Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(*An Autonomous Institute affiliated to University of Pune*)

Structure & Syllabus of

M.Tech. (Industrial Engineering)

Pattern

Effective from Academic Year 2013-14

Prepared by: - Board of Studies in Industrial & Production Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by,

Chairman – BOS **Chairman – Academic Board**

Vision & Mission of Institute

VISION

"To be a globally acclaimed Institute in Technical Education and Research for holistic Socio-economical development"

MISSION

- To impart knowledge and skill based Education in Collaboration with Industry, Academia and Research Organizations
- To strengthen global collaboration for Students, Faculty Exchange and joint Research
- To prepare competent Engineers with a spirit of Entrepreneurship
- To Inculcate and Strengthen Research Aptitude amongst the Students and Faculty

Vision & Mission of Industrial & Production Engg. Dept.

Vision Statement

To be an acclaimed department of preferred choice among stakeholders in the field of industrial and production engineering

Mission Statement

- To create knowledgeable and skilled manpower for meeting current and future demands of industry, government, research organizations and entrepreneurial pursuits
- To strengthen collaborative research amongst students and faculty
- To create sensitivity to social and professional development
- To provide opportunities for life-long learning via global exposure through students- and faculty- exchange and career progression through higher studies
- To strengthen industrial collaboration through training and consultancy

Content

Program Educational Objectives (PEO) for M.E. (Industrial Engineering) Program

PEO No.	Description of the Objective
I	**Careers** Utilize industrial engineering skills and employ them in productive careers in industry or for pursuing higher studies and research.
II	***Engineering Expertise*** Apply mathematical, scientific, engineering fundamentals, methods and tools to represent, integrate and solve real world problems.
III	***Professionalism*** Become ethical leaders, who are socially responsible, work collaboratively with others, and have an appreciation for other disciplines.
IV	***Lifelong Learning*** Remain at the leading edge of the industrial engineering discipline and respond to challenges of an ever-changing environment with the most current knowledge and technology.

2. Program and Course Outcomes

Programme Outcomes:

Our industrial engineering graduates will be able to:

1. Apply knowledge of engineering fundamentals in getting solutions to engineering related problems.
2. Identify, define, formulate, and analyze engineering problems in reaching substantiated conclusions using industrial engineering tools and techniques
3. Demonstrate ability to design and conduct experiments, interpret and analyze data using mathematical, statistical, engineering and software tools and present results.
4. Select, design, analyze, simulate, improve appropriate manufacturing processes, methods, operating systems for products and services to meet desired standards, specifications and requirements
5. Make effective / productive use of man, machine and material resources in manufacturing and service sector
6. Design and improve layouts, material handling and material management systems, supply chain networks
7. Analyze the impact of operational, economical and financial parameters in real life processes and projects.
8. Design solutions for engineering problems, system components or processes that meet specified needs with appropriate consideration for public in terms of quality, safety, energy, ethical, legal, societal and environmental considerations.
9. Communicate effectively the technical details related to design and manufacturing in both written and verbal form using modern tools
10. Understand aspects of entrepreneurship
11. Conduct investigations of complex engineering problems using research-based knowledge and research methods
12. Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological changes
13. Demonstrate knowledge and understanding of engineering, management and ethical principles and apply these as a member and leader in a team, to manage projects in multidisciplinary environments.

Semester I

FF No. 653 Issue No.1, Rev No.1 dated 2/4/2011

Sub. Code	Subject Name	Teaching Scheme		Assessment Scheme					Credits
				ISA				ESA	
		L	P	Class Test	MSE	HA	CA	ESE	
IP50151	Mathematical & Statistical Methods	3		10	30	10			3
IP50153	Work Study@	3		10	30	10			3
IP50155	Quality & Reliability Engineering@	3		10	30	10			3
IP52151	Facilities Planning	3		10	30	10			3
IP52153	Productivity Management	3		10	30	10			3
IP52155	Industrial & Commercial Laws	3		10	30	10			3
IP52157	Materials & Operations Management	3		10	30	10			3
IP52159	Training Needs Analysis & Human Resource Planning	3		10	30	10			3
IP52161	Environmental Engineering & Energy Management	3		10	30	10			3
IP50351	PG Lab 1@ (Based on IP50153 & IP50155)		4				100		4
HS5635	Communication & Soft Skills		2					100	2
IP50451	Comprehensive Viva Voce - I							100	2
IP57751	Semester Project - I		6					100	2
	TOTAL	15	12						25

FF No. : 658

IP 50151 : MATHEMATICAL AND STATISTICAL METHODS

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Mathematical Methods (7Hrs)
Set Theory, Series, Binomial Theorem, variables and functions, least square approximation of functions, Iterative methods : Bisection method, Newton-Rapson method.

Unit II : Matrices (7Hrs)
Theory of Matrices , Application of matrix algebra to solution of linear equations, Gauss elimination method, Gauss Seidal iterative method , Interpolation: Lagrange interpolation, Markovian matrix, Applications of matrices to input-output analysis

Unit III : Descriptive Statistics (7Hrs)
Measures of frequency distribution for central tendency, dispersion, skewness, kurtosis, Types of data, Graphical tools of data presentation, Theory of probability

Unit IV : Probability Distributions (7Hrs)
Discrete probability distributions, Continuous probability distributions, Theory of sampling, Methods of sampling, Sampling distributions, Central Limit Theorem , Estimation in Statistics, Determination of sample size

Unit V : Inferential Statistics (7Hrs)
Tests of hypotheses for Mean, Proportion and Variances , Type I and Type II error in test of hypothesis, ANOVA , Introduction to DOE

Unit VI : Research Methodology (7Hrs)
Types and stages of research process, various methods of data collection, questionnaire design and its various aspects, Characteristics of research- World in general and India in particular

Total Contact Hours: 42

Text Books :

1. Probability & Statistics for Engineers , Richard Johnson,– Prentice Hall of India, Fifth edition 2001

2. Research methodology – C. R. Kothari, New Age International, second edition, 2005

Reference Books :

1. Statistics for Management- Richard Levin , Rubin - Prentice Hall of India, seventh edition, 1998

2. Probability & Statistics- Lipschutz Scymour , Schaum Outline series, McGraw Hill, 1998

3. Design and Analysis of Experiments- Angela Dean, David Voss, Springer International Edition ,1999

4. Taguchi Methods Explained: Practical steps to robust design- Tapan Bagchi, Prentice Hall of India,1993

Course Outcomes :

Students will be able to:

a. represent statistical data graphically; analyze and draw inferences by using techniques like hypothesis testing, regression, correlation, ANOVA etc.
b. identify appropriate examples for each type of probability distribution from business environment.
c. design questionnaire and select appropriate survey method for the predefined purpose.
d. design a plan for experimentation

FF No. : 658

IP50153 :: WORK STUDY

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Introduction to Industrial Engineering (7Hrs)

Introduction to Industrial Engineering, Historical background, Contribution of Taylor and Gilbreth, Productivity – Definition, Types, Improvement, Work Content Analysis, Definition and Scope of Work Study, Productivity study, productivity ratios, Numerical and Cases on Productivity

Unit II : Method Study I (7Hrs)

Method Study - Definition, Steps in Method Study, Various Considerations to select a job for Method Study, Recording – Significance, Need, Charting Symbols, Recording Techniques - Charts and Diagrams, Examine – Questioning Techniques – Primary & Secondary Questions, Methods improvement - cost benefit analysis, Cases on Recording Techniques

Unit III : Method Study II (7Hrs)

Introduction to Principles of Motion Economy, Develop – Alternate Methods of Doing Work, Evaluate – Criteria for Evaluating & Selecting Best Method, Define – Develop Standard Operating Procedures, Work Instructions, Implement – Practical Aspects in Implementing New Method, Overcoming Resistance to Change, Maintain, Standard Operating Procedures – Developing SOPs, Responsibility Matrix, Standard, Work Combination Charts

Unit IV : Work Measurement I – Time Study (7Hrs)

Time Study – Definition, Steps, Concept of Observed Time, Basic/Normal Time, Standard Time, Video Time Study – Elemental breakdown of tasks, types of elements, Rating – Concept, Types, Allowances – Concept, Types, Application, Calculation of Standard Time, Numerical on estimating standard time

Unit V : Work Measurement II (7Hrs)

Work Sampling – Steps Involved, Applications, Advantages, Predetermined Motion Time Standards – Introduction, Methods Time Measurement – Establishing Time Standards using MTM. Introduction to MOST - Basic, Mini and Maxi MOST, General Move, Control Move, Tool Use Sequence, examples on MOST

Unit VI : Job Evaluation and Merit Rating (7Hrs)

Introduction to Job Evaluation system, necessity, Job Analysis, Job Description, Job Evaluation, job classification, Different Job Evaluation Systems like Factor Comparison, Point System etc, merit rating, methods of merit rating, Wages and Incentives, factors influencing wage system, types of wages, wage structure, Incentive schemes

Total Contact Hours: 42

Text Books :

1. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBH Publishing Company, New Delhi, Second Indian Adaptation, 2008

2. Michael Armstrong, Job Evaluation: A Guide to Achieving Equal Pay, Kogan Page Limited, ISBN 0 7494 4481 9

Reference Books :

1. Maynard's Industrial Engineering Hand Book By H.B. Maynard, KJell, McGraw Hill Education, 2001
2. Zandin K.B. - Most Work Measurement Systems, ISBN 0824709535, CRC Press, 2002

Course Outcomes

Our students will be able to:

1. Systematically record and critically examine existing and proposed ways of doing work to effect improvements
2. Do work content analysis and methods improvement
3. Design and develop the workplace layout using principles of motion economy and fundamental hand motions.
4. Establish standard time to carry out a specified job at defined level of performance

FF No. : 658

IP50155: QUALITY AND RELIABILITY ENGINEERING

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Concepts Of Quality **(7Hrs)**

Introduction: Meaning of Quality, Characteristics of Quality, Quality of Product versus Quality of Service, Cost of Quality – Prevention Costs, Appraisal Costs, Value of Quality, Cost-Quality Trade-off. Approaches to Quality as proposed by Deming (PDCA Cycle). Voice of Customer, Quality Function Deployment – Constructing House of Quality for a Specific Product. Contribution of Quality Gurus, Juran, Crosby, Deming's Principles of Management. Concept of TQM – Quality Circles

Unit II : Acceptance Sampling **(7Hrs)**

A. Acceptance Sampling: 100% Inspection versus Sampling Inspection. Concept of Producer Risk and Consumers Risk. Operating Characteristics Curve. AQL, LTPD, AOQL, Sampling Plan – Single Sampling Plan versus Double Sampling Plan. Design Sampling Plan on the basis of MIL, ASQ Standards. Standard Sampling plans. Case on designing of sampling plan using MIL, ASQ standards.

