UNIVERSITY OF ENGINEERING AND MANAGEMENT, JAIPUR

M.Tech Industrial Engineering 1st year (1st semester)

Title of Course: Quantitative Techniques in Industrial Management
Course Code: IE101
L-T scheme: 3-1 **Course Credit: 4**

Course Objectives:

1. To present the basic theory of non linear constrained and unconstrained problems that arose in engineering.
2. To give a thorough understanding of getting solution to these problems and some experience in solving them.
3. To develop the skills for the formulation and solution of mathematical models in their own research.

Learning Outcomes:
After the completion of this practical course, the student will be able to:

1. Model non linear constrained and unconstrained engineering problems
2. Solve multi-objective non linear constrained or unconstrained engineering problems
3. Develop the skills for the formulation and solution of mathematical models in their own research.

Course Contents:

Historical overview of operations research: fundamentals of OR Modeling, Overview of Project Management, Network analysis for time management (CPM, PERT, Crashing and Simulation).

Project Resource Management: Allocation, Leveling and Smoothing methods.

Linear Programming: Basic assumptions, formulation, graphical method Simplex method, duality theory, primal-dual relationships, sensitivity analysis. Transportation and Assignment Problems: Specific features of transportation problem, streamlined simplex method for solving transportation problems, special features of assignment problems, Hungarian method for solving assignment problems.
Nonlinear programming, Sequential Linear Programming, Indirect method, Interior and exterior penalty. Function, Karush-Kuhn-Tucker conditions, Applications

Design of experiments, Introduction to Factorial Designs, Regression models, Response Surface Methodology, Random Effects Models, Nested and Split Plot Designs, Transformations, unbalanced ANOVA and ANCOVA, Taguchi optimization technique, Applications.

Introduction to robust design, Monte-Carlo Sampling, Design under uncertainty, Reliability analysis, Taguchi methods.

Multiobjective optimization, Grey relational analysis, principal component analysis, Weighted sum optimization, Weak and strong dominance, Pareto front computation, Goal programming and isoperformance, Multiattribute Utility Theory.

Text Books:

1. Gupta, P. K., Hira D. S., “Operation Research”, S. Chand and Company
2. Rao, S. S., “Engineering Optimization (Theory and Practice)”, John Wiley & Sons,
3. Taha, H. A. , “Operations Research”, Prentice Hall of India, New Delhi, 9th Edition

Title of Course: Methods Engineering and Ergonomics
Course Code: IE102
L-T scheme: 3-1 **Course Credit: 4**

Course Objectives:

1. To understand work measurement and work improvement techniques like stop watch time study, work sampling, method study, etc.
2. To understand ergonomics with human comfort point of view.

Learning Outcomes:
After the completion of this practical course, the student will be able to:

1. Students will be able to understand the concept of total time of manufacturing.
2. Students will understand the better methods and concept of productivity measurement.
3. Students can evaluate performance of service industry and give proper measures for improvement.
4. They can determine standard time for a job or a process and delays in work.

Course Contents:

Method Study : Analysis of Operations, job work, systems involving man and machines. Schematic methods, charts and other aids for analysis.

Work Study : Method of work measurement, stopwatch study; PMTS; work sampling, setting of time standards.

Motion Study : Principles of motion economy and work center design.

Ergonomics : Basic anatomy of human body and its functional systems; principles of ergonomics, design of display and controls in relation to information processing by human being.

Anthropometry : Experimental and laboratory treatment of selected topics such as study and effects of personal factors environment of human performance. Determination of physiological works, concepts of efficiency and effectiveness.

Text Books:

1. 1. ILO, " Introduction to Work Study (4th Ed)," Universal Book Corporation
2. 2. Barnes, R. M., " Motion and Time Study Design and Measurement of Work ", 7th Ed, Wiley India
3. 3. Helander, M., "A Guide to Human Factors and Ergonomics," Taylor & Francis
4. 4. Kearney, D. S., " Ergonomics Made Easy", Government Institutes (The Scarecrow Press)
5. Gupta, P. K., Hira D. S., "Operation Research", S. Chand and Company
6. Rao, S. S., "Engineering Optimization (Theory and Practice)", John Wiley & Sons,
7. Taha, H. A. , "Operations Research", Prentice Hall of India, New Delhi, 9th Edition

Title of Course: Personnel Management and Industrial Relations
Course Code: IE103
L-T scheme: 3-1 **Course Credit: 4**

Course Objectives:

1. To understand the various functions of personnel management and its applications.
2. To understand various labour legislation and trade unions related acts.

