Process Control

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

**9Hrs**

**UNIT – 3**

**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

**7Hrs**

**UNIT -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

Initiation Strategies; CEO Involvement, Case Study: Teradyne Strategy for Introduction

Infrastructure for Mobilization: Create Explicit Structures for Mobilization, A General Model for Mobilization: The 7 Infrastructures

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



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Organization, Common Patterns of Phase-In

U.S. Focused Strategies for Phase-In: Benchmarking, Six Sigma, Cycle-Time Reduction  
**9Hrs**

**UNIT –5**

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

**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  
**7Hrs**

**TEXT BOOK:**

1. **Four Practical Revolutions in Management: systems for creating unique organizational capability** -Shoji Shiba and David Walden,– Productivity Press & Center for Quality Management, (USA) , 2001, ISBN-9781563273889

**REFERENCE BOOKS:**

1. **Management for Total Quality** -N Logothetis- Prentice Hall of India, New Delhi, 2003, ISBN-81-203-1137-X
2. **Total Quality Management**- Besterfield, Pearson Education, 2011. ISBN, 817758412X, 9788177584127.

**ONLINE LINKS:**

1. <http://nptel.ac.in/syllabus/110101010/>

**SCHEME OF EXAMINATION:** Five questions choosing one each from each unit and Unit 2 and 3 with choice questions



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**COURSE OUTCOMES:** The students,

<b>CO1</b>	Ability to understand the quality concepts and the practical evolution in management, revolution in total quality management
<b>CO2</b>	Ability to analyze the TQM related cases
<b>CO3</b>	Diagnose problems in the quality improvement process
<b>CO4</b>	Apply the quality tools and methods in the manufacturing and service processes
<b>CO5</b>	Ability to make an effective oral presentation on the cases analyzed

**ASSESSMENT**

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**ELECTIVE-IV**

<b>Course</b>	<b>DESIGN FOR MANUFACTURABILITY</b>	<b>Course Code</b>	<b>17IE7DEDFM</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT-1**

**MATERIAL AND PROCESS SELECTION** – Introduction, Advantages of applying DFMA, General requirements of early materials and process selection, Selection of Manufacturing processes, Process capabilities, Selection of materials, Primary process/materials selection, Systematic selection of processes and materials. **6Hrs**

**UNIT-2**

**ENGINEERING DESIGN FEATURES.** – Dimensioning, Tolerances, General Tolerance, Geometric Tolerances, Assembly limits, achieving larger machining tolerances. Screw threads, Ground surfaces, holes. Examples

**Datum features** – Functional datum, machining sequence, manufacturing datum, changing the datum. Examples **6 Hrs**

**UNIT-3**

**COMPONENT DESIGN – MACHINING CONSIDERATIONS** – Drills, Milling cutters, Drilling, Keyways, Dowels, Screws, Reduction in machining areas, Simplification by separation and amalgamation, work piece holding, surface grinding, Component surface design, Examples.

**COMPONENT DESIGN – CASTING CONSIDERATIONS** – Pattern, Mould, parting line, cast holes, machined holes, identifying parting line, special sand cores, designing to obviate sand cores, Examples **10Hrs**

**UNIT-4**

**DESIGN FOR INJECTION MOLDING AND SHEET METAL WORKING** – Injection molding materials, Molding cycle, Systems, molds, machine size, cycle time, Cost estimation, Insert molding, Design guidelines, Introduction to sheet metalworking, Dedicated Dies and Press working, Press selections, Design Rules, Over Molding, Design of Undercuts, Collapsible cores.

**DESIGN FOR DIE CASTING AND POWDER METAL PROCESSING** – Die casting alloys, cycle, machines, dies, finishing, Assembly techniques, Design principles, Powder metallurgy processing, stages, compaction characteristics, Tooling, Sintering, Design guidelines, Surface definition, Example **10 Hrs**

**UNIT-5**

**GEOMETRIC TOLERANCE** – Symbols, Three datum concept of dimensioning, Straightness, concentricity, Run-out, Location Tolerance, Assembly of parts having concentric cylinders, Control of feature location by true position, Body of revolution, Roundness, Profile dimensioning, Tapers, Shaft of two diameters. Examples. **8Hrs**



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**TEXT BOOKS:**

1. **Designing for Manufacturing** - Harry Peck, Pitman Publications, 1983.ISBN10-0273000071
2. **Machine Design** - Dieter ,McGraw hill Publications for topic 1.Metrology - R.K. Jain Khanna, Publication for topic 6.
3. **Product design for manufacture and assembly** - Geoffrey Booth Royd, peter Dewhurst, Winston Knight, Mercel Dekker. Inc. New York, CRC press, Taylor and Francis group, 2011  
ISBN:-13-978142008928-8
4. **Material selection and Design**, - ASM Hand book,Vol. 20

**REFERENCE BOOKS:**

1. **Product Design for Manufacture and Assembly**, Geoffrey Booth Royd - Peter Dewhurst –  
Winston Knight – Marcel Dekker,Inc.– New York -Second Revision, 1994,  
ISBN 0-8247-0584-X.
2. **Designing for Manufacturing** – Harry Peck - Pitman Publications – 1983.
3. **Dimensioning and Tolerance for Quantity Production**,Merhyle F Spotts –Inc.  
Englewood Cliffs - New Jersey - Prentice Hall, 5th edition.Publisher Prentice Hall,  
1982,  
ISBN-13:9780132146845

**ONLINE REFERENCE:**

<http://nptel.ac.in/courses/112101005/>

**COURSE OUTCOMES:**

<b>CO1</b>	To have the capability to systematically design products and/or processes to get the lowest cost, quickest response time, and best-achieved customer expectations.
<b>CO2</b>	Identify opportunities for design.
<b>CO3</b>	Address technical considerations of design and manufacturing.
<b>CO4</b>	Make business decisions concerning the feasibility of a design.
<b>CO4</b>	Utilize DFM and Concurrent Engineering Principles on a "real life" project.

**SCHEME OF EXAMINATION:** Scheme of Examination: Answer one question from each unit. Choice is to be given in Unit-3 and Unit-4.

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<b>Course</b>	<b>INDUSTRIAL DESIGN AND ERGONOMICS</b>	<b>Course Code</b>	<b>17IE7DEIDE</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites:** Nil

**UNIT -1**

**INTRODUCTION:** An approach to Industrial Design -elements of design structure for Industrial Design in engineering application in modern manufacturing systems. **4Hrs**

**UNIT-2**

**ERGONOMICS AND INDUSTRIAL DESIGN:** Introduction -general approach to the man- machine relationship- workstation design-working position.

**Control and Displays:** Shapes and sizes of various controls and displays-multiple displays and control situations -

Design of major controls in automobiles, machine tools etc., design of furniture -redesign of instruments. **10Hrs**

**UNIT-3**

**ERGONOMICS AND PRODUCTION:** Ergonomics and product design -ergonomics in automated systems- expert systems for Ergonomic, design, Anthropometric data and its applications in ergonomic design- limitations of anthropometric data use of computerized database. Case study. **8Hrs**

**UNIT-4**

**VISUAL EFFECTS OF LINE AND FORM:** The mechanics of seeing- psychology of seeing general influences of line and Form.

**Colour:** Colour and light -colour and objects- colour and the eye -colour consistency- colour terms- reactions to Colour and colour continuation -colour on engineering equipment. **8Hrs**

**UNIT-5**

**AESTHETIC CONCEPTS:** Concept of unity- concept of order with variety -concept of purpose style and environment Aesthetic expressions. Style-components of style- house style, observation style in capital goods, case study.

**INDUSTRIAL DESIGN IN PRACTICE:** General design -specifying design equipment-rating the importance of industrial design -industrial design in the design process. **10Hrs**

**TEXT BOOKS:**

1. **Industrial Design for Engineers** - Mayall W.H. - London Hiffee books Ltd. -1988.
2. **Applied Ergonomics Hand Book** - Brain Shakel (Edited) - Butterworth scientific London -1988.
3. **Introduction to Ergonomics** - R. C. Bridger - McGraw Hill Publications - 1995.
4. **Human Factor Engineering** - Sanders & McCormick - McGraw Hill Publications – 6th edition, 2002.