Unit III : Statistical Process Control **(7Hrs)**

A. Statistical Process Control: Variations – Concept, Causes – Random & Assignable, Difference – Process in Control versus Process is Capable, Introduction to Statistical Process Control: Control Charts, X-Bar, R, P and C Charts, Concept of Process Capability (Cp) & Process Capability Index Index (Cpk). Six Sigma Limits.
Applications of Control Charts in Mass Production, Process Production

Unit IV **(7 Hrs)**

Quality Improvement Tools

Introduction to TQM & Quality Circles, Quality Improvement Tools: 7 QC Tools – Check Sheet, Histogram, Pareto Chart, Fishbone Diagram, Run Charts, Scatter Diagram, Process Flow Chart. 7 QM Tools – Program Decision Process Chart, Tree Diagram, Affinity Diagram, Prioritization Matrix, etc. Bench Marking. Quality Improvement Tools: Why-Why Analysis, Root Cause Analysis, Poka Yoke (Mistake Proofing). Bench Marking: Types – Process, Product. Cases on application of 7above concepts from reference books and web sources

Unit V **(7 Hrs)**

Six Sigma & Quality Management Systems

A. Introduction to Six Sigma: Definition, Concept, Methodology. Six Sigma Approaches – Design for Six Sigma (DFSS) Approach & DMAIC Approach, Six Sigma Tools: Importance and overview of ISO 9000-2008: Standard clauses such as Quality Management System, Management Responsibility, Resource Management, Product Realization, Measurement, Analysis and Improvement. Introduction to TS16949: Technical Specifications, Major Components. ISO 9000 Certification: Certifying Bodies & Accreditation Agencies, Necessity for Certification & Certification Process, Benefits of Certification. Malcom Baldrige National Quality Award and other quality awards

Unit VI : Reliability **(7Hrs)**

Concept of probability, reliability-definition, performance ,cost and reliability, stochastic processes, bathtub curve, MTBF, MTTR, hazard rate, failure rate, cumulative probability distribution function, exponential and weibull distributions. Acceptance sampling based on reliability test-OC curves Active and Passive Redundancy, redundancy allocation and limitations, Evaluation of overall system reliability. Preventive maintenance, Testing and repair, reliability centered maintenance, system availability and maintainability. Life testing-objective-classification

Total Contact Hours: 42

Text Books

1. Amitav Mitra, Fundamentals of Quality Control & Improvement, Pearson Education
2. Phadke, Quality Engineering using Robust Design, Pearson Education
3. Charles E.Ebeling Reliability and maintainability engineering.,TMH (2000)

Reference Books

1. J.M. Juran & F.M.Gryna , Quality Planning and Analysis.
2. Juran's Quality Control Handbook.
3. E.L.Grant & R.S. Kearenworth, Statistical Quality Control.
4. Kaoru Ishikawa, Guide to Quality Control, Asian Productivity Organisation, Tokyo.
5. ISO 9000 Quality Management System , International Trade Center, Geneva
6. Connor, P.D.T.O., "Practical Reliability Engineering ", John Wiley (1993).
7. Green A.E., and Bourne A.J. "Reliability, Technology", Wiley Interscience, 1991

Course Outcomes:

Students will be able to:

1. Understand and apply principles of quality management
2. Select and use appropriate tools and techniques for measuring, improving and controlling quality in context of business and operational problems
3. Understand Six Sigma Methodology

FF No. : 658

IP52151:: FACILITIES PLANNING

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I **(7 Hrs)**
Introduction to Facilities Planning

Scope of Facilities Planning – Importance & Objectives, Nature Of Location Decision, Affecting Facility Location, Single & Multiple Facility Location Models, Qualitative Considerations in Facility Location, Factors Urban v/s Rural Location, Site Selection. Plant Layout – Introduction, Types of Plant Layout: Product, Process, Fixed Postion, Hybrid – Cellular, FMS, etc. Phases of Layout Planning. Urban Location versus Rural Location. Case Study in Location Decisions, Location Pattern In India

Unit II **(7 Hrs)**
Systematic Layout Planning 1

Systematic Layout Planning, P-Q Analysis, Flow of Materials Analysis – Charting & Diagram Techniques, Activity Relationship Analysis – REL Diagram, Space Requirements & Availability, Techniques of Space Determination. Need And Advantages Of Planned Material Flow, Factors For Consideration, Types of Flow Patterns, Flow Patterns For Production Lines And Assembly Lines. Case Study in REL Chart

Unit III **(7 Hrs)**
Systematic Layout Planning 2

Systematic Layout Planning: Modifying Considerations, Practical Limitations, Selection of Layout – Techniques of Layout, Installation of Layout, Concept of Line Balancing: Heuristics, Assessing Performance. Computerized Layout Planning – Introduction & Concept. CORELAP, ALDEP. Criteria For Computerized Facility Layout, Concept Of Computerized Layout Programs Like CRAFT & PLANET

Unit IV **(7 Hrs)**
Material Handling

Material Handling Function, Scope And Functions Of Material Handling , Manual Mechanical Handling Ratio, MH Equipment Types- Positioning Equipment, Unit Load Equipment, Auto Identification & Control Equipment, Transport Equipment – Conveyors, Cranes, Industrial Trucks. Principles of Material Handling, Storage Equipment, AGVs & Robots. Industrial Safety – Training for Safety, Communicating Safety Messages, Safe Practices in Industry, Safety Considerations in Manual & Mechanical Handling, Transportation, Role of Factory Inspector, Safety Officer

Unit V **(7 Hrs)**
Systematic Handling Analysis

Handling Analysis, External Integration, Classification of Materials, Layout Considerations, Analysis of Moves, Visualization of Moves, Flow Diagram – DI Plot, Preliminary Handling Plans, Modifications & Practical Limitations, Calculation of Requirements, Evaluation of Alternatives, Installation

Unit VI **(7 Hrs)**
SHA, Maintenance & Safety

Role Of Maintenance Management, Organization & Systems Of Maintenance Management, Types Of Maintenance: Breakdown, Preventive, Predictive. Industrial Safety – Training for Safety, Communicating Safety Messages, Safe Practices in Industry, Safety Considerations in Manual & Mechanical Handling, Transportation, Role of Factory Inspector, Safety Officer.

Text Books

1. Practical Plant layout .. Richard Muther
2. Systematic Layout Planning .. Richard Muther
3. Systematic Handling Anaylsis .. Richard Muther
4. Clark, Facility Planning, Pearson Education
5. Plant layout and design By James More

Reference Books

1. Plant Layout and Material Handling ..By James M Apple
2. Plant Layout By Immer
3. Plant Layout By Shubin
4. Material handling By Allexander
5. Material Handling Equipment By N Rudenko

6. Maintenance Engineering Handbook By Lindley Higgins

Course Outcomes

Our students will be able to:

1. Analyze and select location of facilities for manufacturing and service organizations
2. Analyze, design and improve existing and new layouts for manufacturing and service organizations
3. Analyze and select appropriate material handling systems for manufacturing organizations

FF No. : 658

IP 52153 : PRODUCTIVITY MANAGEMENT

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Productivity Basics (7Hrs)

Productivity basics in relation with Production, Profitability, Financial statements, Quality, Technology, Factors affecting productivity, and their importance – inflation employment, standard of living, Economic power, Political power, Method of Statistical indices,

Unit II : Productivity Measurement : Conceptual Framework And Models (7Hrs)

Use of KPA in MBO, MBO and PO-P, Production function models, Product oriented models , Surrogate models , Economic utility models, Models based on systems approach, Financial ratios as measures of productivity.

Unit III : Standard Man Hour (7Hrs)

SMH as a unit of measurement, Inputs and SMH accounting in jobbing, mass-production, Batch type factory work and process factories and service work, Uses of SMH, SMH Balance sheet, Productivity monitoring schemes.

Unit IV : Productivity Management : The Role Of External Environment (7Hrs)

External Environment sub-systems such as socio-cultural, Technological, economic, political sub system, approaches to measure impact of external environment

Unit V : Productivity Improvement Implementation Strategies (7Hrs)

Productivity planning, Productivity improvement strategies- The organization factor, Human factor-Behavioral Techniques, Technology Factor, Productivity Audit and Control

Unit VI : PM at various levels (7Hrs)

District level, Regional level, State level, National level and International levels, International Labor Organization (ILO)- Role, importance, duties, research studies and publications, Productivity Improvement strategies around the world- Australia, Asia, Europe, Africa, North America, South and Central America

Total Contact Hours: 42

Text Books :

1. Productivity Management : A systems Approach by Prem Vrat, G.D. Sardana, B.S. Sahay, Narosa Publishing House
2. Work and Productivity by Kawal Kira, Oxford & IBH Publishing Co. Pvt.Ltd.

Reference Books :

1. Productivity Engineering and Management by David Sumanth, Tata McGraw-Hill Publishing co. Ltd.
2. Productivity Management : A practical handbook by Joseph Prokopenko, Oxford& IBH Publishing Co. Ltd.

Course Outcomes

Our students will be able to:

1. Analyze performance of a organization on the basis of various productivity measures
2. Understand and apply productivity improvement techniques in manufacturing and service sector
3. Understand the significance of productivity improvement techniques and productivity management

FF No. : 658

IP52155::INDUSTRIAL AND COMMERCIAL LAWS

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I **(7 Hrs)**

The Industrial Disputes Act, 1947

The Industrial Disputes Act, 1947. Works Committee, Conciliation Officers, Board of Conciliation, Court of Inquiry, Labour Courts, Tribunals, National Tribunal. Procedure, power and duties of the authorities. Strikes and lockouts, layoffs and retrenchment, closure. Unfair labour practices, Penalties, Case Laws

Unit II **(7 Hrs)**

The Trade Union Act 1926

The Trade Union Act 1926. Formation of Trade Unions, Collective bargaining capacity. The Industrial Employment [Standing Orders] Act, 1946 (20 of 1946). Draft Standing Orders, conditions for certification of Standing Orders. Appeals, Register of Standing Orders. Temporary application of model standing orders

Unit III **(7 Hrs)**

The Factories Act, 1948 and The Employees Provident Fund and Miscelleneous Provisions Act, 1952

Health, Safety, Provisions relating to Hazardous Processes, Welfare, Working Hours of Adults, Employment of young persons, Annual Leave with wages. The Employees' Provident Fund & Miscellaneous Provisions Act, 1952 (10 of 1952). Employee's Provident Fund Schemes. Central Board, Employee's Pension Scheme, Employee's Deposit Linked Insurance Scheme, Contributions.