Learning Outcomes:
After the completion of this practical course, the student will be able to:

1. To understand the scope & Objective of personnel Management.
2. To get knowledge about personnel functions like personnel planning, recruitment training appraisal etc.
3. To become aware about employee health security welfare related issues.
4. To understand nature, Causes and settlement of Industrial disputes.

Course Contents:

Human behaviour : Human behavior of an individual as a member as a small group and as a member of an organization, Influence of culture organizational, social, national and international on individual.

Analysis : Analysis of dynamic behaviour of organization by simulation structure of organization and flow of men, money, material, information capital, equipment and order, system models on the basis of policy of management to evolve effective policies for management.

Personnel management : Scope and objectives of personnel management, personnel planning, labor market, recruitment training and placement.

Job evaluation : Job evaluation, merit rating, wage incentives, employee health, security and welfare, morale and motivation, industrial disputes, voluntary and compulsory settlement trade unionism.

Labour legislations : Performance appraisal and evaluation.

Text Books:

1. Human Resources Management: K. Aswathappa, Tata McGraw Hill.
2. Dynamics of Industrial Relations: C. B. Mamoria, Himalaya Publication.
3. Personnel Management: Edwin Flippo, Tata McGrawHill.
4. Fundamentals of Human Resource Management: David A. Decenzo & Stephen PRobbins, Wiley-India.

Title of Course: Materials Management
Course Code: IE104
L-T scheme: 3-1 **Course Credit: 4**

Course Objectives:

1. To apply knowledge of materials management in practice.
2. To understand various tools of materials management.

Learning Outcomes:
After the completion of this practical course, the student will be able to:

1. Students will learn about the dynamics of materials management.
2. Students will learn the importance of materials in Industry.
3. Students will learn about the optimum Inventory management.
4. Student get exposure to use computers in materials management.

Course Contents:

Materials: Profit Centre : Role of materials management techniques in material productivity improvement, cost reduction and value improvement.

Purchase management : Purchase management, incoming material control. Acceptance sampling and inspection. Vendor rating system. Inventory management, various inventory control models.

MRP : Material requirement planning systems. Discrete lot sizing techniques. Wagner and whitin algorithm. Silver and Metal algorithm. Algorithms for multi-product lot sizing with constraints inventory management of perishable commodities.

JIT : Design of inventory distribution systems. Inventory management in Kanban and Just-in-time.

Text Books:

1. Gopalkrishnan, P. “Purchasing & Materials Management”, TMH, New Delhi, 2004
2. Tersine R.J, “Material Management & Inventory Control”, Worth Holand, New York, 1976
3. Material management & Inventory Control: Tersine
4. Applied Materials Management: S. Chatterjee

Title of Course: Methods Engineering and Ergonomics Lab
Course Code: IE191
Year: 1st Year
L-T-P Scheme: 4-0-0 **Course Credits: 2**

Introduction:

Industrial engineering is a combination of manufacturing technology, engineering sciences with management science. An industrial engineer typically has a wide knowledge of engineering practices and is aware of the management challenges related to production. The goal is to accomplish the production process in the smoothest, most-judicious and most-economic way.

Objectives:

- To understand work measurement and work improvement techniques like stop watch time study, work sampling, method study, etc.
- To understand ergonomics with human comfort point of view.
- The emphasis throughout the laboratory course will be on understanding the basic features of the processes rather than details of constructions of machine, or common practices in manufacturing or acquiring skill in the operation of machines.
- Evidently, acquaintance with the machine is desirable and the laboratory sessions will provide adequate opportunity for this.