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**COURSE OUTCOMES**

<b>CO1</b>	To understand the issues regarding Industrial design
<b>CO2</b>	Able to understand the human factors, system, human outcome and control
<b>CO3</b>	Able to apply basic knowledge of physical ergonomics such as physical load, anthropometry, biological variation and biomechanics.
<b>CO4</b>	Apply basic knowledge of physical factors affecting human beings in relation to lighting, sound and noise, climate and vibrations
<b>CO5</b>	Apply basic knowledge of cognitive ergonomics such as perception, memory, information processing, attention, learning decision-making , stress and mental workload

**SCHEME OF EXAMINATION:** To set one question from units **1, 2&4** and two questions from units 3 and 5.

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<b>Course</b>	<b>SYSTEM DYNAMICS</b>	<b>Course Code</b>	<b>17IE7DESMD</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT -1**

Introduction to systems thinking, modeling and dynamic simulation, Causal loops and feedbacks, building blocks of system dynamics: stocks and levels, **8Hrs**

**UNIT -2**

Equations underlying the modeling, Positive and negative feedback loops, Dynamics of growth, modeling delays, co-flows & decision making, Capturing nonlinear relationships, instability and oscillation, business and supply chain models, Model validation and testing, **8 Hrs**

**UNIT -3**

Control theory concepts of transfer functions, time domain analysis, and state space formulation, solution of the state equation and determination of the system's response. **8Hrs**

**UNIT -4**

Characteristic equation and roots; Frequency-domain techniques; Stability analysis, and design of feedback regulators, controllability and observability. **8Hrs**

**UNIT -5**

Applications will be presented to emphasis cross-functional management issues, new product development, management of fluctuating workloads, market growth and stagnation, and project management. **8Hrs**

**TEXT BOOKS:**

1. **Business Dynamics: Systems Thinking and Modeling for a Complex World**, John Sterman, Irwin/McGraw-Hill (2000), ISBN-13:978-0-07-106812-3, ISBN-10:0-07-106812
2. **System Dynamics**, Palm William J III, III edition, McGraw Hill College 2009, ISBN- 0073529273, 9780073529271

**REFERENCES**

1. **System Dynamics: A Practical Approach for Managerial Problems**, Sushil, Wiley Eastern (1993)
2. **System Dynamics Modelling: A Practical Approach**, R.G. Coyle, Chapman & Hall/CRC (1996)
3. **System Dynamics: A Quick Introduction**, Craig W. Kirkwood, Arizona State University (1998)
4. **The Fifth Discipline**, Peter Senge Currency,2006
5. **Control Systems Engineering**, Norman Nise, 4th ed., John Wiley & Sons, 2004
6. **System Dynamics**, K. Ogata, 4th ed., Prentice Hall, 2003
7. **Digital Control**, K. Moudalya, John Wiley & Sons, 2007



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**COURSE OUTCOMES**

<b>CO1</b>	To introduce students to mathematical modeling of Dynamic Systems
<b>CO2</b>	To develop skills in analyzing Simulating and identifying systems based upon their I/P and O/Presponses
<b>CO3</b>	To introduce to design and analysis of basic feedback systems

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<b>Course</b>	<b>NON-CONVENTIONAL MACHINING</b>	<b>Course Code</b>	<b>17IE7DENCM</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Production Technology- I**

**UNIT -1**

**INTRODUCTION:** History, Classification, Comparison between conventional and nonconventional machining process selection.

**MECHANICAL PROCESS: ULTRASONIC MACHINING (USM):** Introduction, Equipment, tool materials & tool Size, Abrasive slurry, Effect of parameter: Effect of amplitude of frequency and vibration, Effect of grain diameter, Effect of applied static load, effect of slurry, Tool and work material, USM process Characteristics: Material removal rate, tool wears, Accuracy, surface finish, Applications, advantages& disadvantages of USM.

**8Hrs**

**UNIT-2**

**ABRASIVE JET MACHINING (AJM):** Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, Size of abrasive grain, Velocity of the abrasive jet, Mean No. abrasive particles per unit volume of the carrier gas, Work material, Standoff Distance (SOD), Nozzle design, Shape of cut. Process characteristics Material removal rate, Nozzle wear, Accuracy & Surface finish applications, advantages & disadvantages of AJM.

**WATER JET MACHINING (WJM):** Process principle, equipment, process parameters, process capabilities, applications, advantages and disadvantages, Demonstration of WJM

**6Hrs**

**UNIT- 3**

**CHEMICAL MACHINING (CHM):** Introduction, Elements of process, chemical blanking process: Preparation of work piece, Preparation of masters, masking with photo resists, etching for blanking, applications of chemical blanking, chemical milling (Contour machining) :- Process steps : masking, Etching, process characteristics of CHM :Material removal rate, accuracy, surface finish, Hydrogen embrittlement, Advantages & applications of CHM.

**ELECTROCHEMICAL MACHINING (ECM):** Introduction, classification of ECM process, Fundamental principles of ECM, Elements of ECM process: Cathode tool, Anode workpiece, source of DC power, Electrolyte, Tool-work gap, Chemistry of the ECM process, ECM-process characteristics: Material removal rate, Accuracy, Surface finish. ECM Tooling: ECM tooling techniques and examples, Tool & insulation materials, Tool size, Electrolyte flow arrangement, Handling of slug, Economics of ECM, Determination of metal removal rate, evaluation of metal removal rate of an alloy, Applications, Advantages, Limitations of ECM,

**10 Hrs**



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**UNIT-4**

**EDM PROCESS:** Introduction, machine, dielectric fluid, spark generator, EDM tools(Electrodes): Electrode manufacture, Electrode wear, EDM electrode holders, EDM tool design: Choice of matching operation, electrode material selection, machine settings, under sizing and length of electrode, Machining time. Flushing: Pressure flushing, Suction flushing, Side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristic: Metal removal rate, Accuracy, surface finish, Heat affected Zone. Applications: EDM accessories applications, Electrical Discharge Grinding(EDG), Travelling wire EDM, Demonstration of wire EDM. **10Hrs**

**UNIT- 5**

**PLASMA ARC MACHINING (PAM):** Introduction, process principle, equipment, non – thermal generation of plasma, selection of gas, Mechanism of Metal removal, PAM process parameters, Process characteristics. Safety precautions, applications, advantages and limitations of PAM. **6Hrs**

**TEXT BOOKS:**

1. **Modern Machining Process**, Pandey and Shan, Tata McGraw Hill 2009.
2. **Production Technology**, HMT, Tata McGraw Hill 2001.

**REFERENCE BOOKS:**

1. **New Technology**, Bhattacharya, 2000.
2. **Unconventional Machining Process**, M K Singh, New Age Publications.2008, ISBN-13:9788122422443
3. **Thermal Metal Cutting Process**, B J Ranganath, I K International Publishing House Pvt Ltd.,2008 ISBN -9788189866907
4. **Fundamentals of Machining and Machine Tools**, R K Singal, I K International Publishing House Pvt Ltd., 2010, ISBN:9788189866662

**COURSE OUTCOMES**

<b>CO1</b>	Be able to explain how nontraditional machining techniques differ from traditional machining processes and the Ultrasonic machining
<b>CO2</b>	Be able to describe Abrasive jet Machining and Electrochemical techniques
<b>CO3</b>	Be able to describe the Chemical Metal Removal Processes
<b>CO4</b>	Be able to describe the Electrical Discharge Machining and Plasma Arc Machining Processes

**SCHEME OF EXAMINATION:** One Question to be set from each unit and Two Questions to be set from the units 3 & 4.

Student has to answer any 5 questions selecting at least one question from each unit.