Unit IV **(7 Hrs)**

The Industrial Employment [Standing Orders] Act, 1946

Draft Standing Orders, conditions for certification of Standing Orders, Appeals, Register of Standing Orders. Temporary application of model standing orders.

Unit V **(7 Hrs)**

The Competition Act, 2000

Objective, Competition Commission, Dominant Position, Anti-Competitive Agreements, Relevant Markets, Cartel, Abuse of Dominant Position, Regulation of Combinations. Case studies and penalties.

Unit VI **(7 Hrs)**

The Sale of Goods Act, 1930 (3 of 1930)

Contract of Sale, Formalities of Contract, Subject Matter of Contract, the Price, Conditions and Warranties. Transfer of Property as between seller and buyer, Transfer of title. Case studies and penalties.

Text Books

1. Pramod Verma, "Management of Industrial Relations", Oxford and IBH Publishing Co., Mumbai.
2. C. Jagamohandas and Co., Mumbai – publications of Acts with short notes.

Reference Books

1. Taxman, Commercial Laws.
2. Taxman, Labour Laws.
3. Bare Acts and Bare Acts with Cases for each of these acts

Course Outcomes:

Students will be able to:

1. Apply and utilize legal provisions for resolving industrial disputes in an organization
2. Apply and utilize legal provisions related to health, safety, welfare, working conditions, wages and salaries in an organization
3. Apply and utilize legal provisions for ethical and fair competition, contract of sale in course of trade

FF No. : 658

IP52157: MATERIALS & OPERATIONS MANAGEMENT

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I (7 Hrs)
Scope of Operations Management & Materials Management

Scope of Operations Management - Nature, Scope, Importance. Various Functions in Operations. Types of Production Systems – Project type, Job shop, Batch Production, Flow / Continuous Production, Mass Production - Characteristics and applicability of each type. Operations Strategies: Process choice – Select the appropriate production system. Introduction to ETO, MTO, ATO & MTS. Functions in Operations Management. Relations of operations with R&D, Design, Materials, Marketing, Finance, Personnel.
Functions of Materials Management – Sourcing/Procurement, Inventory, Stores, Vendor Development etc. Organization of Materials Management Function

Unit II (8 Hrs)
Inventory Management & Replenishment Systems

Classification and Costs of Inventories: Types, Objective of holding inventories, Different types of Inventories, Costs Associated with Inventory - Carrying cost, Procurement cost. EOQ - Concept, Assumptions of EOQ Model, Practical Constraints – Numerical Analysis, Quantity Discounts. EMQ Model - Carrying cost, Set up cost. EOQ Special Considerations – Spares, Bought-outs, etc.
Replenishment Systems: Introduction, Concept of lead time and its effects on Inventory, Components of Lead Time - Internal and External. Variability in demand and lead time. Safety Stock Evaluation and ways to minimize lead time, Different types of replenishment systems like Fixed order quantity system, Fixed order interval system, Combination of fixed order interval and quantity system, Two Bin System.
Selective Inventory Control: Concept of Selective Inventory Control, ABC analysis, VED analysis, HML analysis, SDE analysis, SOS analysis, FSN analysis, GOLF analysis.

Unit III (7 Hrs)
OPC and Demand Forecasting

Operations Planning & Control – PPC – Functions, Operations Planning & Control Framework.
Components of Demand, Techniques of Demand Forecasting – Qualitative (Survey & Judgmental – Delphi, Expert Opinion) & Quantitative (Causal Methods – Input-Output Method, Leading Indicators Method & Time Series Analysis – Moving Average, Exponential Smoothing, Regression Method). Holts Model, Winters Model, Box-Jenkins Model. Measuring Errors in Forecasting – MAD, MSE, Tracking Signal
Qualitative Techniques of Forecasting – Experts Opinion, Delphi Method, Market Survey

Unit IV **(7 Hrs)**

Aggregate Planning(S & OP) & Quantitative Techniques in Scheduling

Pure Strategies – Chase, Level, Mixed Strategies, Master Production Schedule, Detailed Capacity Requirement Planning, Johnsons Algorithm - Sequencing n jobs on m machines, Assignment Models.
Numerical & Cases in Aggregate Planning

Unit V **(7 Hrs)**

MRP II (Manufacturing Resource Planning)

MRP II (Manufacturing Resource Planning) Operations Control – Gantt Charts. Planning & Scheduling Techniques: Scheduling v/s Loading, Scheduling Types – Forward Scheduling & Backward Scheduling Scheduling Techniques – Dispatching Rules – SPT, LPT, DSRO, Critical Ratio, EDD, etc. – Evaluate lateness, tardiness. Johnsons Algorithm – n jobs on 2 machines, 3 machines
Documentation - Production Work Order. Techniques of scheduling, dispatching and expediting. Nature of production control in different types of production systems.

Unit VI **(7 Hrs)**

Material Requirement Planning (MRP I) & Production Activity Control

Material Requirement Planning (MRP I): Inputs to MRP – MPS, BOM – Types of BOM, BOM Explosion, Inventory Transaction Files, MRP Processing (Logic) – Time Phased Operation Plan, Numerical on BOM Explosion Netting Requirements, Outputs of MRP.
Significance of Process Planning. Preparation of Process Plans & Process Sheets, Time, Cost & Material Estimation.

Text Books

1. Chary, Production & Operations Management –McGraw Hill Publications
2. Chase, Aquilano, Jacobs, Operations Management for Competitive Advantage, Tata McGraw Hill
3. S K Mukhopahyay, Operations Planning & Control, Jaico Publications

Reference Books

1) Krajewski, Operations Management, 9th Edition, Pearson Education
2) Production & Operations Management – Panneerselvam, McGraw Hill Publications.

Course Outcomes:

Our students will be able to:

1. Design and develop replenishment systems for manufacturing and services organizations
2. Analyze, manage and optimize the inventory levels for manufacturing and services organizations
3. Analyze, assess and develop vendor selection and rating systems for manufacturing organizations for effective procurement of materials
4. Determine the appropriate production system based on the product attributes such as variety, volumes, etc.
5. Understand need of various functions in production planning and control for better management of manufacturing and/or service systems
6. Develop analytical mind for identifying and solving demand forecasting problems using appropriate tools and techniques
7. Develop aggregate plans, master production schedule, capacity requirement plan, and material requirements plans, as part of resource requirements planning systems

FF No. : 658

IP 52159: TRAINING NEEDS ANALYSIS AND HUMAN RESOURCE PLANNING

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Learning Curve **(7Hrs)**

Learning curve characteristics, Three domains of learning- Cognitive, Psycho-motor, Affective , Various methods of Learning performance measurement- Class-room learning, On the job training, Induction Program: its importance and implications for achieving person – organization fit, Training and Development of Industrial personnel, Psychological Testing and interviews, Characteristics of a Learning Organization

Unit II : HR Planning **(7Hrs)**

Organizational Business planning, Strategic planning vs. divisional/ departmental planning, Manpower planning: process, procedure, methods, pre-requisites, job/role defining and profiling and recruitment decisions, Selection devices and decisions: individual and group processes, tools and techniques, Customization of tests, Validation and reliability, Important Environmental Influences

Unit III : PMS **(7Hrs)**

Performance Management System - Goal setting, Performance review, discussion and counseling; various methods of designing performance appraisal with its merits and demerits. Empowering / Dis-empowering Systems

Unit IV : Reward Management **(7Hrs)**

Pay for position, performance and person; Designing rewards for motivation and retention, Career Planning and Development: individual growth vis-à-vis organization; role of individual and organizations, Employee morale, Attitudes and Job Satisfaction

Unit V : Job Analysis **(7Hrs)**

Job Design, Job Analysis, Job evaluation, Quality of work life: Balancing personal and professional life for organizational and personal success, Employee welfare, Participative management, Employee communication, HR in Information Technology organizations

Unit VI : Conflict Management **(7Hrs)**

Employee Grievance Handling and discipline management: both legal and strategic approaches, HR Intervention: its importance and types, Employee Separation Schemes: VRS, and retaining the best talent, Displining the problem employees, HR in mergers and acquisitions

Total Contact Hours: 42

Text Books :

1. Human Resource and Personnel Management by K. Aswathappa, Tata McGraw Hill
2. Human Resource Management by Biswajeet Pattanayak, Prentice Hall of India

Reference Books :

1. Managing Human Resources by Bohlander, Snell, Sherman, Thomsan Learning
2. Human Resource Management : An Experimental Approach by H. John Bernardin, Tata McGraw Hill
3. Human Resource Management by C.B. Mamoria, S. V. Gankar , Hamalaya Publishing House

Course Outcomes:

Students will be able to:

1. Conceptualize the components of individual and group behavior, learning and training
2. Understand the practicability of performance management systems and reward management
3. Apply job analysis and conflict management techniques in organizations

FF No. : 658

IP52161: ENVIRONMENTAL ENGINEERING AND ENERGY MANAGEMENT

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Introduction (7Hrs)

Energy Scenario – global, sub continental and Indian, Energy economy relation, Future energy demand and supply scenario, Integrated energy planning with particular reference to Industrial Sector in India, Captive power units and others – demand v/s supply. The Prevention and Control of Pollution Act, 1974, The Energy Conservation Act, 2001, The Environmental Protection Act, 1986

Unit II: Energy Sources (7Hrs)

Physical Aspects of Energy: Classification of energy – Hydel, Thermal, Nuclear, Wind, & from Waste Products. Efficiency and effectiveness of energy utilization in Industry. Energy and energy analysis

Unit III : Legal Provisions (7Hrs)

Legal provisions in Energy Management and its impact: The Energy Conservation Act, 2003, The Electricity Act, 2003. National Electricity Policy. Rural Electrification

Unit IV : Demand Side Management (7Hrs)

Energy utilization, Instrumentation and data analysis, Financial aspects of energy management, Energy management as a separate function and its place in plant management hierarchy.

Energy Demand Management : Scope , Methodology, modes of energy savings, Plant energy and utility systems, Efficient energy management – Nine steps – i) Identification ii) Investigation iii) Quantification iv) Decisions v) Presentation vi) Implementation vii) follow-up viii) Set Targets ix) Re-examine

Unit V : Energy Audit and Energy Saving (7Hrs)

Energy Audit: Audit and analysis, Energy load measurements, System evaluation and simulation, Energy saving techniques and guidelines: Administrative control, Proper Measurement and monitoring system, Process control, proper planning & scheduling, Increasing capacity utilization, Improving equipment control, waste heat recovery, Change of energy source. Up gradation of Technology. Change of product specifications, Use of High efficiency equipment, Design modification for better efficiency, Improved periodic maintenance; Energy conservation with particular reference to waste heat recovery in different industries; Improvement in combustion system and use of Industrial waste; Co-generation and rational operation of production processes. Case study analysis.