Course Contents:

1. Study of charting techniques
2. Study of principles of motion economy
3. Study of Therbligs
4. Stop watch time study
5. Work sampling study
6. Training for performance rating
7. Ergonomic assessment of different types of chair/tables
8. Response time measurement
9. Design of workstation
10. Design of displays
11. Design of controls
12. Physiological cost of activity

M.Tech Industrial Engineering 1st year (2nd semester)

Title of Course: Automation in Production
Course Code: IE201
L-T scheme: 3-1 Course Credit: 4

Course Objectives:

1. To teach graduates various automation systems and its components, so that they all like to apply it to the various practical situations in industries.
2. To understand various tools of automation.
3. Students should be able to learn to increase the efficiency of an existing system by Automation.
4. Learning about time saving and doing more precise job operations.

Learning Outcomes:

After the completion of this practical course, the student will be able to:

1. Students will be able to evaluate & Compare investment Projects.
2. Students will be able to analyze & the evaluate the performance of automated production times based on production times, production rate and efficiency of live.
3. Students will be able to design part delivery System and evaluate the performance of automated assembly times.
4. Students should be able to evaluate and select a suitable CNC/ machining centers for manufacturing a particular component.

Course Contents:

Automation:
Principles, basic concepts, economy, efficiency, productivity and performance of machine tools, main trends in automation, automatic devices and design, automatic and semi-automatic machines, programme controlled machines, special purpose machines, unit type and transfer machines, automation in assembly, gauging and size control.

Numerical Control (N.C.):
Management implication, advantages and applications, N.C Systems and controls, information processing and storage. Part programming languages, manual programming, machine axis system, machining centres, computer aided N.C. and adaptive control. Selection of components for NC manufacturing, tools for NC.

Text Books:

1. Groover M.P , “Automation, production System & CIMS”, Prentice Hall of India, 2nd Ed, 2002
2. Zimmers, Groover , “CAD/CAM”, Prentice Hall of India, 9th Ed.; 1998
3. Kundra, Rao, Tiwari, “ Numerical Control and Computer Aided Manufacturing”, TMH
4. Koren Yoram, “Computer Control of Manufacturing Systems”, McGrawHil, 3rd Ed, 1986

Title of Course: Reliability and Maintenance Engineering
Course Code: IE202
L-T scheme: 3-1 **Course Credit: 4**

Course Objectives:

1. To equip the graduate to plan, design, and execute effective maintenance strategy and maintenance practices in various types of industries and apply various RCM based tools to analyse and prioritise various defects.
2. To equip graduates with the state of the art condition monitoring technologies and instrumentation.
3. To equip graduates with the essentials reliability theory and engineering to enable them to develop and enhance reliability programs.
4. To understand the statistical & Reliability concepts applied in maintenance and related models.

Learning Outcomes:
After the completion of this practical course, the student will be able to:

1. Criticality of failure analysis, review of reliability. Logical diagrams of real life situations to find the reliability of the system.
2. To understand basic models of maintenance systems, including various aspects of breakdown & prevention of breakdown in respect of the maintenance and their controls.
3. To understand spares management, costing and budgeting of equipment maintenance resources planning for flaming for maintenance facilities and their implications in real scenario.
4. Cost and resources management for maintenance.

Course Contents:

Introduction to reliability and maintainability: Engineering reliability definition. reliability assurance. reliability through redundancy, maintainability, maintainability improvement. maintainability vis-à-vis Maintenance techniques and defect failure analysis: dismantling and assembling, inspection and adjustment, lubrication. maintenance cleaning, Welding. metal spraying, metal stitching, Defect recording and failure analysis. downtime analysis, breakdown analysis (FTA, FMEA).

Maintenance types/systems and Condition monitoring: planned/unplanned maintenance, breakdown, corrective. Opportunistic, routine, preventive, predictive maintenance: condition based maintenance system, design-out maintenance, selection of maintenance system, online/offline monitoring, visual, temperature, leakage, vibration, monitoring. ferrography, spectography, cracks, corrosion, noise/sound, smell/odour monitoring. condition monitoring of lutes and hydraulic systems and cross country pipe lines. Maintenance planning and scheduling: job planning. job manuals, long term and short term plans, overhauls and renovation. corporate turn around planning

Reliability in design and manufacture: Design analysis methods, QFD, LSA, FMECA, HAZOPS, part, materials and process (PMP) review. Production Failure Analysis and Corrective Action System (FRACAS). software reliability and analysis methods. reliability management and quality management- approaches.