**ONLINE REFERENCE:** <http://nptel.ac.in/courses/112104028/>





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**ASSESSMENT**

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Semester End Examination (SEE)-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

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**ELECTIVE-V**

<b>Course</b>	<b>COMBINATORIAL OPTIMIZATION</b>	<b>Course Code</b>	<b>17IE7DECOO</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT-1**

Classification of optimization Theory: Unconstrained problems-necessary and sufficient conditions, The Newton-Raphson method, Constrain problems-Equality Constraints, Inequality Constraints. **7Hrs**

**UNIT-2**

NP Hard and NP complete Problems: Basic Concepts, Non deterministic Algorithms, the classes NP hard and NP Complete, NP Hard Scheduling Identical processors, flow shop scheduling, job shop scheduling. Review of graphs and network, review of computational complexity **10 Hrs**

**UNIT-3**

Shortest Path Algorithm, Minimum Cost Network Flows, Maximum Flow Algorithm, Matching Algorithm: Travelling Salesman Problem, Postman Problems, and Machine Scheduling Problem. **10Hrs**

**UNIT-4**

Meta Heuristics: Iterative Improvement, Variable Neighborhood Search and GRASP  
Simulated Annealing: Advantages, Acceptance Function, Tabu Search **6Hrs**

**UNIT-5**

Genetic Algorithm: What Are Genetic Algorithm?, Robustness of Traditional Optimization and Search Methods, The Goals of Optimization, How are Genetic Algorithm different from Traditional Methods, A Simple Genetic Algorithm, Genetic Algorithm at Work- A simulation by Hand, Grist for the Search Mill- Important Similarities, Similarity Templates (Schemata) **7 Hrs**

**TEXT BOOKS:**

1. **Optimization Algorithms for Networks and Graphs**- Jrevans and E. Mineika, 1<sup>st</sup> Edition.
2. **Genetic Algorithm**- David E Goldberg, - Pearson Education Asia, 2<sup>nd</sup> Edition.2008, ISBN-13: 9788177588293
3. **Operation Research**- Hamdy A Taha- 7<sup>th</sup> edition, Pearson Education,2003, ISBN-9780130323743
4. **Fundamentals of Computer Algorithms**-Ellis Horowitz, Sartaz Sahani and Sanguthevar Rajasekaran- Galgotia Publications 1<sup>st</sup> Edition., 2010ISBN 10: 8175152575 / ISBN 13: 9788175152571



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**REFERENCE BOOKS:**

1. **Operations Research**-Ravindran, Philips and Solberg, Wiley International, 2<sup>nd</sup> edition, 2007,ISBN 10: 8175152575 / ISBN 13: 9788175152571
2. **Operations research**- Hiller Leiberman- Holdenday / CBS publishers 1994 Edition.
3. **Operations research**- S. D. Sharma-Kedarnath Ramanth and Co. 2000

**ONLINE REFERENCE:**

<http://nptel.ac.in/courses/110106059/>

**COURSE OUTCOMES:**

<b>CO1</b>	Able to formulate the combinatorial optimization efficiently
<b>CO2</b>	Able to explain how a Combinatorial Optimization problem can be solved
<b>CO3</b>	Able to explain how fast a Combinatorial Optimization problem can be solved
<b>CO4</b>	Explain mathematical theory underlying the algorithm for combinatorial Optimization problems
<b>CO5</b>	Apply Evolutionary Computation Methods to find solutions to complex problems by genetic Algorithm.

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Semester End Examination (SEE)-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

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<b>.Course</b>	<b>ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEM</b>	<b>Course Code</b>	<b>17IE7DEAIE</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT-1**

**ARTIFICIAL INTELLIGENCE:** Introduction, definition, underlying, assumptions, importance of AI, AI and related fields. State space representations, defining a problem, production systems and its characteristics, search and control strategies introduction preliminary concepts, examples of search problems.

**UNIFORMED OR PRELIMINARY CONCEPTS:** Examples of search problems. Uniformed or blind search, informed search, OR graphs, heuristic search techniques generate and test, hill climbing, best first search, problem reduction, constraint satisfaction, means ends analysis. **8Hrs.**

**UNIT-2**

**KNOWLEDGE REPRESENTATION ISSUES:** Representations and mapping, approaches, issues in KR, types of knowledge procedural Vs declarative, logic programming, forward Vs backward reasoning, matching, non-monotonic reasoning, and its logic. **6Hrs.**

**USE OF PREDICATE LOGIC :** Representing simple facts, Instance and Is a relationships, syntax and semantics for propositional logic, FOPL and properties of wffs, conversion to causal form, resolution, natural deduction. **6Hrs.**

**UNIT-3**

**STATISTICAL AND PROBABILISTIC REASONING:** Symbolic reasoning under uncertainty, probability and Baye's theorem, certainty factors and rule based systems, Bayesian networks, Demster Shafer theory, fuzzy logic. **6Hrs.**

**UNIT-4**

**EXPERT SYSTEMS :** Introduction, structure and uses, representing and using domain knowledge, expert system shells, pattern recognition, introduction to recognition and classification process, learning classification patterns, recognizing and understanding speech. **6Hrs.**

**UNIT- 5**

**INTRODUCTION TO KNOWLEDGE ACQUISITION:** Types of learning, general learning model and performance measures, Typical expert systems: MYCIN variants of MYCIN, PROSPECTOR, DENDRAL, PUFF. **8Hrs**

**INTRODUCTION TO MACHINE LEARNING:** Perceptrons, checker playing examples, learning automata, genetic algorithm, intelligent editors. **4Hrs.**



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**TEXT BOOKS:**

1. **Artificial Intelligence and Expert systems**, Elaine Rich and Kevin Knight, M/H, 1983.
2. **Introduction to Artificial Intelligence and Expert systems**, Dan W. Patterson, PHI, New Delhi, 1999.
3. **Artificial Intelligence in business, science and industry**, Wendry B, Ranch, VI, II application, PHI, 1985.

**REFERENCE BOOKS :**

1. **A guide to expert systems** Waterman, D.A, Addison-Wesley Inc., 1986.
2. **Building expert systems** Hayes, Roth, Waterman, D.A (ed), AW, 1983.
3. **Designing expert systems** Weis, S.M. and Kulliknowske, London, Champion Hull, 1984.

**COURSE OUTCOMES**

<b>CO1</b>	Be able to get an insight into fundamentals of AI and related areas
<b>CO2</b>	Learn applications of AI and ES in various fields such as 1.Defense, Medical Diagnostics, Surgery etc
<b>CO3</b>	Determine the Knowledge Representation issues, Reasoning mechanisms, Logic Programming, properties of wffs etc.
<b>CO4</b>	Learn logic programming basics, Reasoning under uncertainty, Baye's theorem, Bayesian Networks and other related reasoning methods
<b>CO5</b>	Study Expert Systems – their logic, growth and development along with applications, concept of knowledge Acquisition, working of typical ES's such as MYCIN, DENDRAL, PROSPECTOR, PUFF etc. and also Machine Learning, Genetic Algorithm

**SCHEME OF EXAMINATION:**

Five questions to be set with one question from each unit carrying 20 marks each. 1 and 2 units will have an internal choice

**ASSESSMENT**

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Semester End Examination (SEE)-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

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<b>Course</b>	<b>THEORY OF CONSTRAINTS</b>	<b>Course Code</b>	<b>17IE7DETOC</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites:** Nil

**UNIT-1**

**INTRODUCTION TO THEORY OF CONSTRAINTS.** TOC Thinking Tools: Current Reality tree and core conflicts, conflict clouds, Negative branch reservations, prerequisite tree, categories of legitimate reservation, layers of resistance. **8Hrs**

**UNIT-2**

**TOC APPLICATIONS IN PRODUCTION/OPERATIONS:** Concept of Drum, Buffer, Rope, Simplified Drum Buffer rope, Drum Buffer rope, Use of simulator to explain DBR. **9Hrs**

**UNIT-3**

**TOC APPLICATION IN DISTRIBUTION:** Replenishment Model and case discussions. **7Hrs**

**UNIT-4**

**TOC APPLICATIONS IN FINANCE AND MEASUREMENTS:** Throughput accounting **8Hrs**

**UNIT-5**

**TOC APPLICATIONS IN PROJECT MANAGEMENT:** Critical chain and case discussion **8Hrs**

**TEXT BOOKS**

1. **Goldsratt's Theory of constraints:** A Systems approach to Continuous Improvement, H. William Dettmer, 1997, ISBN-087389-370-0 ,
2. **Project Management,** Chaudhry S. Tata Mc Graw hill, ISBN-13:978-0-07-460068-9

**ONLINE RESOURCES**

[www.nptel.ac.in](http://www.nptel.ac.in)

**SCHEME OF EXAMINATION:** Unit- 1 and Unit- 2 will have internal choice.

**ASSESSMENT**

Continuous Internal Evaluation (CIE) includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

Semester End Examination (SEE)-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)



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<b>Course</b>	<b>INDUSTRIAL EXPERIMENTATION</b>	<b>Course Code</b>	<b>17IE7DEIEX</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites:** Nil

**UNIT - 1**

**INTRODUCTION:** History of quality engineering: Japan versus U.S. track records. Taguchi Approach to Quality: Definition of quality, Loss function, Off-line and On-line quality control, Taguchi's quality philosophy. ANOVA, Test of hypothesis. **6Hrs**

**UNIT - 2**

**BASIC DESIGNS:** Completely Randomized Design, Randomized Block Design, Latin Square Designs, one way analysis of variance and two way analysis of variance.