Provisions under the Electricity Act, functions of Bureau of Energy Efficiency

Unit VI : Environment Protection Act, 1986 (7Hrs)

Environment, Environmental Pollutants, Hazardous Substances, Powers of Central Government, Prevention. Control and Abetment of Environmental Pollution, Offences and Penalties.

Total Contact Hours: 42

Text Books :

1. Energy Conservation Act 2001(Act No 52 OF 2001) with short comments, Alahabad Law Publishers (India) Pvt Ltd, 2003.
2. Electricity Act 2003(Act No 36 of 2003) Bare Act with short comments. Professional Book Publishers, New Delhi, 2003.

Reference Books :

1. Paul W., O'callaghan; Energy Management, McGraw Hill Professional Publishing, 1993
2. Wayne C. Turner; Energy Management Handbook, The Fairmont Press Inc., Lilburn, GA 30047
3. B.L. Capheart, W.J. Kennedy; Guide to Energy Management, The Fairmont Press Inc., Lilburn, GA 30047

Course Outcomes:

Students will be able to:

1. Understand present & future energy scenario, importance of energy conservation & energy efficiency.
2. Study various energy conversion processes & their use to generate energy..
3. Understand and participate to conduct energy audit in an organization.
4. Understand efficient energy management approaches.

FF No. : 658

IP50351 :PG LAB 1

Credits: 02 **Teaching Scheme: -** Laboratory 2 Hrs/Week

Part A: Work Study: List of Practical

1. Study of research paper from journal on productivity improvement
2. Assignment on – Flow process chart
3. Assignment on – Two handed process chart
4. Assignment on – Multiple activity
5. Assignment on – Flow diagram and string diagram
6. Case – Bagging Exercise – Method Study 1 (Record, Examine)
7. Case – Bagging Exercise – Method Study 2 (Develop, Evaluate. Define)
8. Training in Rating - Dealing Cards
9. Training in Rating – Walking
10. Setting Time Standards using Time Study – Video Analysis
11. Setting Time Standards using Time Study – Stop watch time study
12. Setting Time Standards using MTM – Video Analysis
13. Setting Time Standards using stop watch time study data– Video Analysis
14. Work Sampling Exercise – preparing and executing work sampling plan

Text Books :

1. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBH Publishing Company, New Delhi, Second Indian Adaptation, 2008

2. Michael Armstrong, Job Evaluation: A Guide to Achieving Equal Pay, Kogan Page Limited, ISBN 0 7494 4481 9

Reference Books :

1. Maynard's Industrial Engineering Hand Book By H.B. Maynard, KJell, McGraw Hill Education, 2001
2. Zandin K.B. - Most Work Measurement Systems, ISBN 0824709535, CRC Press, 2002

Course Outcomes

Our students will be able to:

1. Systematically record and critically examine existing and proposed ways of doing work to effect improvements
2. Do work content analysis and methods improvement
3. Design and develop the workplace layout using principles of motion economy and

fundamental hand motions.

4. Establish standard time to carry out a specified job at defined level of performance

Part B: Quality & Reliability Engineering

Assignments:

1. Design of Sampling Plan
2. Design of Control Charts – Variables
3. Design of Control Charts – Attributes
4. Assignment on Process Capability
5. Case Study on 7 QC Tools
6. Case Study on 7 QM Tools
7. Case on Constructing House of Quality (QFD) for any Product
8. Assignment 1 on Reliability
9. Assignment 2 on Reliability
10. Assignment on Six Sigma

Text Books

1. R.K. Jain, Engineering Metrology, Khanna Publication.
2. K.J.Hume, Engineering Metrology, Kalyani publication

Reference Books

1. K.W.B.Sharp,Practical Engineering Metrology,Pitman Publication.
2. J.M. Juran & F.M.Gryna , Quality Planning and Analysis.
3. Juran's Quality Control Handbook.
4. I.C.Gupta, A Text book of Engineering Metrology, Dhanpat Rai and Sons.
5. E.L.Grant & R.S. Kearenworth, Statistical Quality Control.
6. Kaoru Ishikawa, Guide to Quality Control, Asian Productivity Organisation, Tokyo.
7. ISO 9000 Quality System – S. Dalela.
8. ISO 9000 Quality Management System , International Trade Center, Geneva

Course Outcomes:

Students will be able to:

1. Understand and apply principles of quality management
2. Select and use appropriate tools and techniques for measuring, improving and controlling quality in context of business and operational problems
3. Understand Six Sigma Methodology

FF No. : 658

IP57751 : SEMESTER PROJECT I

Credits: 02 **Teaching Scheme: -** Laboratory 2 Hrs/Week

Assessment of Semester Project

Semester Project will be based on all subjects of that Semester except GP.

1. The Semester Project will be for a group of 2 students. Head of Department to appoint Project Guides. 2 credits will be awarded to the candidate after the viva voce and project demonstration at the End of Semester.
2. Group formation, discussion with faculty advisor, formation of the Semester Project statement, resource requirement, if any should be carried out at the start of the Semester. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.
   The Assessment Scheme will be: End Semester Examination: 100 marks

Course Outcomes :

A student will be able to

1. analyze/evaluate a concept / system / machine operation / process etc
2. make physical working model/charts of concepts or carry out a survey
3. analyze and improve methods and determine work content considering human factors
4. make effective / productive use of man, machine and material resources
5. investigate complex problems using various statistical, quantitative and simulation tools
6. work as an individual and lead the teams effectively to achieve the set objectives.
7. prepare project report and present at the end of semester

Semester II

FF No. 653 Issue No.1, Rev No.1 dated 4/4/2013

Sub. Code	Subject Name	Teaching Scheme		Assessment Scheme					Credits
				ISA				ESA	
		L	P	Class Test	MSE	HA	CA	ESE	
IP50152	Optimization Techniques & Simulation Modeling@	3		10	30	10			3
IP50154	Project Management@	3		10	30	10			3
IP50156	Human Factors Engineering	3		10	30	10			3
IP52152	Supply Chain Analysis & Modeling	3		10	30	10			3
IP52154	Entrepreneurship Development	3		10	30	10			3
IP52156	Management Information System	3		10	30	10			3
IP52158	World Class Manufacturing	3		10	30	10			3
IP52160	Product Design & New Product Development	3		10	30	10			3
IP52162	Automation Strategies	3		10	30	10			3
IP50352	PG Lab 2@ (Based on IP50152 & IP50154)		4				100		4
IP57753	Technical Seminar I		2					100	4
IP50452	Comprehensive Viva Voce - II							100	2
IP57752	Semester Project - II		6					100	2
	TOTAL	15	12						27

FF No. : 658

IP50152:: OPTIMIZATION TECHNIQUES & SIMULATION MODELING@

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I (7 Hrs)
Linear Programming

Linear Programming, Formulation of LP Problem, Standard Form, Solution using Simplex Method. Duality. Special Conditions in LPP. Economic Interpretation of Dual, Solution of LPP using Duality concept, Dual Simplex Method. Sensitivity Analysis. Big M method Two phase method.
Solution of LPP using TORA & Solver in Excel

Unit II (7 Hrs)
Queuing Theory & Simulation

Queuing Theory: Introduction, terminology, Poisson single and multi channel queuing system models: M/M/1 Model, M/M/C Model, M/Ek/1 Model. Simulation: Definition, Introduction, Application, Monte Carlo Simulation. Applications of Simulation, Generation of Random Numbers.
Simulation software, Building Model on Simulation Software, Running the simulation, Understanding the results

Unit III (7 Hrs)
Replacement Model & Theory of Games

Replacement Model: Replacement of capital equipments that deteriorates with time, time value of money (a) remains same (b) changes with constant rates during period. Equipment renewal policy, group and individual replacement. Individual Replacement, Group Replacement Policies, Problems. Game Theory: Game theory Introduction, Terminology, Two -person zero sum game, minimax and maximin principle, Saddle Point, Games with pure and mixed strategies, Dominance property, Solutions with Graphical methods.
Case studies on Replacement Models & Game Theory: L.P. method, approximation method.

Unit IV (7 Hrs)
Goal Programming, Integer Programming & Dynamic Programming

Goal Programming & Decision Making Tools: Goal Programming-Definition, Introduction, Problems, Analytical Hierarchy Process, Integer Programming: Branch & bound, cutting plane method. Dynamic Programming: Introduction, application, capital budgeting, different problems solved by dynamic programming.
Case studies based on Integer Programming & Dynamic Programming

Unit V **(7 Hrs)**

Network Theory 1

Introduction to Networks, deriving networks on the basis of graph theory, Maximal flow minimal cut theorem, applications of networks in operations research. Various models in OR which can be solved using networks techniques.

Unit VI **(7 Hrs)**

Network Theory 2

Multi-terminal Maximal flows, Multi-terminal shortest paths. Multi commodity flows. Synthesis of networks. The general minimal cost flow problem, Minimal cost calculation, Network simplex Method. Matching problems and the bottleneck assignment problem.

Text Books

1. Taha H A Operation Research and Introduction, McMillian, 8/e, Pearson Education
2. Gupta & Hira: Operations Research, S. Chand & Co.
3. Paneerselvam Operations Research , Prentice Hall of India
4. Philips, Ravindran; Network theory,
5. R. T. Rockafellar (1984), Network Flows and Monotropic Optimization, Wiley.

Reference Books

1. Hiller and Libermann, Introduction to Operation Research, McGraw Hill 5th edn.
2. S.D. Sharma – Operations Research, Kedarnath, Ramnath &Co
3. J K Sharma, Operations Research Theory and Application, Pearson Education Pvt Ltd, 2nd Edn, ISBN-0333-92394-4
4. Kanthi Swarup & others – Operations Research, Sultan chand and Sons R. K. Ahuja, T. L. Magnanti, and J. B. Orlin (1993), Network Flows: Theory Algorithms and Applications, Prentice Hall.
5. M. S. Bazaraa, J. J. Jarvis, and H. D. Sherali (1990), Linear Programming and Network Flows, 2nd Edition, John Wiley, New York.
6. L. R. Ford, and D. R. Fulkerson (1962), Flow in Networks, Princeton University Press, Princeton.