Text Books:

1. Srivastava S K, “Industrial Maintenance Management”, S. Chand, 1998
2. L.S. Srinath , “Reliability Engineering”, Affilated East-West Press , 4th Edition 2005
3. Higgins L.T. , “Maintenance engineering hand book”, Mc. Graw Hill Inc, 1995

Title of Course: Project Evaluation and Management
Course Code: IE203
L-T scheme: 3-1 **Course Credit: 4**

Course Objectives:

1. To work effectively and professionally in a team while executing a project.
2. To design the methodology to be followed for the project.
3. To prepare a proper proper project charter.
4. To plan & Schedule the Project activity.

Learning Outcomes:
After the completion of this practical course, the student will be able to:

1. Students will be able evaluate Project performance.
2. Students will be able to prepare project audit report.
3. Students will be Demonstak the ability to understand to use of human resources, contract project team.
4. Students will be able to plan & Schedule the Project activity.

Course Contents:

Introduction : Concepts of Project Management, Project Management Life Cycle

Establishing the Project: Scope, Time, Cost and Performance Goals, Organizing Human Resources and Contracting, Organizing systems and Procedures for Project implementation, Project Direction, Coordination and Control, Project Evaluation, Benefits of Project evaluation, Limitations of Project evaluation, Methods of Project evaluation.

Project Management Performance : Management Information System, Project Management Tools.

Text Books:

1. Project Management: David Cleland, Lewis Ireland, Tata McGraw Hill
2. Project Management: S. Chaudhary, Tata McGraw Hill
3. Guide to Project Management: Harold Kerzner, Tata McGraw Hill.
4. Project Management: Jack Gido, James Clements, Cengage Learning

Title of Course: Computer Integrated Manufacturing Systems
Course Code: IE204
L-T Scheme: 3-1 **Course Credits: 4**

Course Objectives:

1. To develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.
2. To Obtain an overview of computer technologies including computers, database and data collection, networks, machine control, etc, as they apply to factory management and factory floor operations.
3. To Describe the integration of manufacturing activities into a complete system
4. Acquire sensitivity to human-factors related issues as they affect decision making in the factory environment.

Learning Outcomes:
After the completion of this practical course, the student will be able to:

1. Use commercial CAD/CAM software to process product models
2. Demonstrate the knowledge of the operation of CNC machines.
3. Analyze and evaluate layouts of automated industrial/manufacturing systems.
4. Define Computer Integrated Manufacturing (CIM) and describe its main features.
5. Demonstrate an awareness of personal and process safety practices and procedures.

Course Contents:

Evolving manufacturing environment, New competitive challenges, Evolving Role of Information Technology, CIM Systems: Flexibility, Integration and Automation Opportunities, Automation of information and manufacturing systems, Automation strategies, Towards Flexible Automation, Islands of automation, Evolution Towards CIM systems, Computer based integration between various functions - manufacturing, sales, design, materials etc Flexible Manufacturing Systems (FMS) as mini CIM, Computer Integrated Production Management, ERP, Group technology, Concurrent Engineering, Simulation and AI in CIM systems, CIM and beyond.

Text Books:

1. Goldratt, Eliyahu M. (1992) **The Goal**. North River Press.
2. Groover, Mikell P. (2007). **Automation, Production Systems, and C.I.M**. Prentice-Hall: Englewood Cliffs, N.J.
3. Computer Integrated Manufacturing System- Y. Koren, McGraw-Hill.

Title of Course: Computer-Aided Manufacturing Lab
Course Code: IE291
L-T-P Scheme: 4-0-0 **Course Credits: 2**

Introduction:
Computer-aided technologies is the use of computer technology to aid in the design, analysis, and manufacture of products.

Advanced CAx tools merge many different aspects of the product lifecycle management (PLM), including design, finite element analysis (FEA), manufacturing, production planning, and product.

Objective:
The CAD/CAM Lab is located in 119 and is available for the development of designs utilizing both 2D and 3D Software. The lab is available to graduate students in the Department of Mechanical Engineering. Student technicians are available 30 hours each week to assist in the Computer Aided Design (CAD) package has three components: a) Design, b) Analysis, c) Visualization. Specially trained graduate students with a strong understanding of the Computer-aided design (CAD) is the use of computer systems to assist in the creation, modification, analysis, or optimization of a design and Computer-aided manufacturing (CAM) is the use of computer systems to plan, manage, and control the operations of a manufacturing plant through direct or indirect computer interface with plant's resources.