**FACTORIAL EXPERIMENTATION - TWO LEVELS:** Full Factorial Designs: Experimentation as a learning process. Traditional scientific experiments, Two factor design, Four-factor design, replicating experiments, Factor interactions. Fractional factorial designs based on eight-run experiments. **12Hrs**

**UNIT -3**

**TAGUCHI TECHNIQUES:**

**CONSTRUCTING ORTHOGONAL ARRAYS:** Counting degrees of freedom, selecting a standard orthogonal array, dummy level technique and compound factor method, Linear graphs and interaction assignment, Modification of linear graphs, column merging method, branching design, Strategy for constructing an orthogonal array, Comparison with the classical statistical experiment design. **10Hrs**

**UNIT 4**

**STEPS IN ROBUST DESIGN:** Case study discussion, Noise factors and testing conditions, Quality characteristics and objective functions, Control factors and their levels, Matrix experiment and data analysis plan, Conducting the matrix experiment, data analysis, verification experiment and future plan. **6Hrs**

**UNIT - 5**

**SIGNAL-TO-NOISE RATIO FOR STATIC PROBLEMS:** Evaluation of sensitivity to noise, S/N ratios for Smaller-the-better, Larger-the-better, Nominal-the-best and Asymmetric Cases.

**SHAININ TECHNIQUE:** Introduction, salient features, case studies in sequential DOE tools to solve chronic problems. **6Hrs**

**TEXTBOOKS:**

1. **Quality Engineering Using Robust Design** - Madhav S. Phadke, Prentice Hall PTR, Englewood Cliffs, New Jersey 07632.
2. **Design of Experiments** - D.C. Montgomery, John Wiley and Sons, 2002.
3. **World Class Quality using DOE to make it happen**, Keki R. Bhote, American Management Association publications, 2<sup>nd</sup> Ed. 2000



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**REFERENCE BOOK:**

1. Designing for Quality - Robert H. Lochner and Joseph E. Matar, - an Introduction Best of Taguchi and Western Methods or Statistical Experimental Design", Chapman and Hall Madras, 2nd edition.

**ONLINE REFERENCE:**

<http://www.nptel.ac.in/syllabus/110104020/>

<http://www.eformacion.com>

[http://www.sas.com/storefront/aux/en/spdesignanalysisjmp/66584\\_excerpt.pdf](http://www.sas.com/storefront/aux/en/spdesignanalysisjmp/66584_excerpt.pdf)

**COURSE OUTCOMES**

<b>CO1</b>	To understand principles of analysis of variance, experimental designs like CRD, factorial, Taguchi and Shainin design
<b>CO2</b>	To select & construct the appropriate experimental design for a particular problem.
<b>CO3</b>	To analyze the data & interpret the experimental results

**SCHEME FOR EXAMINATION:** Five questions choosing one each from each unit and Unit 2 and 3 with choice questions

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**ELECTIVE-VI**

<b>Course</b>	<b>LEAN MANUFACTURING</b>	<b>Course Code</b>	<b>17IE7DELNM</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT- 1**

**INTRODUCTION TO LEAN MANUFACTURING:**

Objectives of Lean manufacturing-key principles and implications of lean manufacturing-traditional Vs Lean manufacturing. **5Hrs**

**LEAN MANUFACTURING CONCEPTS:**

Value creation and waste elimination-man kinds of waste- pull production- different models of pull production- continuous flow-continuous improvement/Kaizen-worker involvement-cellular layout-administrative lean **6Hrs**

**UNIT- 2**

**LEAN MANUFACTURING TOOLS AND METHODOLOGIES:**

Standard work-communication of standard work employees- standard work and flexibility-visual control –quality at the source- 5S principles- preventive maintenance – total quality management -total productive maintenance- changeover/setup time-batch size reduction-production leveling **6Hrs**

**UNIT- 3**

**VALUE STREAM MAPPING:**

The as-is diagram-the future state map-application to the factory simulation scenario-line balancing- Poke Yoke- Kanban- Overall equipment effectiveness. **6Hrs**

**UNIT- 4**

**JUST IN TIME MANUFACTURING:**

Introduction-elements of JIT-uniform production rate-pull versus push method-Kanban system-small lot size-quick, inexpensive set-up-continuous improvement, Optimized production technology **6Hrs**

**ONE PIECE FLOW:** Process razing techniques-cells for assembly line- case studies. **4Hrs**

**UNIT- 5**

**IMPLEMENTING LEAN:** Road map- senior management Involvement-best practices. **4Hrs**

**RECONCILING LEAN WITH OTHER SYSTEMS:** Toyota production system-lean six sigma- lean and ERP-lean with ISO9001:2000 **3Hrs**

**TEXT BOOKS:**

1. **A Study of the Toyota Production System**, Shigeo Shingo , Andrew P. Dillon, Productivity Press,1989, ISBN 9780915299-17-8 ,
2. **The Machine that changed the World**, James P. Womack, Daniel T. Jones and Daniel Roos Free press, Simon and Schuster Inc., New York, 2007, ISBN SBN 10: 0743249275 ISBN 13: 9780743249270



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**REFERENCE BOOKS:**

1. **Design and Analysis of Lean Production Systems**, Askin R G and Goldberg J B, John Wiley and Sons Inc., 2003, ISBN 9812-53-027-4
2. **What is lean Six sigma**, Micheal, L George, David T Rowlands, Bill Kastle, McGraw Hill, New York, 2004.
3. **Lean Tools; A Pocket Guide to Implement Lean Practices, Productivity And Quality** Micheal Wader, Publishing Pvt Ltd, 2002.
4. **One-piece Flow**, Productivity Press Kenichi Sekine, Portland Oregon, 1992.
5. **Continuous Improvement in Operations**, Alan Robinson, Productivity Press, Portland Oregon, 1991.
6. **Juran Institute's Six Sigma break Through and Beyond**, Joseph A De Feo, William W Bearnard, Juran Institute's Six Sigma break Through and Beyond, Tata McGraw hill Edition, New Dehli, 2004.
7. **Operations, Management for Competitive Advantage**, Richard B Chase F Robert Jacobs and Nicholas J Aquilano, McGraw Hill/Irwin: Tenth Edition, 2003.
8. **Improving Product Quality by preventing defects: Poke-Yoke**, Productivity press, 1992.

**E-BOOKS:** [www.scodanibbio.com/site/access/e\\_courses/downloads/.../vsm\\_pw.pdf](http://www.scodanibbio.com/site/access/e_courses/downloads/.../vsm_pw.pdf)  
[www.amazon.in/How-To...Lean-Manufacturing-ebook/dp/B002LC8HF](http://www.amazon.in/How-To...Lean-Manufacturing-ebook/dp/B002LC8HF) (Lonnie Wilson)

**ONLINE REFERENCES:** <http://nptel.ac.in/courses/110105039/> (Six Sigma)

**COURSE OUTCOMES:**

<b>CO1</b>	To define and describe, lean manufacturing practices such as value stream mapping, lead-time reduction, setup time reduction, just-in-time techniques, and process management tools.
<b>CO2</b>	To identify the elements of 5S program and demonstrate implementation
<b>CO3</b>	To plan, implement, and evaluate the impact of a lean manufacturing practice
<b>CO4</b>	To identify and describe the potential enterprise issues associated with the planning, implementation, and evaluation of lean manufacturing principles
<b>CO5</b>	To describe the relevance of lean manufacturing principles to manufacturing processes and equipment, supply chain management, product development, and human resource management

**SCHEME OF EXAMINATION:** Answer one question from each unit. Choice is to be given in Unit-1 and Unit-4

**ASSESSMENT**

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<b>Course</b>	<b>MANAGEMENT INFORMATION SYSTEM</b>	<b>Course Code</b>	<b>17IE7DEMIS</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P</b>	<b>3-0-0</b>

**Prerequisites:** Nil

**UNIT - 1**

**FUNDAMENTALS OF INFORMATION SYSTEMS:** Information systems in business, fundamentals of information systems solving business problems with information systems.