Course Outcomes:

Our students will be able to:

1. Formulate a certain class of decision problems and solution
2. Formulate real life queuing problems and generate optimal solutions
3. Simulate various real life problems and generate optimal solutions

FF No. : 658

IP50154:: PROJECT MANAGEMENT

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I **(7 Hrs)**

Introduction:

A. Definition & Characteristics of Project, Performance Parameters: Time, Cost & Quality. Difference with respect to Standard Routine Production. Classification of Projects: Sector based, Investment based, Technology based, Causation based, Need based (BMERD) - Balancing, Modernization, Replacement, Expansion & Diversification Project Life Cycle Phases – Concept/Initiation Phase: Parameters Involved in Project Identification. Sources of New Project Ideas,

B. Governmental Framework for Identification of Opportunities, Incentives from state &

Unit II **(8Hrs)**

Project Conceptualization & Feasibility Analysis

A: Project Definition Phase: Project Formulation & Feasibility. Types of Feasibility Studies – Pre-feasibility, Support/Functional, Feasibility Study. Preparation of Project Feasibility Report & Specification; Aspects of Project Feasibility Managerial/Organization: Promoters Background, Criteria of Evaluation, Marketing/Commercial: Demand & Supply, Competition, Market Survery, Porter's 5 Forces, Operational/Technical: Process, Technology, Location, Capacity, Labour, Raw Material & Utility Availability. Financial: Cost of Project, Means of Finance, Financial Projections – Profit & Loss Account, Balance Sheet, Funds Flow Statement, Cash Flow Statement, Schedule of Fixed Assets, Schedule of Term Loans.

B Socio-Economic: Socio-Cost Benefit Analysis. Effective Rate of Protection, Domestic Resource Cost

Unit III **(7 Hrs)**

Project Planning & Scheduling

Planning & Organization Phase: Project Planning, Scheduling & Monitoring, Statement of Works, Project Specifications, Work Breakdown Structure, Network Analysis & Duration Estimating Network Diagrams – PERT/CPM, Estimate Activity Times, Milestone Scheduling. Resource Leveling, Resource Smoothening, Project Crashing, Numerical & Cases in Project Planning

Unit IV **(7 Hrs)**

Project Cost Management

Project Cost Estimation: Need, Causes of Cost & Time Overruns. Nature of Cost Estimates, Types of Project Cost Estimates, Estimation of Manpower & Utilities.
Project Monitoring: Earned Value Analysis: Planned Value, Earned Value, Cost & Schedule Variance, Performance Indices, Estimate & Completion, Estimate to Complete, etc. Numerical & Cases
Capital Budgeting Techniques: Payback Period, Discounted PBP, IRR, NPV, PI, Annual Worth.

Unit V **(7 Hrs)**
Project Organization, Monitoring, Implementation & Control

Project Organization & Management. Project Organization Structure – Pure, Matrix, Functional, Role of Project Manager, Implementation Phase: Activities Involved: Erection & Commissioning, Installation, Trial Runs & Commencement of Commercial Production. Cleanup/Shutdown Phase: Handover to Client, Settlement of Accounts
Contract Management: Responsibility Sharing Matrix, Types of Contract Payments, Risk Factors in Contracts – Contractor & Owner.

Unit VI **(7 Hrs)**
Critical Chain & Computer Applications in Project Planning & Control

Critical Chain Management – Concept of critical chain, buffers, Planning project with critical chain
Introduction to MS Projects – Understanding the MS Project screen & different views, Defining the project, Working with calendar, Outline the project, Create dependencies between tasks, Creating WBS, Format task list and Gantt chart, Resource planning, leveling and preparing resource graph, Working with baseline, tracking the project.

Text Books

1. Harold Kerzner, Project Management
2. Narendra Singh; Project Management & Control; Himalaya Publishing House, Mumbai.
3. S.Choudary, Project Management, Tata McGraw Hill
4. Prasanna Chandra; Project: Preparation, Appraisal, Budgeting & Implementation
5. Pinto, Project Management – Achieving Competitive Advantage & MS Projects, Pearson Education

Reference Books

1. Maylor, Project Management, Pearson Education,
2. Gopal & Ramamurthy; Project Management Handbook; Macmilan.
3. Project Management Body of Knowledge, PMI
4. Practical Project Management by Ghatak & Sandra, Pearson Education (Singapore)

Pte. Ltd, 2001
5. Handbook on Project Appraisal & Follow-up, SARDA, Govind Prakashan,2001

Course Outcomes:

Students will be able to:

1. Ascertain the feasibility of small and medium projects with respect to managerial, marketing, operational, financial and socio-economic perspectives
2. Plan and schedule small and medium projects to achieve the triple constraint of time, cost and quality using software package
3. Monitor the progress of projects to determine variances and recommend corrective actions software package

FF No. : 658

IP50156:: HUMAN FACTORS ENGINEERING

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Introduction **(7Hrs)**

Human criteria's, human physical activities, features of the human body, Measures of physiological functions such as: energy expenditure, gross body activity, local muscular activity, work load, work efficiency, work and rest. Type of movements of body members. manual material handling (MMH)

Performance criteria for physical activity such as: Strength & endurance, speed of movements, accuracy of movements

Unit II **(8 Hrs)**

Applied Anthropometry and Work Space

Introduction to anthropometry, use & principles of anthropometry data, work spaces, work space envelopes for seated persons, design of work spaces such as: work surface height, seated & standing, principles of seat design, workplace design.

Design and Displays: Information input & processing, visual displays of static & dynamic information. Auditory, textual & olfactory displays, general location of controls & displays within workspace, concept of visibility

Physical space & arrangement, principles of arrangement of component, Functions of controls, types of controls, factors in control design, design of specific hand operated controls, foot controls and special control devices.

Unit III **(8 Hrs)**

Working Conditions & WMSDs

Illumination: Color systems, energy consideration,

Atmospheric conditions: Measurement of thermal variables, wet-bulb globe temperature, Botsball, heat stress index, heat index, wind chill index,

Noise: Physiological effect of noise on performance, noise exposure limits,

Effect of lighting on performance. Physiological effect of heat & cold on performance. Noise controls. Work related musculoskeletal disorders, visual environment, thermal environment, auditory environment, Vibrations

Unit IV **(8 Hrs)**

Energy Expenditure

A. Muscle mechanism, BMR, Heart Rate variations, Oxygen consumption, Rest

allowances, Rate of energy expenditure, Manual Material Handling Capacity determination
B. Effect of environmental conditions and work design on Energy Expenditure

Unit V **(8 Hrs)**
Ergonomics and Work Organization

Human factors applications in system design, characteristics of system design, human factors data for interface design, ergonomic safety & health management
Case studies of ergonomically designed product.

Unit VI : Legal and Safety Aspects **(7Hrs)**

Provisions in the Factories Act, NIOSH, OSHA guidelines, ISO 18000, Product liabilities

Total Contact Hours: 42

Text Books :

i. ILO, Introduction to Work study
ii. Curie R. M. & Faraday, Work study

Reference Books :

i. M. S. Sanders and Ernest J. McCormick, McGraw Hill Inc., Human Factors Engineering and Design.
ii. E. Grad jean, Fitting Task to the Man.
iii. The Factories Act, 1948.

Course Outcomes:

Students will be able to:

1. Use principles of anthropometry and ergonomically design work spaces, work places and work stations
2. Identify injuries and occupational diseases that occur due to improper workplace design
3. Perform ergonomic assessments and provide solutions for better and safer workplace design
4. Assess and provide better physiological working conditions to enhance operator comfort

FF No. : 658

IP52152:: SUPPLY CHAIN ANALYSIS & MODELING

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I **(8 Hrs)**
Logistics & Warehousing

A. Definition, Logistics Function: Transportation – Significance, Modes of Transportation, Warehousing – Objectives, Warehousing Functions, Types of Warehouses, Inventory Management, Order Processing – Role of IT, Material Handling
Transportation: Modes of Transportation – Rail, Road, Pipelines, Water Air – Advantages & Disadvantages, Concept of TL, LTL, FTL. Selections of Appropriate Modes of Transportation. Warehouse Management: Concept of SKUs, Warehousing Principles & Best Practices in Receiving, Shipping, Order Picking, Storage & Put away, Warehouse Activity Profiling, Warehouse Layout Planning

Unit II **(7 Hrs)**
Concept of SCM

Supply Chain: Concept, Objective. Decision Phases in Supply Chain. Process View of Supply Chain – Cycle View, Push/pull view, Supply Chain Performance – Achieving Strategic Fit. Types of Supply Chain – Responsive, Efficient, Achieving Strategic Fit. Supply Chain Drivers – Facilities, Inventory, Transportation, Information.
Importance of Supply Chain, Examples of Supply Chain

Unit III **(8Hrs)**
Network Design in Supply Chain

Factors Influencing Distribution Network Design – Response time, Product variety, Product availability, Customer experience, Order visibility, Return ability.
Logistics Modeling: Location – Allocation Models Multiple Facility Location Models: Baumol Wolf Method, Add & Construction Heuristic,
Allocation Models: Transportation Model: Variants, Special Cases, Solution - Vogel's Approximation Method, Optimality Methods – UV Method, Stepping Stone Method, Transshipment problems. Traveling Salesman Problem, Vehicle Routing Problem
Factors Influencing Network Design Decisions – Strategic, Technological, Macroeconomic, Political, Infrastructure, Competitive

Unit IV **(7 Hrs)**
Planning Demand & Supply in a Supply Chain

Managing Supply: Managing Capacity – time flexibility of workforce, seasonal workforce, subcontracting, use of dual facilities, design product flexibility into production processes. Managing Inventory – use common components across multiple products, build inventory of high demand of predictable demand products
Managing Demand: Variable pricing, Forward buying.
Collaborative Planning Forecasting & Replenishment, Demand Forecasting & Aggregate Planning in Supply Chain.

Unit V **(7 Hrs)**
Planning & Managing Inventories in a Supply Chain

Managing Economies of Scale: Cycle Inventory- Role in SC - Lot sizing for single product, multiple products or customers, Aggregating multiple products in single order
Managing Uncertainty: Safety Inventory – Role in SC – Determine appropriate level of safety inventory
Transportation & Inventory Cost Trade-off: Choice of Transportation Mode, Inventory Aggregation. Transportation cost and customer-responsiveness trade-off
Pricing & Revenue Management in Supply Chain: Role, Revenue Management for Multiple Customer Segments, Seasonal Demand, Bulk & Spot Customers
Economies of scale to exploit quantity discounts. Procurement Process. Sourcing Planning & Analysis

Unit VI **(7 Hrs)**
Co-ordination & Technology in the Supply Chains

Co-ordination in Supply Chain: Lack of SC Coordination & Bullwhip Effect. Effect on Performance. Obstacles to SC Coordination. Manager Levers to Achieve Coordination. Information Technology and Supply Chain: Role of IT in SC Supply Chain IT Framework. E-business & Supply Chain
Building Strategic Partnerships and Trust within a Supply Chain. Future of IT in Supply Chain. Cases on E-business and supply chains

Text Books

1. Sunil Chopra & Peter Meindl, Supply Chain Management - Strategy, Planning & Operation –Pearson Education

Reference Books

1. Bowersox , Logistical Management - The Integrated Supply Chain Process
2. Christopher, Logistics & Supply Chain Management, Pearson Education
3. Logistics & Supply Chain Management – Raghuram
4. Business Logistics / Supply Chain Management – Ronald Ballou, Peason Education.