CAD/CAM LAB Equipment & Software's:
- Ansys 12.1
- Pro Engineering Wildfire 5.0
- CATIA V5
- Auto CAD 2011
- LCD Mounting Projector
- HP Printer 1020, 1008 Epson 2090 .

M.Tech Industrial Engineering 2nd year (3rd semester)

Title of Course: Flexible Manufacturing System & Robotics
Course Code: IE301
L-T Scheme: 3-1 **Course Credits: 4**

Course Objectives:

1. To develop an understanding of Flexible Manufacturing System (FMS) and its impact on productivity, product cost, and quality.
2. To obtain an overview of FMS, Automation and Robotics as they apply to factory management and factory floor operations.
3. To describe the integration of robotics and manufacturing activities into a complete system
4. Acquire sensitivity to human-factors related issues as they affect decision making in the factory environment.

Learning Outcomes:
After the completion of this practical course, the student will be able to:

1. Will be able to understand concept of FMS, group technology & Cellular Manufacturing.
2. Know the component of FMS, AGV
3. Kinematics & Dynamics involved in Robotics.
4. Application of Robotics in helical hanging Welding, Painting.

Course Contents:

Introduction to Automation Flexible Manufacturing, Manufacturing Integration Model, Inventory's Relation to Integration Effect.

Flexible Manufacturing Strategy, Manufacturing Cells, Group Technology & Cellular Manufacturing, Components of Flexible Manufacturing, Pallets and Fixtures, Machining Centers.

Inspection Equipment, Material Handling Stations, Storage System, In-process Storage system, Manually Operated Stations, Allied Operation Centers, AGV, Robotics Configuration, Introduction to Kinematics & Dynamics, Drives, Control, Sensors and Gripers, Robotic Work cells.
Applications of Robotics in handling, Welding, Painting, Assembly, Machining and other areas, Selection of Robots.

Text Books:

1. Robotics Technology & Flexible Automation: S. R. Deb (Tata McGrawHill)
2. Automation, Production System, and CIM: M. P. Groover (Pearson Education)
3. Computer Control of Manufacturing System: Yoram Koren (McGrawHill)

Title of Course: Total Quality Management
Course Code: IE302
L-T Scheme: 3-1 **Course Credits: 4**

Course Objectives:

1. To explain the students about the basics and practical significance of quality management.
2. To enable students to apply mathematical approaches to solve quality and industrial engineering problems
3. To train students with various philosophies given by quality gurus for solving quality and industrial engineering problems
4. To enable students for higher studies and research.

Learning Outcomes:
After the completion of this practical course, the student will be able to:

1. Make quality control charts for predicting loss of process control.
2. Make use of statistical tools for minimizing inspection in acceptance control.
3. Design quality management and assurance systems.
4. Predict and evaluate reliability of the products.
5. Develop skills to increase quality and reliability of manufactured product.

Course Contents:

Introduction to TQM : Quality Assurance, Quality Design and Development, Total Quality Control, Cost of Quality, Total Quality Culture, TQM and Team Work, ISO 9000 Series of standards, Special requirements for Implementation of ISO in Organization.
Quality Management, Reliability as Quality Characteristic, Failure analysis, Redundancy, System Reliability, Auditing Quality System, Concepts in Quality repay, Total Safety system for TQM, Quality Circles, Use of control charts, Inspection and Measurement, TAGUCHI loss function.
System approach to TQ culture, Acceptance Sampling methods- single, multiple and sequential plans, Quality Control Tools for Quality improvement, Quality system-KAIZEN, Quality circles, Statistical Quality Control and its tools, Problem Solving methodology for quality improvement, Terotechnology and product Quality, TQM implementation.

Text Books:

1. TQM. And IS014000: Dr. K. Arora
2. Essentials of TQM / More house: Debra L
3. Engineered Quality in Construction, partnering & TQM - Singapore: McGraw Hill, 1994