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<th>Course No</th>
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<td>13.708</td>
<td>Quality Control and Non Destructive Testing Lab (N)</td>
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**13.706 Elective III**

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<tr>
<th>Course No</th>
<th>Name of subject</th>
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<tr>
<td>13.706.1</td>
<td>Entrepreneurship Development (N)</td>
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<td>13.706.2</td>
<td>Total Productive Maintenance (N)</td>
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<td>13.706.3</td>
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<td>13.706.4</td>
<td>Customer Relationship Management (N)</td>
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<tr>
<td>13.706.5</td>
<td>Non Destructive Testing Techniques (N)</td>
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<tr>
<td>13.706.6</td>
<td>Value Engineering and Analysis (N)</td>
</tr>
</tbody>
</table>
13.701 HEURISTICS FOR DECISION MAKING (N)

Teaching Scheme: 3(L)-1(T)-0(P)  
Credits: 4

Course Objectives:

- To introduce the students to various metaheuristic solution algorithms.
- To demonstrate the applications of these algorithms for solving large real life problems.

Module – I


Module – II


Module – III

Concentration vs Tabu search. Simulated Annealing, Main Components of Simulated Annealing, Homogenous vs. Inhomogenous Simulated Annealing, Annealing Schedules, Applications in sequencing and scheduling, travelling salesman problem etc. Variants of Simulated Annealing.

**Module – IV**

Artificial Neural Networks- Biological and Artificial Neural Networks, Basic Concepts, Generic Algorithm, Application Areas, Application of ANN to solve TSP, Knapsack Problems etc. Constraint Programming- Problem Formulation in Constraint Programming, Basic Search and Constraint Propagation, Constraint Programming vs Mathematical Programming, Application of Constraint Programming in Bin Packing, Scheduling, Sequencing, Facility Location problems etc. Use of Metaheuristics in Constraint Programming.

**References:**

7. Fred Glover, Tabu Search.
11. Maurice Clerk, *Particle Swarm Optimization*, ISTE Ltd.

**Internal Continuous Assessment Pattern:** *(Maximum Marks: 50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 3) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 3 hours  Maximum Total Marks: 100

The question paper shall consist of 2 parts.
Part A (20 marks) - Five short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

Course outcome:

After completion of this programme, the students will have knowledge of various metaheuristic solution algorithms and applications of the same. They will have the skill to model real life problems and to select and apply proper heuristic techniques to solve them.
13.702 SYSTEM ANALYSIS AND DESIGN (N)

Teaching Scheme: 3(L)-1(T)-0(P)  
Credits: 4

Course Objectives:

- To study the tools for modeling dynamic systems.
- To evolve mathematical model and conduct dynamic analysis of real world systems.
- To validate and optimize the system dynamic models.

Module – I


Module – II

Analytical approach to behavior of linear low-order systems - First order positive and negative feedback systems, Pure second order positive and negative feedback systems. Introduction to complex feedback systems. Structure and Behavior of Dynamic systems: - fundamental modes of dynamic behavior – Exponential growth, goal seeking, oscillation and process point – interactions of fundamental modes.

Module – III


Module – IV

References:


**Internal Continuous Assessment: (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern: (Maximum Marks: 100)**

Examination duration: 3 hours                Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

**Course outcome:**

After the completion of this course, students will apply system dynamic modeling concepts on various engineering and business scenarios. They will be in a position to follow a step-by-step approach towards modeling real world systems.
13.703 RELIABILITY ENGINEERING (N)

Teaching Scheme: 2(L)-1(T)-0(P)  
Credits: 3

Course Objectives:

- To stress the importance of reliability engineering.
- To know the application of reliability while designing a product.
- To understand the evaluation methods of reliability, maintainability and availability.

Module – I


Module – II

Redundancy Techniques in System design: Component vs Unit redundancy, Weakest-link Technique, Mixed redundancy, Standby redundancy, Redundancy optimization, Double failures and Redundancy. Markov analysis, load sharing systems, standby system, degraded systems, three state devices, covariate models.