Course Outcomes:

Students will be able to:

1. Identify the key elements and processes in a supply chain and their interaction
2. Identify the techniques used in management of critical components of supply chain
3. Analyze and select the appropriate modes of transportation
4. Analyze, design and improve stores and warehousing processes
5. Analyze, design and optimize supply chain networks for manufacturing organizations

FF No. : 658

IP52154:: ENTREPRENEURSHIP DEVELOPMENT

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I **(7 Hrs)**
Entrepreneurship

Introduction: Entrepreneur, Entrepreneurship, Intrapreneur. Theories of Entrepreneurship Concept of Vision, Mission & Its Relevance to Entrepreneurship. Entrepreneurship Development in India – Role of EDC, EDI, DST, NSETB, Networks Organizations – MCED, etc. in promoting entrepreneurship

Unit I **(7 Hrs)**
Introduction Motivation Inputs To Entrepreneurship

Motivational input: Charms of being an entrepreneur. Reasons for being an entrepreneur. Study of the wealth creators of an economy. Myths of entrepreneurship. Case studies of successful entrepreneurs. qualities necessary to be a successful entrepreneur, developing entrepreneurship qualities, Entrepreneurship tendency test. Achievement oriented work environment. Psychological tendencies in budding entrepreneurs. Entry barriers to entrepreneurship and how to overcome them. Overcoming family and social barriers, overcoming and understanding barriers to business development.
Administration inputs to entrepreneurship – planning scheduling, time management

Unit II **(7 Hrs)**
Legal Inputs To Entrepreneurship

The Government policies promoting entrepreneurship and business. Business environments Legal inputs on staring a business. Review of forms necessary to start businesses. Review of registration procedures.Business classifications. Sales Excise Duties and Tax formalities. (Assignment)Overview on rules and regulations for different types of business units**.** Overcoming legal obstackles, Long term partnering with law and tax firms Monopoly creation of Logos, branding , Copyrights and Patents.
Shop ACT Business cards, venue Ambience,

Unit III **(7 Hrs)**
Business Opportunity Identification Inputs To Entrepreneurship

Understanding the needs of businesses. Choosing the right opportunity. What business should be done ? How to search for business opportunities and convert them to cash . Business opportunity identification methodology. Business creation methods. Places to look for business. How to take help for getting business. When to look for business opportunities ? Case studies on the right time to do a business
How to formulate a business and project plan. Project counseling to students

Unit IV **(7 Hrs)**

Marketing Inputs To Entrepreneurship

What to sell and how to sell ?: , Market research and survey, overview on methods of forecasting, launching and marketing the products and services, sales and distribution, project feasibility study – market feasibility, technical feasibility, sources of finance, financial feasibility – project costing and budgeting, product costing. Where to find finance and how to get project finance for a business ; Legal input to a business Marketing inputs to entrepreneurship : How to prepare a business plan and strategise . How to identify the right strategy for market development . Exploiting an attractive market . Creating competitive advantages for the market . Creating the right strategy . Inputs for strategy development

Unit VI **(7 Hrs)**

Problem Solving Inputs To Entrepreneurship

How to solve problems as and when they arrive ? Business crisis and how to solve them when they arise . Review of Cash crisis Starting Crisis, Delegation crisis, Management crisis and Succession crisis. Review of methods to solve each crisis.
Methods to solve new crisis which may arrive in the future. Review of luck and the business cycle.
Tax and relativity of moral ethics in adverse business (corrupt) environments.

Text Books

1. S J Phansalkar, Making Growth Happen – Learning from First Generation Entrepreneurs.
2. Class notes on entrepreneurship

Reference Books

1. Dr J. S. Juneja, Small and Medium Enterprise: Challenges and opportunities
2. Kondalah, chukka; Enterprise in the new millennium, McGraw-Hill publication
3. Harvard Business Review on Enterprise : Harvard Business Review, McGraw-Hill publication.

4. Gopal & Ramamurthy; Project management Handbook, Macmilan.
5. Prassanna Chandra; Preparation, Appraisal, Budgeting and Implementation.
6. Rabindra N Kanungo, Entrepreneurship & Innovation Models for Development.

Course Outcomes:

Students will be able to:

1. Evaluate his or her own entrepreneurial tendency and ability
2. Analyze the techno-commercial feasibility of new business ventures
3. Brainstorm ideas for new and innovative products or services.

FF No. : 658

IP52156 MANAGEMENT INFORMATION SYSTEM

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Introduction (7Hrs)
Definitions, objective, structure, operating elements, MIS structure based on management activity, organizational function

Unit II: System concepts (7Hrs)
Definition, Types of systems, system decomposition, system entropy, system stress, methods of simplification, design concepts

Unit III : SDLC Approach (7Hrs)
System development life cycle approach, system requirement specifications, entity relationship diagram, data dictionary, report generation, database administration

Unit IV : Object Oriented Analysis and Design (7Hrs)
Introduction, concepts of objects, class, encapsulation, various steps of OOA, methods like Booch, Rambaugh etc. Domain Analysis, Human computer Interface, Introduction to System Testing

Unit V : Decision Support System (7Hrs)

Introduction to decision support system, experts systems, hardware and software acquisition, legal Issues

Unit VI : Information Management and society (7Hrs)
Ccomputer security, privacy, manual versus electronic information, back up protection, user interfaces, encryption, responsibility and ethics

Total Contact Hours: 42

Text Books :

i. Software Engineering, K. K. Agarwal, Yogesh Singh, New Age Publishers Pvt. Ltd., New Delhi ISBN 81 224 1638 1

Reference Books :

i. Management Information System by Jawadekar W.S., Tata McGraw Hill 2002
ii. Management Information System by Davis G.B., Tata McGraw Hill Edition 2000
iii. **Lorna M. Daniells** Business Information Sources, University of California Press, 1993

Course Outcomes:

Students will be able to:

1. Understand System development life cycle approach.
2. Perform Object Oriented Analysis and Design
3. Designing Human computer Interface & decision support system

FF No. : 658

IP52158:: WORLD CLASS MANUFACTURING

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I **(7 Hrs)**
WCM & Lean Manufacturing

Introduction To World Class Manufacturing. Lean Manufacturing – Definition & Concept. Characteristics of Lean Manufacturing. Lean Mfg Tools & Techniques, Concept of MUDA, MURA & MURI. Value Stream Mapping – VSM Symbols, Current State v.s Future State, Kaizen Bursts.
Hall's, Schonberger,s framework of World Class Manufacturing, Various models of world class manufacturing

Unit II **(7 Hrs)**
Lean Manufacturing Tools & Techniques 1

Kaizen – Concept, Types of Kaizen, Kaizen Worksheets, Developing Kaizen
Design of JIT-Pull System, Kanban – Types, Calculations of Kanban
Set-up Time Reduction: SMED Methodology for Set-up reduction, Set-up Reduction Projects, Quick attachment devices

Unit III **(7 Hrs)**
Lean Manufacturing Tools & Techniques 2

Group Technology Approaches, Group Technology – Codification & Classification Systems. Characteristics Of A Group/ Cell Families Of Parts, Production Flow Analysis And Choice Of Family , Benefits And Applications Of Group Technology. Cellular Manufacturing: Work cell concepts and applications, Work cell design, work cell staffing and equipment issues
Concept of Standard Work – Work Standardization, Standard Operating Procedures, Charting techniques in work standardization

Unit IV **(7 Hrs)**
Total Productive Maintenance

Maintenance – Breakdown, Preventive, Predictive. TPM: Concept & Origin, Outline of TPM – 8 Pillars, TPM Performance Measures – PQCDSM & OEE, Introduction to Autonomous Maintenance (Jishu Hozen) activities, Small-Group activities of TPM. Introduction to 5S: Steps in 5S Methodology, Concept of 1S(Seiri), 2S(Seiton), 3S (Seiso), 4S (Shiketsu), 5S, (Shitsuke). Implementation of 1S & 2S
MBNQA, EFQM Award, RBNQA Award, JIPM TPM Award, Losses & Abnormalities in TPM

Unit V **(7 Hrs)**
Business Process Reengineering

BPR Concepts, Practices & Philosophy, Key features and guiding principles of Reengineering, Kinds of changes that occur in reengineering, Changes required on Behavioral Side in a BPR Project, Concepts of Business and Core Processes in BPR. Process Mapping – IDEF Standard, BOLO (Be On Look Out) Methodology.
Tools in BPR

Unit VI **(7 Hrs)**
Theory of Constraints

Introduction to TOC, Concept, Constraints – Types, Concept of Throughput, Inventory & Operating Expenses, Throughput Accounting, TOC Methodology, Numerical & Cases in TOC. Application of TOC in industry
Drum-Buffer-Rope Approach, Numerical & Case in TOC Applications

Text Books

1. Cause and Effect Lean – The essentials of Lean Manufacturing by John Bicheno
2. Learning to See, James Womack & Daniel Jones
3. Hammer M. and Champy J. Re-engineering the Corporation - Harper Collins.

Reference Books

1. World Class Manufacturing -A strategic perspective by B.S. Sahay, Saxena, Macmillan, India
2. World Class Manufacturing – Richard Schonberger
3. Introduction to TPM: Total Productive Maintenance by Nakajima Seiichi
4. Total Productive Maintenance by Terry Wireman (Industrial Press)
5. TPM material/ books published by JIPM (Japanese Institute of Plant Maintenance)
6. Lean Thinking by James Womack & Daniel Jones

Course Outcomes:

Students will be able to:

1. Identify, eliminate and reduce the non-value added activities (wastes) in manufacturing organization
2. Apply the tools and techniques of lean manufacturing and constraint management to improve productivity in manufacturing and service organizations
3. Analyze, map and improve business processes for achieving improvements

FF No. : 658

IP52160: PRODUCT DESIGN & NEW PRODUCT DEVELOPMENT

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Product methodology & the structure of Design Process (7Hrs)
Introduction of Product methodology , methodological problems, characteristics of methods, The phases of product design process, foundations of phase models, three phase models etc

Unit II : Design materials & human factors in product design (7Hrs)

Material properties, metals, plastics, rubber, woods & factors considered while designing for metals, plastics, rubber, woods etc, Anthropometry factors, physiological factors, psychology factors, anatomy factors.