**6Hrs**

**UNIT - 2**

**INFORMATION SYSTEMS FOR BUSINESS OPERATIONS:** Business information systems, Transaction processing systems, management information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

**ISSUES IN MANAGING INFORMATION TECHNOLOGY:** Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology.

**10Hrs**

**UNIT - 3**

**INTRODUCTION TO E-BUSINESS:** E-commerce frame work, Media convergence, Consumer applications, Organization applications.

**E-BUSINESS MODEL:** Architectural frame work for E-commerce, Application services and transaction Models – B2C Transactions, B2B Transactions, Intra-Organizational Transactions.

**E-BUSINESS MODEL:** WWW Architecture: Client server structure of the web, e-Commerce architecture, Technology behind the web.

**12Hrs**

**UNIT - 4**

**CONSUMER-ORIENTED E-COMMERCE:** Consumer oriented Application: Finance and Home Banking, Home shopping, Home Entertainment, Mercantile Process Models, Consumers perspective, Merchants perspective.

**6Hrs**

**UNIT - 5**

**ELECTRONICS DATA INTERCHANGE (EDI):** EDI Concepts, Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI.

**6Hrs**

**TEXT BOOKS:**

1. **Management Information systems-** managing information technology in the internet worked enterprise- jams. A O'Brien – Tata McGraw Hill publishing company limited, 2002.
2. **Frontiers of E-Commerce**– Ravi Kalakota and Andrew B. Whinston Pearson Education

**REFERENCE BOOKS:**

1. **Management Information systems-** S. Sadogopan.PHI 1998Edn.ISBN 81-203-1180-9
2. **Information systems for modern management** - G.R. Murdick PHI, 2nd Edition.



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**E-books:**

<http://www.mu.ac.in/mis.pdf>

[http://www.academia.edu/5275161/Management\\_Information\\_Systems\\_12th\\_Edition](http://www.academia.edu/5275161/Management_Information_Systems_12th_Edition)

**Online References:**

<https://books.=Management+Information+system+ebooks>

**Course Outcome:** Student will be

<b>CO1</b>	Able to acquire knowledge of the functional areas of business and the interrelationships among the functional areas within a business to solve business problems
<b>CO2</b>	Able to use analytical and reflective skills in decision making and recognize legal and ethical issues confronting them
<b>CO3</b>	Able to understand technical knowledge of computer networks, information security and information assurance
<b>CO4</b>	Contribute to the performance of a group within a business setting
<b>CO5</b>	Knowthe differences among global economies, institutions, business practices and cultures

**Scheme of Examination:** One question each from units 1 , 4, 5 & two questions from unit2 & unit 3 .

**ASSESSMENT**

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**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>HUMAN RESOURCE MANAGEMENT</b>	<b>Course Code</b>	<b>17IE7DEHRM</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites:** Nil

**UNIT – 1**

**INTRODUCTION:** Evolution of HRM, Objectives, Functions and Policies. **5Hrs**

**HUMAN RESOURCE PLANNING:** Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting, job Description, Job Specification. **5Hrs**

**UNIT - 2**

**RECRUITMENT:** Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process. **5Hrs**

**SELECTION:** Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and Limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion exit interview, (Tutorial on written test, Group discussion, Interviews). **5Hrs**

**UNIT - 3**

**TRAINING AND DEVELOPMENT:** Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods. **5Hrs**

**PERFORMANCE APPRAISAL:** Components (all round performance appraisal), Methods, Advantages and limitations of different methods, Personal Counseling based on Annual Confidential Reports. **5Hrs**

**UNIT - 4**

**COUNSELLING AND HUMAN RESOURCE ACCOUNTING:** Characteristics, Need, Function, Types, Suggestions for personnel development, communication function, communication process, effective communication. Human resource records, Advantages of HR accounting, various methods of accounting. **5Hrs**

**UNIT – 5**

**INDUSTRIAL RELATIONS:** Indian trade union act, standing orders act, Indian factories act.

**INDUSTRIAL DISPUTES AND SETTLEMENT:** Indian Industrial Disputes act, Industrial disputes settlement machinery. Works committee, Board of Conciliation, Voluntary Arbitration, Compulsory arbitration, Court of inquiry, Industrial tribunal, Adjudication. **4Hrs**

**TEXT BOOKS:**

1. **Human Resources Management** – Dr. K Ashwathappa, Tata McGraw Hill, Edition 1999
2. **Management of Organisations Behaviour** – Hersey and Blanchard – Prentice Hall of India Edn – 1998
3. **Industrial Relations** – Arun Monappa – TMH, ISBN – 0-07-451710-8



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**REFERENCES BOOKS:**

1. **Personnel / Human resource Management** – Decenoz and robbins PHI, 2002
2. **Management of Human Resources** – CB Mamoria – Himalaya Publication House, 2003
3. **Industrial Acts** by Jain, 2004

**ONLINE REFERENCE:** [www.shrm.org](http://www.shrm.org),

**COURSE OUTCOMES**

<b>CO1</b>	Human Resource Management objectives, functions and polices to describe and specify job, they also learn to plan for man power requirement.
<b>CO2</b>	Selection procedure, process, write tests, discuss in groups and attend interviews.
<b>CO3</b>	Training and Development to train and develop employees of the industry and to do Performance appraisal for continuous improvement.
<b>CO4</b>	Counseling and human resource accounting to suggest for personnel development, communication and to maintain records.
<b>CO5</b>	Industrial relations to follow factory acts, to resolve Industrial Disputes and settle industrial disputes.

**SCHEME OF EXAMINATION:**

FIVE Questions to be set with one question from units 1 to 5 carrying 20 marks each. Questions in unit 2& 3 units will have an internal choice

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

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**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>RELIABILITY ENGINEERING</b>	<b>Course Code</b>	<b>17IE7DERLE</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites:** Nil

**UNIT- 1**

**INTRODUCTION:** Concepts, terms, and definitions of reliability and related performance measure, Terminology in reliability, Failure rate, MTBF, Life test, importance of reliability, definition, meaning of adequate performance, reliability-engineering Programme and its scope, Typical applications.

**RELIABILITY MANAGEMENT:** Reliability goals & policies, economics of reliability, reliability data Collection, Reliability requirement data collection and agreement, Design validation for reliability  
**6Hrs**

**UNIT- 2**

**COMPONENT LIFE:** Failure distribution function, reliability function and hazard rate function, interrelationships, MTTF, MTBF, bath tub curve (Mortality curve), conditional reliability function, constant and time dependent failure models, Accelerated tests and testing conditions for component life.

**PRACTICAL FAILURE PATTERNS:** Failure behavior of mechanical, electrical, electronic parts, common failure distribute.  
**6Hrs**

**COMBINATORIAL RELIABILITY (RELIABILITY OF SYSTEMS):** Reliability analysis of systems: (Success-Failure models only) Analysis of Series, parallel, series parallel and parallel series configurations. R out of n configurations, redundancy improvement factor, stand by systems.  
**6Hrs**

**TECHNIQUES FOR COMPLEX SYSTEMS RELIABILITY EVALUATION:** Inspection methods, event space methods, path tracing methods, decomposition methods, cut set methods, tie set methods.  
**2Hrs**

**UNIT- 3**

**DESIGN FOR RELIABILITY:** System effectiveness measures and life cycle cost analysis, reliability allocation, methods for reliability in design, failure analysis, systems safety and fault tree analysis, multistate model. Failure mode effect and criticality analysis. House of Reliability  
**4Hrs**

**MARKOV MODELS FOR SYSTEM RELIABILITY:** Reliability analysis of state dependent systems, Markov analysis, and stand by system analysis.  
**4Hrs**

**UNIT- 4**

**MAINTENABILITY AND AVAILABILITY:** Analysis of Down time, Repair Time distributions, maintainability, Maintenance increment, Design for maintainability. Availability analysis, Different forms of availability, system availability analysis, mission availability, Availability of stand by system  
**6Hrs**





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**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**UNIT- 5**

**ANALYSIS FAILURE DATA:** Types of life testing, data collection, Empirical methods, Estimation of Static life, types of life testing: development of confidence intervals, acceptance test procedures for life estimation using exponential, Weibull and Gamma distribution models, Sequential life tests and acceptance criteria.