Unit III : Economic factors influencing design (7Hrs)
Product value, safety, reliability & environmental considerations, economic analysis, break even analysis, profit & competitiveness, economic of a new product design.

Unit IV : Value engineering in product design, **(7Hrs)**
introduction, historical perspective, nature & measurement of value, importance of value, value analysis job plan, creativity, steps for solving & value analysis, value analysis tests

Unit V : Strength considerations in product design, (7Hrs)
principal stress trajectories(force flow lines), balanced design, criteria & objective of design, material toughness, resilience, designing for uniform strength.

Unit VI : Modern Approaches To Product Design (7Hrs)
Concurrent Design, Quality Function Development (QFD), Rapid Prototyping

Total Contact Hours: 42

TEXT BOOKS:

1. Product design & Manufacturing- A.K.Chitale, R.C Gupta
2. Product Design : Fundamentals & Methods – N.F.M. Roozenburg & J.Eekels

REFERENCE BOOKS:

1. Product design & Manufacture- Jhon R Lindbeck
2. Mayall W.H., "Industrial Design for Engineers" London Liifee Books Ltd. 1967
3. Dale Huchingson R "New Horizons for Human Factors in Design " McGraw Hill Company 19811.Indistrial Design-Mayall

Course Outcomes:

Students will be able to:

1. Apply expert knowledge of the product development process; from market analysis, product design and manufacturing to market introduction and sales.
2. Apply new theories on innovation and change, including emerging paradigms such as user-driven innovation, open innovation and market forecasting in practice.
3. Understand the new product development process.
4. Acquire competence with a set of tools and methods for product design and development.
5. Understand awareness of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production).

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IP52162: AUTOMATION STRATEGIES

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Unit I : Hard And Soft Automation (7Hrs)

Mechanisation And Automation, Concept And Scope Of Automation, **SPM,Transfer Machines,Soft Automation** Overview Of Manufacturing Processes, Types Of Manufacturing Systems, The Product Cycle, Computer's Role In Manufacturing, Sources And Types Of Data Used In Manufacturing, Central Processing Unit, Memory Input/Output Section, Computer Programming, Mini Computer, Micro Computer, P.C., Super Computers.

Low Cost Automation. Socio Economic Consideration

Unit II : NUMERICAL CONTROL: (7Hrs)

THE BEGINNING OF CAM: Historical Background, Basic Components Of NC Systems, NC Procedure, NC Coordinate System And Machine Motions, Applications And Economics Of NC, Part Programming- Manual And Computer Assisted The APT Language.

COMPUTER CONTROLS IN NC SYSTEMS: Problems With Conventional NC Computer Numerical Control, Direct Numerical Control, Combined CNC/ DNC Systems, Adaptive Control Machining System Computer Process Interfacing, New Development And Latest Trends.

Unit III : Process Planning (7Hrs)

COMPUTER AIDED PROCESS PLANNING: Traditional Process Planning, Retrieval Process Planning System, Generative Process Planning, Machinibility Data System, Computer Generated Time Standards.

GROUP TECHNOLOGY: Introduction, Part Families, Part Classification And Coding, Coding System And Machining Cells.

COMPUTER AIDED PRODUCTION MANAGEMENT SYSTEMS: Traditional Production, Planning And Control, Introduction To Computer Aided PPC, Introduction To Computer Aided Inventory Management, Manufacturing Resource Planning (MRP-II), Computer Process Monitoring And Shop Floor Control, Computer Process Control.

Unit IV : Quality Control (7Hrs)

COMPUTER AIDED QUALITY CONTROL: Traditional Quality Control, Computer In Quality Control, Contact Inspection Methods, Non Contact Inspection Methods, Optical And Non Optical Computer Aided Testing.

COMPUTER AIDED MATERIAL HANDLING: Traditional Material Handling, Computer Control On Material Handling, Conveying, Picking. Ware House Control,

Computerized Material Handling For Automated Inspection And Assembly.
COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Introduction, Types Special Manufacturing Systems, Flexible Manufacturing Systems (FMS), Machine Tools And Equipment, Material Handling Systems, Computer Control Systems.
Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Carousel Storage Systems, Work-In-Process Storage, Interfacing Handling And Storage With Manufacturing, Problems,

Unit V : Robotics (7Hrs)
Introduction, Classification Based On Geometry, Devices, Control And Path Movement, End Effectors - Types And Applications: Sensors - Types And Applications. Industrial Applications Of Robots For Material Transfer, Machine Loading / Unloading, Welding, Assembly And Spray Painting Operations.

Unit VI : Future Automated Factory (7Hrs)
Computer Networks For Manufacturing, Hierarchy Of Computers In Manufacturing, Local Area Networks, Manufacturing Automation Protocol, Trends In Manufacturing, The Future Automated Factory, Human Workers In The Future Automated Factory, 786 The Social **Future Automated Factory** Impact.

Total Contact Hours: 42

Text Books

1.CAD/ CAM- Groover & Zimmer, Prentice Hall
2.Automation Production Systems and CIMS – Groover, Prentice Hall

Reference Books

1. CAD/ CAM – Beasanat & Lui, EWP.
2. Material Handling Hand Book, McGraw Hill.
3. Industrial Robotics – Groover Mitchell, McGraw Hill.
4. 6.Robotics and Flexible Automation by SR Deb

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IP50352 :PG LAB 2

Credits: 02 **Teaching Scheme: -** Laboratory 2 Hrs/Week

Part A: Optimization & Simulation

1. Assignment on Linear Programming Problem
2. Assignment on integer programming.
3. Assignment on dynamic programming.
4. Assignment on goal programming.
5. Assignment on decision making tools.
6. Assignment on replacement models.
7. Assignment on theory of games.
8. Assignment on queuing theory.
9. Assignment on simulation.
10. Assignment 1 on simulation
11. Assignment 2 of simulation
12. Assignment 3 on simulation

Text Books

1. Hira Gupta, Operations Research

Reference Books

1. S.K. Basu, H. Bagchi, D.K. Pal – Operation Research, Oxford IBH
2. H. Taha, Operation Research

Course Outcomes:

Our students will be able to:

1. Formulate a certain class of decision problems and solution
2. Formulate real life queuing problems and generate optimal solutions
3. Simulate various real life problems and generate optimal solutions

Part B: Project Management

1. Preparation of Project Feasibility Report
    a. Project Identification, Definition
    b. Project Feasibility – Managerial/Organizational Perspective
    c. Project Feasibility – Marketing, Exit Plan
    d. Project Feasibility – Operational
    e. Project Feasibility – Financial, Financial Projections
2. Assignment on Capital Budgeting – PBP, Discounted PBP, NPV, IRR, Annual Worth
3. Numerical on PERT/CPM – Calculation of Floats, Determination of Critical Path & Project Duration
4. Case let - Project Crashing
5. Case let - Resource Leveling & Resource Smoothening
6. Assignment on Earned Value Analysis
7. Assignment on Critical Chain
8. Project Planning & Scheduling (Using MS Projects) 1 – Preparation of Statement of Works, WBS
9. Project Planning & Scheduling (Using MS Projects) 2 – Network Diagram, Gantt Charts, Project Monitoring

Text Books

1. Narendra Singh; Project Management & Control (1998); Himalaya Publishing House, Mumbai.
2. S.Choudary, Project Management

Reference Books

1. Gopal & Ramamurthy; Project Management Handbook; Macmilan.
2. Prasanna Chandra; Preparation, Appraisal, Budgeting & Implementation
3. Project Management Body of Knowledge

Course Outcomes:

Students will be able to:

1. Ascertain the feasibility of small and medium projects with respect to managerial, marketing, operational, financial and socio-economic perspectives
2. Plan and schedule small and medium projects to achieve the triple constraint of time, cost and quality using software package
3. Monitor the progress of projects to determine variances and recommend corrective actions software package

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IP57753 :TECHNICAL SEMINAR 1

Credits: 0 **Teaching Scheme: -** Hrs/Week

Assessment of Technical Seminar

Seminar Topic should be relevant to Industrial Engineering discipline and should not be a part of syllabus. It is mandatory to review at least 5 research papers on the topic chosen

1. Review – I: during Mid Semester Examination (Compulsory) as per the Academic Calendar.
2. Review – II : The last week before term-end (Optional)
3. For poor performing students identified by the examination panel, a second review to be taken. Review II optional for other students. For Review II, deduction of 10 marks will take place.
4. Seminar is an individual activity with separate topic and presentation.
5. Duration of presentation – 12 minutes
   Question and answer session – 8 minutes

Seminar Evaluation Scheme :

1.	Attendance during Semester	– 5 marks
2.	Attendance during Seminar presentation self & peer	– 5 marks
3.	Relevance of Seminar topic	– 5 marks
4.	Timely Abstract submission	– 5 marks
5.	Literature review	– 20 marks
6.	Technical contents	– 20 marks
7.	Presentation	– 25 marks
8.	Question & answer Session	– 15 marks
		---
		100 marks

FF No. : 658

IP57752 : SEMESTER PROJECT II

Credits: 0 **Teaching Scheme: -** Hrs/Week

Assessment of Semester Project

Semester Project will be based on all subjects of that Semester except GP.

1. The Semester Project will be for a group of 2 students. Head of Department to appoint Project Guides. 2 credits will be awarded to the candidate after the viva voce and project demonstration at the End of Semester.
2. Group formation, discussion with faculty advisor, formation of the Semester Project statement, resource requirement, if any should be carried out in the earlier part of the Semester. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.
   The Assessment Scheme will be: End Semester Examination: 100 marks

Course Outcomes :
A student will be able to

1. analyze/evaluate a concept / system / machine operation / process etc
2. make physical working model/charts of concepts or carry out a survey
3. analyze and improve methods and determine work content considering human factors
4. make effective / productive use of man, machine and material resources
5. investigate complex problems using various statistical, quantitative and simulation tools
6. work as an individual and lead the teams effectively to achieve the set objectives.
7. prepare project report and present at the end of semester

Semester III

FF No. 653 Issue No.1, Rev No.1 dated 4/4/2013

Sub. Code	Subject Name	Teaching Scheme		Assessment Scheme					Credits
				ISA				ESA	
		L	P	Class Test	MSE	HA	CA	ESE	
HS66151	Institute Level Open Elective	2		10	30	10		50	2
IP62151	Department Level Open Elective (Costing & Economics)	2		10	30	10		50	2
IP67752	Dissertation Stage I		4					100	15
IP67751	Technical Seminar II		2					100	4
	TOTAL	4	6						23

FF No. : 658

IP 62151 : COSTING AND ECONOMICS

Credits: 02 **Teaching Scheme: -** Theory 2 Hrs/Week

Unit I **(07 Hrs)**

Cost

A. Cost, Cost Centre. Cost Unit. Elements of Cost: Material Cost. Different methods of pricing of issue of materials – LIFO, FIFO, HIFO, Weighted Average & Their Significance in material cost calculation and valuation of stocks. Labour Cost: Direct & Indirect Different methods, Time Keeping & Time Booking. Methods of calculating labour turnover. Direct Expenses: Constituents and Significance. Accounting for Prime Cost.