**APPLICATION AND CASE STUDIES:** Case example involving redundancy, burning tests, preventive maintenance analysis, Repairable system analysis, Software reliability.

**6Hrs**

**TEXT BOOKS:**

1. **Concepts of Reliability Engineering** -L. S. Srinath, - Affiliated East West Press Pvt.Ltd 2nd ed.
2. **Reliability Engineering** - Dr. Balaguru Swamy Tata McGraw Hill, Fourth Edition, 2003
3. **An introduction to Reliability and Maintainability** - Charles E Ebeling TMH, Edition 2000, ISBN 0-07-042138-2

**REFERENCES BOOKS:**

1. **Reliability Hand Book** Ireson and Grant, McGraw Hill -1995
2. **Mathematical Theory of Reliability and Mathematics** Barlow and Proschan, 1<sup>st</sup>Edition, John Wiley and Sons, 1996, ISBN-978-0-898713-69-5
3. **Probability Reliability & Engineering approach**-Shooman-1976.
4. **Practical Reliability Engineering** Patrick D.T.O John Wiley and Sons 2002.
5. **Introduction to Reliability Engineering** E E Lewis John Wiley & Sons, 2nd edition., 1996, ISBN-0471104841, 9780471104841

**COURSE OUTCOMES**

CO1	To understand the fundamentals of reliability like failure rate, availability, maintainability etc.
CO2	Ability to predict systems reliability availability, maintainability component failure data
CO3	To analyze the interference between strength and stress, or life data for estimating reliability and also strategies for enhancing reliability of components and systems

**SCHEME FOR EXAMINATION:** Five questions choosing one each from each unit and Unit 2 and 3 with choice questions

**ASSESSMENT**

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**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**INSTITUTIONAL ELECTIVE-I**

<b>Course</b>	<b>DATA BASE MANAGEMENT SYSTEM</b>	<b>Course Code</b>	<b>17IE7IEDBM</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT - 1**

**DATABASES AND DATABASE USERS:** Introduction, characteristics of data base approach, intended use of a DBMS, advantages and implication of database approach.

**DATABASE SYSTEMS CONCEPTS AND ARCHITECTURE:** Data models, Schemas and instances' DBMS architecture and data independence, database languages and interfaces, database system environment, classification of data base management Systems.

**6Hrs**

**DATA MODELING:** High level conceptual data models for database design. Entity types, entity. Sets, attributes, and keys. Relationships, relationship types, roles, and Structural constraints, Weak entity types. ER Diagrams

**6Hrs**

**UNIT - 2**

**RECORD STORAGE AND PRIMARY FILE ORGANIZATIONS:** Secondary storage devices, buffering of blocks, placing fill records on disk, operations on files, heap files a sorted files, hashing techniques.

**4Hrs**

**INDEX STRUCTURE OF FILES:** Single-level and multilevel ordered indexes, dynamic multi-level indexes using B-trees and B+trees.

**2Hrs**

**UNIT - 3**

**RELATIONAL DATA MODE ANQ RELATIONAL ALGEBRA:** Brief' discussion on Codd rules, relational model concepts, constraints, and schemas. Update operation on relations, basic and additional relational algebra operations, and queries in relational algebra.

**Structured Query Language (SQL):** Data definition etc. in SQL2.Basic and complex queries in SQL. Insert, delete, update statements, and views in SQL, embedded SQL.

**10Hrs**

**UNIT - 4**

**DATABASE DESIGN:** Design guidelines for relational schemes, functional Dependencies, normalization -1st, 2nd, 3'd, 4 , and 5th normal forms. Database design process, factors influencing physic I database design guidelines, and guidelines for relational systems.

**6Hrs**



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**UNIT - 5**

**SYSTEM IMPLEMENTATION:** System catalog for RDBMSs, transaction processing and system concepts, properties of transactions, brief discussion on concurrency, control and recovery techniques, database security and authorization. **4Hrs**

**BRIEF DISCUSSION ON:** Distributed databases, objected oriented databases, next generation databases, and interfacing with other technologies. **2Hrs**

**ONLINE REFERENCE:**

<http://nptel.ac.in/video.php?subjectId=106106093>

**TEXTBOOKS:**

1. **Fundamentals of database systems**"- Ramez Elmasri and Shamkanth B. Navathe, , Addison Wesley Publishing Company, 6<sup>th</sup> Edition,
2. **Database Management System**, -Raghu Ramakrishnan and Johanne's Gehrke, , TATA McGraw Hill, 3'd Edition, ISBN 0-071231511 I

**REFERENCE BOOKS:**

1. **Modern Data base management:** McLfadden, Hoffer, Prescott
2. **Database Management Design** Gary W. Hansen and James V. Hansen, PHI Pvt . Ltd, 2nd Edition

**COURSE OUTCOMES**

CO1	Able to use, appreciate advantages and implication of database
CO2	Able to understand DBMS architecture, languages, interfaces, data modeling
CO3	Able to carry out indexing, understand relational model concepts, schemas
CO4	Able to use SQL, design database, carryout transaction processing, implement systems

**SCHEME OF EXAMINATION:** One Question to be set from each unit and Two Questions will be set from the Unit 1 & Unit-3. Student will answer any 5 questions selecting at least one from each unit.

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

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**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>HUMAN RESOURCE MANAGEMENT</b>	<b>Course Code</b>	<b>17IE7IEHRM</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites:** Nil

**UNIT – 1**

**INTRODUCTION:** Evolution of HRM, Objectives, Functions and Policies. **5Hrs**

**HUMAN RESOURCE PLANNING :** Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting, job Description, Job Specification.

**5Hrs**

**UNIT - 2**

**RECRUITMENT:** Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process. **5Hrs**

**SELECTION:** Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and Limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion exit interview, (Tutorial on written test, Group discussion, Interviews). **5Hrs**

**UNIT - 3**

**TRAINING AND DEVELOPMENT:** Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods. **5Hrs**

**PERFORMANCE APPRAISAL:** Components (all round performance appraisal), Methods. Advantages and limitations of different methods, Personal Counseling based on Annual Confidential Reports. **5Hrs**

**UNIT - 4**

**COUNSELLING AND HUMAN RESOURCE ACCOUNTING:** Characteristics, Need, Function, Types, Suggestions for personnel development, communication function, communication process, effective communication. Human resource records, Advantages of HR accounting, various methods of accounting. **5Hrs**

**UNIT – 5**

**INDUSTRIAL RELATIONS:** Indian trade union act, standing orders act, Indian factories act.

**INDUSTRIAL DISPUTES AND SETTLEMENT:** Indian Industrial Disputes act, Industrial disputes settlement machinery. Works committee, Board of Conciliation, Voluntary Arbitration, Compulsory arbitration, Court of inquiry, Industrial tribunal, Adjudication. **4Hrs**

**TEXT BOOKS:**

1. **Human Resources Management** – Dr. K Ashwathappa, Tata McGraw Hill, Edition 1999
2. **Management of Organizations Behaviour** – Hersey and Blanchard – Prentice Hall of India Edn – 1998
3. **Industrial Relations** – Arun Monappa – TMH, ISBN – 0-07-451710-8



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**REFERENCES BOOKS:**

1. **Personnel / Human resource Management** – Decenoz and robbins PHI, 2002
2. **Management of Human Resources** – CB Mamoria – Himalaya Publication House, 2003
3. **Industrial Acts** by Jain, 2004

**ONLINE REFERENCE:** [www.shrm.org](http://www.shrm.org),

**COURSE OUTCOMES**

<b>CO1</b>	Human Resource Management objectives, functions and polices to describe and specify job, they also learn to plan for man power requirement.
<b>CO2</b>	Selection procedure, process, write tests, discuss in groups and attend interviews.
<b>CO3</b>	Training and Development to train and develop employees of the industry and to do Performance appraisal for continuous improvement.
<b>CO4</b>	Counseling and human resource accounting to suggest for personnel development, communication and to maintain records.
<b>CO5</b>	Industrial relations to follow factory acts, to resolve Industrial Disputes and settle industrial disputes.

**SCHEME OF EXAMINATION:**

FIVE Questions to be set with one question from units 1 to 5 carrying 20 marks each. Questions in unit 2& 3 units will have an internal choice

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

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**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course Name</b>	<b>OPERATIONS RESEARCH (Institutional Elective)</b>	<b>Course Code</b>	<b>16MD7IE1OR</b>
<b>Credits</b>	<b>03</b>	<b>L – T – P -S</b>	<b>3- 0- 0-0</b>
<b>CIE</b>	<b>50 Marks(100% weightage)</b>	<b>SEE</b>	<b>100 Marks(50% weightage)</b>

**Prerequisites:**

Matrix computations, Statistics and Probability.

**COURSE DESCRIPTION: COURSE OBJECTIVES:** To acquaint the students with quantitative methods and different techniques for effective decision making; model formulation and applications that are used in solving business decision problems in various environments. The course includes linear programming, transportation, assignment problems, CPM/PERT techniques, Game theory.

**UNIT-1**

**INTRODUCTION:** Evolution, definition, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, Linear Programming Problems (LPP) - Formulation of LPP-Graphical solution. Use of slack, surplus and artificial variables, Canonical and Standard forms, Solution of LPPs using Simplex method, Big- M method. **09Hrs**

**UNIT-2**

**TRANSPORTATION PROBLEM:** Formulation of transportation problem, types, initial basic feasible solution using North-West Corner method, least cost method, Vogel approximation method, Degeneracy in transportation problems, optimal solutions by MODI method. **07Hrs**

**UNIT-3**

**ASSIGNMENT PROBLEM-** Formulation, types, Hungarian method for assignment problem, Unbalanced assignment problem, application to maximization cases and travelling salesmen problem **07 Hrs**

**UNIT-4**

**PERT-CPM TECHNIQUES:** Introduction, network construction-AON & AOA diagrams, Fulkerson's rule for numbering the events, Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project. Predicting the completion time of project; crashing of simple projects. **09Hrs**

**UNIT-5**

**GAME THEORY:** Formulation of games, types, solution of games with saddle point, Solution of games without saddle point, 2x2 games without saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games. **07Hrs**



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**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**TEXT BOOK:**

1. S.D. Sharma-Operations Research, Kedarnath Ramanath & Co.2002
2. R. Panneer Selvam-Operations Research, second edition, PHI Learning Private Limited 2011.
3. Richard Bronson, Govindasami Naadimuthu: Schaumn Outline series-second edition, Tata McGraw Hill edition 2004, Eleventh reprint 2011.

**REFERENCE BOOKS:**

1. Hiller and Liberman -Introduction to Operations Research, Ninth edition Mc Graw Hill Publications.
2. Hamdy A Taha H A- Operations Research, eighth edition, Pearson Prentice Hall.
3. Kanti Swarup, P K Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, 2010.

**E-LEARNING:**

1. <https://books.google.co.in/books?isbn=8131711048>, Taha-2008
2. <https://books.google.co.in/books?isbn=8121902819> D S Hira-2008
3. <https://books.google.co.in/books?isbn=8131700003>,A. M. Natrarajan, P Balasubramani-2006

**Question Paper Pattern:**

1. Each unit consists of one full question.
2. Each full question consists of two, three or four subdivisions.
3. Five full questions to be answered.
4. Internal choice in Unit 1 and Unit 4.

**COURSE OUTCOMES**

CO #	COURSE OUTCOME (CO)	PO
CO 1	Formulate a real-world problem as a mathematical programming model.	1,2
CO 2	Formulate and solve transportation models by applying cost cutting strategies.	2,3
CO 3	Formulate and solve assignment models and travelling salesmen problems.	2,3
CO 4	Construct a project network and apply program evaluation review technique and critical path management.	2,3
CO 5	Employ Game theory for strategic decision making.	2,3

**ASSESSMENT**

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**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>PRODUCT DESIGN &amp; DEVELOPMENT</b>	<b>Course Code</b>	<b>17IE7IEPDD</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT- 1**

**INTRODUCTION:** Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development.

**DEVELOPMENT PROCESSES AND ORGANIZATIONS:** A generic development process, concept development: the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization.

**PRODUCT PLANNING:** The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process. **8Hrs**

**UNIT- 2**

**IDENTIFYING CUSTOMER NEEDS:** Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.

**PRODUCT SPECIFICATIONS:** What are specifications, when are specifications established, establishing target specifications, setting the final specifications. **6Hrs**

**UNIT-3**

**CONCEPT GENERATION:** The activity of concept generation clarify the problem, search externally, search internally, explore systematically, reflect on the results and the process.

**CONCEPT SELECTION:** Overview of methodology, concept screening, and concept scoring,

**CONCEPT TESTING:** Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, and reflect on the results and the process.

**PRODUCT ARCHITECTURE:** What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues. **10Hrs**

**UNIT- 4**

**INDUSTRIAL DESIGN:** Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assesses the quality of industrial design

**DESIGN FOR MANUFACTURING:** Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

**Prototyping:** Prototyping basics, principles of prototyping, technologies, planning for prototypes **6Hrs**





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**UNIT- 5**

**INTELLECTUAL PROPERTY RIGHTS:** Basic principles of IP laws: Introduction, Concept of property, Need for a holistic approach, Basis for protection, Invention, Criteria for patentability, Non – patentable inventions. Patents: Introduction, principles underlying the patent law in India, patentable invention. Procedure for obtaining patent. **6Hrs**

**PRODUCT DEVELOPMENT ECONOMICS:** Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

**MANAGING PROJECTS:** Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation. **4Hrs**

**TEXT BOOKS:**

1. **Product Design & Development**, Karl T. Ulrich & Steven D., Tata McGraw Hill, 3<sup>rd</sup> Edition, 2003
2. **Product Design and Manufacturing**, A.K. Chitale and R.C. Gupta, PHI.,2013, 6<sup>th</sup> Edition, ISBN-978-81-203-4873-8
3. **Basic principles and acquisition of Intellectual Property Rights**, Dr. T Ramakrishna, CIPRA, NSLIU -2005.
4. **Intellectual Property Law Handbook**, Dr.B.L.Wadehra, Universal Law Publishing Co. Ltd., 2002.

**REFERENCE BOOKS:**

1. **New Product Development**, Tim Jones, Butterworth Heinr1ann, Oxford, UIC 1997.
2. **New Product Development: Design & Analysis**, Roland Enene, Kinetovicz, John Wiley and Sons Inc., N. Y. 1990.
3. **Product Design for Manufacture and Assembly**,GefferryBoothroyd, Peter Dewhurst and Winston Knight.
4. **Successful Product Design**, Jill Hollins, Stwout Pugh, Butterworth, London 1990.

**ONLINE LINKS:**<http://nptel.ac.in/courses.php>

**SCHEME FOR EXAMINATION:** Five questions choosing one each from each unit and Unit 1 and 2 with choice questions

**COURSE OUTCOMES**

<b>CO1</b>	Understand the basic concepts of product design
<b>CO2</b>	Understand the product design process in industry
<b>CO3</b>	Understand the economic factors involved in PD
<b>CO4</b>	Understand the basic concepts of IPR
<b>CO5</b>	Understand modern approaches helpful in product design





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**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**  
**ASSESSMENT**

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**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>AUTOMATION IN MANUFACTURING</b>	<b>Course Code</b>	<b>17IE7IEAIM</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**UNIT - 1**

**INTRODUCTION:** Introduction to automation, definition, types of automation, reasons for automating, arguments for and against automation.

**PRODUCTIVITY CONCEPTS AND MATHEMATICAL MODELS:**

Introduction, manufacturing lead-time, components of operating time, production rate, plant capacity, utilization and availability, work-in-process, automation strategies. (Problems)

**10Hrs**

**UNIT - 2**

**HIGH VOLUME PRODUCTION SYSTEM:** Introduction to automated flow lines, Configuration of flow lines, Methods of work-part transport systems, Performance analysis of automated flow lines, analysis of automated transfer lines without buffer, automated flow lines with storage buffer, analysis of a two-stage line. Line balancing of assembly systems. (Problems on line balancing only).

**10Hrs**

**UNIT - 3**

**GROUP TECHNOLOGY:** Part families, part classification and coding systems, machine cell design, application consideration in group technology.

**COMPUTERIZED MANUFACTURING PLANNING SYSTEMS:** Introduction, computer aided process planning, retrieval and generative type of process planning, benefits of computer aided process planning.