Unit II **(07 Hrs)**

Overheads

A. Classification: Production, Office & Administration, Selling & Distribution. Treatment of Overheads: Collection of Overheads - Criteria, Primary and Secondary Distribution of Overheads: Step Method, Reciprocal Method, Repeated Distribution Method. Absorption of Overheads: Machine hour, labour hour rate. Under and Over Absorption of Overheads. Accounting for Overheads. Preparation of Cost Sheet & Cost Statement

Unit III **(07 Hrs)**

Activity Based Costing & Transfer Pricing

A. Concept, Concept of Cost Drivers. Calculation of Costs. Mechanism of Activity Based Costing. Transfer Pricing: Objective, Methods – Cost Based, Market Prices Based, Negotiated Prices. Recommended procedure for Transfer Pricing

B. Limitations of Traditional Costing

Unit IV : **(07 Hrs)**

Time Value of Money & Life Cycle Costing

Time Value of Money – Basis for comparison of alternatives, Present Worth, Future Worth, Annual Worth, Annuity, Perpetuity,

Life Cycle Costing - Introduction, methodology, applications of LCC in industrial world, differentiation with traditional costing methods

Total Contact Hours: 28

Text Books :

1. Theusen H.G., Engineering Economic Analysis, Prentice Hall of India
2. Bhattacharya A. K., "Principles and Practice of Cost Accounting", Prentice Hall India.
3. B K Bhar, "Cost Accounting – Methods and Problems", Academic Publishers

Reference Books :

1. Henry M. Steiner, Engineering Economic Principles, McGraw Hill
2. S.M. Mahajan, Engineering Economics, Everest Publishing House, Pune
3. Samuelson PA, Nordhaus WD, Economics, Tata McGraw Hill
4. Colin Drury, "*Management and Cost Accounting*", English Language Book Society, Chapman and Hall London.
5. Khan M. Y., Jain P. K., "*Financial Management",* Tata McGraw Hill

FF No. : 658

IP67752 :: DISSERTATION STAGE I

Credits: 15	

Prerequisite : Nil

Objectives:

- To train the students to apply their engineering knowledge to real life problem solving.

The dissertation work could be of the following nature:

1. Manufacturing / Fabrication of a prototype machine' including selection, concept, design, material, manufacturing the components, assembly of components, testing and performance evaluation.
2. Improvement of existing machine / equipment / process.
3. Design and fabrication of Jigs and Fixtures, dies, tools, special purpose equipment, inspection gauges, measuring instruments for machine tools.
4. Computer aided design, analysis *of* components such as stress analysis.
5. Problems related to Productivity improvements.
6. Problems related to value engineering.
7. Problems relating to material handling system.
8. Energy Audit of organization, Industrial evaluation of machine devices.
9. Design of a test rig for performance evaluation of machine devices.
10. Product design and development.
11. Analysis, evaluation and experimental verification of any engineering problem encountered.
12. Quality systems and management. Total Quality Management.
13. Quality improvements, In-process Inspection, Online gauging.
14. Low cost automation, Computer Aided Automation in Manufacturing.
15. Time and Motion study, Job evaluation.
16. Ergonomics and safety aspects under industrial environment
17. Management Information System.
18. Market Analysis in conjunction with Production Planning and Control.

OR

Fabrication of models, machines, prototypes based on new ideas, robots and machine based on hitech systems and automation, experimental set-up, fabrication of testing equipment, renovation of machines, etc. Computer based design / analysis or modeling / simulation of product(s), mechanism(s) or system (s) and its validation or comparison with available benchmarks / results. Modelling/simulation of product(s), mechanism(s) or system(s) and its validation or comparison with available bench marks / results. Design/development and

Fabrication of models, machines, and prototypes based on new ideas, robotic and automation systems, Experimental set ups, test rigs/ equipments.

The project work shall be taken up individually or in a group consisting of not more than 4 students.

A report containing maximum 50 pages shall be submitted based on the background, need and scope of the project, project specifications, activities involved in the project and activity plan, study of literature and basic theory, and work completed (if any).

Guidelines:

- Report shall be typed or printed.
- Figures and tables shall be on separate pages and attached at respective positions.
- Project title and approval sheets shall be attached at the beginning of the report followed by index and synopsis of the project.
- References shall be mentioned at the end followed by appendices (if any).
- When a group of students is doing a project, names of all the students shall be included on every certified report copy.

Each group of students shall submit two copies of reports to the institute and one copy shall be prepared for each individual student.

Course Outcomes:

Students will be able to:

1. Review literature and identify the problem.
2. Apply basic industrial engineering fundamentals in the domain of practical applications.
3. Correlate the theoretical and experimental/simulations results and draw proper inferences.
4. Apply industrial engineering knowledge in carrying out industrial projects related with setting up production norms, establishing time standards, effecting productivity and quality improvements, resource optimization, etc.
5. Prepare report as per the standard guidelines.
6. Carry out cost estimate and make reasonable trade-offs between functions and costs in planning engineering projects.
7. Plan and manage an engineering project with continuous monitoring and control activities.
8. To practice data collection and analysis using quantitative, statistical and simulations methods and software packages.
9. To practice project planning and control, and costing in industrial engineering related improvement projects
10. Select and use appropriate technology building blocks and industrial engineering tools and techniques to develop a solution for an industrial problem

11. Develop personal and professional qualities such as leadership, communication skills, team working skills, co-operative attitude, and co-ordination ability as well as enthusiasm for attempting a problem solution in a right approach

FF No. : 658

IP67751 :TECHNICAL SEMINAR II

Credits: 0 **Teaching Scheme: -** Hrs/Week

Assessment of Technical Seminar

Seminar Topic should be based on Project Dissertation. Seminar should consist of review of at least 8 research papers

1. Review – I: during Mid Semester Examination (Compulsory) as per the Academic Calendar.
2. Review – II : The last week before term-end (Optional)
3. For poor performing students identified by the examination panel, a second review to be taken. Review II optional for other students. For Review II, deduction of 10 marks will take place.
4. Seminar is an individual activity with separate topic and presentation.
5. Duration of presentation – 12 minutes
   Question and answer session – 8 minutes

Seminar Evaluation Scheme :

1.	Attendance during Semester	– 5 marks
2.	Attendance during Seminar presentation self & peer	– 5 marks
3.	Relevance of Seminar topic	– 5 marks
4.	Timely Abstract submission	– 5 marks
5.	Literature review	– 20 marks
6.	Technical contents	– 20 marks
7.	Presentation	– 25 marks
8.	Question & answer Session	– 15 marks
		---
		100 marks

Semester IV

Sub. Code	Subject Name	Teaching Scheme		Assessment Scheme					Credits
				ISA				ESA	
		L	P	Class Test	MSE	HA	CA	ESE	
IP67753	Dissertation Stage II		8					100	25
	TOTAL		8						25

FF No. : 658

IP67753 :: DISSERTATION STAGE II

Credits: 2	**Teaching Scheme: -** Practical 1Hr/Week

Prerequisite : Nil

Objectives:

- To train the students to apply their engineering knowledge to real life problem solving.

The dissertation work could be of the following nature:

1. Manufacturing / Fabrication of a prototype machine' including selection, concept, design, material, manufacturing the components, assembly of components, testing and performance evaluation.
2. Improvement of existing machine / equipment / process.
3. Design and fabrication of Jigs and Fixtures, dies, tools, special purpose equipment, inspection gauges, measuring instruments for machine tools.
4. Computer aided design, analysis *of* components such as stress analysis.
5. Problems related to Productivity improvements.
6. Problems related to value engineering.
7. Problems relating to material handling system.
8. Energy Audit of organization, Industrial evaluation of machine devices.
9. Design of a test rig for performance evaluation of machine devices.
10. Product design and development.
11. Analysis, evaluation and experimental verification of any engineering problem encountered.
12. Quality systems and management. Total Quality Management.
13. Quality improvements, In-process Inspection, Online gauging.
14. Low cost automation, Computer Aided Automation in Manufacturing.
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16. Ergonomics and safety aspects under industrial environment
17. Management Information System.
18. Market Analysis in conjunction with Production Planning and Control.

OR

Fabrication of models, machines, prototypes based on new ideas, robots and machine based on hitech systems and automation, experimental set-up, fabrication of testing equipment, renovation of machines, etc. Computer based design / analysis or modeling / simulation of product(s), mechanism(s) or system (s) and its validation or comparison with available benchmarks / results. Modelling/simulation of product(s), mechanism(s) or system(s) and its validation or comparison with available bench marks / results. Design/development and Fabrication of models, machines, and prototypes based on new ideas, robotic and automation systems, Experimental set ups, test rigs/ equipments.

The project work shall be taken up individually or in a group consisting of not more than 4 students.

A report containing maximum 100 pages shall be submitted based on the background, need and scope of the project, project specifications, activities involved in the project and activity plan, study of literature and basic theory, and work completed (if any).

Guidelines:

- Report shall be typed or printed.
- Figures and tables shall be on separate pages and attached at respective positions.
- Project title and approval sheets shall be attached at the beginning of the report followed by index and synopsis of the project.
- References shall be mentioned at the end followed by appendices (if any).
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Course Outcomes:

Students will be able to:

1. Review literature and identify the problem.
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3. Correlate the theoretical and experimental/simulations results and draw proper inferences.
4. Apply industrial engineering knowledge in carrying out industrial projects related with setting up production norms, establishing time standards, effecting productivity and quality improvements, resource optimization, etc.
5. Prepare report as per the standard guidelines.
6. Carry out cost estimate and make reasonable trade-offs between functions and costs in planning engineering projects.
7. Plan and manage an engineering project with continuous monitoring and control activities.
8. To practice data collection and analysis using quantitative, statistical and simulations methods and software packages.
9. To practice project planning and control, and costing in industrial engineering related improvement projects
10. Select and use appropriate technology building blocks and industrial engineering tools and techniques to develop a solution for an industrial problem
11. Develop personal and professional qualities such as leadership, communication skills, team working skills, co-operative attitude, and co-ordination ability as well as enthusiasm for attempting a problem solution in a right approach