**6Hrs**

**UNIT - 4**

**FLEXIBLE MANUFACTURING SYSTEMS:** Introduction to FMS, components of FMS, types of FMS, Layout configurations, computer control system, application and benefits of FMS. FMS planning and implementation issues.

**COMPUTER NETWORKS FOR MANUFACTURING:** Introduction, hierarchy of computers in manufacturing, local area networks, manufacturing automation control.

**8Hrs**

**UNIT - 5**

**AUTOMATED INSPECTION AND TESTING:** Introduction, contact and non-contact inspection techniques, Types of coordinate measuring machines, applications and benefits, machine vision.

**THE FUTURE AUTOMATED FACTORY:** Introduction, trends in manufacturing, the future automated factory, the social impact of automated systems, Industry 4.0

**6Hrs**

**SCHEME OF EXAMINATION:**

To set two questions from units 1 & 2 and one question from units 3, 4 & 5.



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**TEXT BOOKS:**

1. **Automation, Production Systems and Computer Integrated Manufacturing** - Mikell P. Groover, Pearson – Education, New Delhi, 5<sup>th</sup> Printing, 1996, ISBN-812030618X, 2003e, ISBN-81-7808-511-9
2. **Computer control of manufacturing systems** –Yorem Koren, 2005e, ISBN-0-07-Y66379-3

**REFERENCE BOOKS:**

1. **CAD/CAM**, Mikell P. Groover and Emory W.Zimmers, PHI, New Delhi , 22<sup>nd</sup> printing - 2003, ISBN-81-203-0402-0
2. **An Introduction to Automated Process Planning System** – Tiess Chieu Chang and Richard A Wysk PHI , 1985e,

ONLINE: [www.nptel.ac.in](http://www.nptel.ac.in)

**Course Out comes:**

<b>CO1</b>	Is able to acquire the knowledge of fundamentals of automation, the types of automation and the need to go in for automation. Learn about the concepts of production automation, strategies in automation.
<b>CO2</b>	Is able to learn about the transfer mechanisms, analysis of production and assembly automated flow lines and balancing of flow lines.
<b>CO3</b>	Is able to understand the philosophy of Group technology and learn about computerized process planning system, types of computer aided process planning, and benefits of CAPP.
<b>CO4</b>	Is able to acquire the knowledge ofFlexible manufacturing systems, Layout configurations, and implementation of FMS. Isable to understand about computer networks for production automation,hierarchy, network topology, manufacturing automation protocol.
<b>CO5</b>	Is able to understand the concept of computerized measuring systems, types of equipment used in the automated systems. Is also able to acquire the knowledge of trends in manufacturing, and the future automated factory.

**ASSESSMENT**

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**Semester End Examination (SEE)**-a written examination for theory courses and practical/ design examination with built-in-oral part (Viva voice)

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<b>Course Title</b>	<b>SIX SIGMA</b>	<b>Course Code</b>	<b>17IE7IESS</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P</b>	<b>3-0-0</b>

**Prerequisites: Nil**

**UNIT – 1**

**INTRODUCTION:** Six Sigma Introductory Overview, Project Selection, Process and Financial Metrics, Project Reporting Expectations **7 Hrs**

**UNIT – 2**

**PROJECT DEFINITION:** Project Charters, Estimating Financial Metrics, Definition of process outputs (characteristics, defects, and defectives), Process Mapping **7 Hrs**

**UNIT – 3**

**MEASUREMENT SYSTEM ANALYSIS:** Fundamental Statistical Measures, Control Charts, Common and Special Cause Improvement Strategies, Introduction to Minitab, Variable Gage R&R, Attribute Agreement Analysis, Variables Data Capability Analysis, Attribute Agreement Analysis **8 Hrs**

**UNIT – 4**

**QUALITY TOOLS/HYPOTHESIS TESTING:** Quality Tools, Introduction to Hypothesis Testing, one proportion Tests, Two proportion Tests, Chi Square Testing, t Tests, ANOVA, Correlation Analysis, Single Regression, Multiple Regression **8 Hrs**

**UNIT – 5**

**DESIGN OF EXPERIMENTS (DOE):** Introduction to Design of Experiments, Non Parametric tests and analysis, General Full Factorial Designs, Two-Level Factorial Designs, Three-Level Factorial Designs, Post-hoc Analysis, Fractional Factorials, Improve and Control: Solution Selection and Prioritization, Pilot Studies (assessing counter measures), Final Capability Analysis, Process Controls, Wrap-Up , Demonstration on Catapult Experiment **9Hrs**

**TEXTBOOKS:**

1. Design for Six Sigma, Gerg Brue, TMH 2003, ISBN 0-07-058120
2. Six Sigma for Managers, Greg Brue, TMH 2002; ISBN - 0-07-048639-5

**SCHEME FOR EXAMINATION:** Five questions choosing one each from each unit and Unit 2 and 3 with choice questions

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<b>Course</b>	<b>SIMULATION MODELING AND ANALYSIS</b>	<b>Course Code</b>	<b>17IE7IESMA</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites:** Nil

**UNIT-1**

**INTRODUCTION TO SIMULATION:** Simulation, advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study.

**SIMULATION EXAMPLES:** Simulation of Queuing systems, Simulation of Inventory System, Simulation of Project Management and Other simulation examples **10Hrs**

**UNIT - 2**

**GENERAL PRINCIPLES:** Concepts in discrete - events simulation, event scheduling / Time advance algorithm

**RANDOM NUMBERS:** Properties, Generations methods, Tests for Random number-Frequency test, Runs test, Autocorrelation test, Gap test, Poker test. **08Hrs**

**UNIT -3**

**RANDOM VARIATE GENERATION:** Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, Acceptance - Rejection Techniques – Poisson Distribution. **08Hrs**

**UNIT - 4**

**ANALYSIS OF SIMULATION DATA:** Input Modeling: Data collection, Identification and distribution with data, parameter, Goodness of fit tests, Selection of input models without data

**Verification and Validation of Model-** Model Building, Verification, Calibration and Validation of Simulation Models. **08Hrs**

**UNIT - 5**

**STATISTICAL ANALYSIS OF SIMULATION DATA** -Estimation Methods, Simulation Run Statistics, Replication of Runs, Batch Means, Spectral Analysis.

**Output Analysis** -Stochastic Nature of output data, Measures of Performance and their estimation. **05Hrs**

**TEXT BOOKS:**

- 1. Discrete Event system Simulation -**  
Jerry Banks, John S Carson, II, Berry L Nelson, Prentice Hall, 1996
- 2. Discrete-event System Simulation,** David M Nicol, 5<sup>th</sup> Edition, Pearson Education, Asia, 2010
- 3. Systems Simulation with Digital Computer,** Narsingh Deo,, PHI Publication (EEE).1978
- 4. Simulation Modeling & Analysis** Averill, M Law, W David Kelton, - ; McGraw Hill, International Editions – Industrial Engineering series, 1991
- 5. Systems Simulation,** Gordan. G. "", Prentice Hall India Ltd, 1991.



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**REFERENCE BOOKS:**

1. **Simulation -- Business & Economics** Sheldon M. Ross, Academic Press, 31-Dec-2012
2. **Simulation Modeling and Analysis with Arena**, Tayfur Altiok, Benjamin Melamed, 2010

**ONLINE COURSES**

1. <http://nptel.ac.in/courses.php?disciplineId=110>
2. <http://informs-sim.org/>
3. E-learning: <http://vtu.ac.in>
4. <http://ocw.mit.edu/>
5. [http:// youtube.com/](http://youtube.com/) Discrete Event simulation

**SOFTWARE PACKAGES**

1. Simulation Packages : Arena, Quest, Witness,
2. MS Excel, Minitab

**SCHEME OF EXAMINATION**

Each question from each unit and internal choice from **Unit 1 & Unit 2**

**COURSE OUTCOMES**

<b>CO1</b>	Understand concepts, steps and different types of simulation and its models.
<b>CO2</b>	Explain the simulation applications with analytical problems
<b>CO3</b>	Explain & Solve random number generators and its testing
<b>CO4</b>	Apply & Solve inverse transformation techniques in simulation modeling
<b>CO5</b>	Evaluate input data and output by means of statistical tests

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