Module – III

Reliability design process, system effectiveness, economic analysis and life cycle cost, reliability allocation, optimal, Arinc, Agree methods. Fault Tree Analysis, Tie-set and Cut-set methods, Use of Boolean Algebra in reliability analysis.

Module – IV

Maintainability and Availability: Definitions and basic concepts, Relationship between reliability, availability and maintainability, Inherent availability, Achieved availability, Operational availability, Repairable systems, Markovian models. Reliability Allocation: for series system.

References:

6. Duffuaa, Planning and control of Maintenance Systems- modeling and analysis, John Willey & Sons.
10. Govil A. K., Reliability Engineering-
11. Rowland Caplan, A practical approach to Reliability-

Internal Continuous Assessment (Maximum Marks-50)
50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern: (Maximum Marks: 100)
Examination duration: 3 hours Maximum Total Marks: 100
The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

Course outcome:
After completion of this programme, students acquire the knowledge of fundamentals of Reliability engineering, failure modes and causes, Understand the evaluations of reliability models, MTTF, Markov model and its applications, Understand the series, parallel models, multi-state devices, redundancy techniques, quantification of maintainability and availability.
13.704 QUALITY ENGINEERING (N)

Teaching Scheme: 3(L)-1(T)-0(P)  
Credits: 4

Course Objectives:

- Should develop knowledge on theories, tools and practices in quality engineering.
- Should be able to construct, use and interpret the various control charts for solution of problems in the area of quality.
- Should acquire knowledge on acceptance sampling plans and able to use them in sampling inspection.
- Should be able to use the advanced tools in quality engineering for quality improvement.

Module – I

Philosophies of Deming, Juran and Crosby etc., Quality objectives – Quality of design, Quality of conformance, Quality of performance, Quality function, Quality control – Quality Assurance – Quality value and engineering-Quality systems- Cost of quality, Quality engineering in product design - quality engineering in design of production processes - quality engineering in production - quality engineering in service.


Module – II

Statistical process control, systematic approach, process variability. Process control and Control Charts for variables and attributes. CUSUM and Exponentially Weighted Moving Average (EWMA) Control charts.


Module – III

Acceptance sampling plans – single, double, multiple and sequential - for attributes and variables. OC curves- for single and double sampling plans. Evaluating sampling plans - AOQ, ATI and ASN. minimum inspection per lot, formulation of inspection lots and selection of samples, Standard sampling plans - MIL-STD 105E sampling method and its equivalents, Dodge - Romig tables and ABC standards, AOQL and LTPD plans.
Module – IV


References:

1. Amitava Mithra, Fundamentals of Quality Control and Improvement, Pearson Education.
2. Grant, Statistical Quality Control, McGraw Hill.

Internal Continuous Assessment Pattern: (Maximum Marks: 50)

50% - Tests (minimum 2)
30% - Assignments (minimum 3) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours                Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.
Note: If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

Course outcome:

After the course the student will be able to

- Understand various statistical theories, tools and practices in quality engineering.
- Will be able to use control charts for solving quality problems.
- Acquire knowledge on acceptance sampling plans and will be able to use them in sampling inspection.
- Will be able to use advanced tools in quality engineering for quality improvement.
13.705 ENTERPRISE RESOURCE PLANNING (N)

Teaching Scheme: 3(L)-1(T)-0(P)  Credits: 4

Course Objectives:

- To introduce the students to the basics, implementation issues and business modules of ERP
- To be aware of some popular products in the area of ERP
- To appreciate the current and future trends in ERP

Module – I
Introduction to ERP and Enterprise Applications: Definition, Need, History, Enterprise Applications; ERP Implementation—Life Cycle, Methodologies; Cost and Benefit of ERP Implementation; selection of ERP consulting partner; selection of ERP package; ERP Project Management; Business Process Reengineering; Business Process Modeling and Business Modeling; ERP Training; Change Management; Application Support.

Module – II
ERP Functional Modules: Human Capital Management; Financial Management; Procurement and Inventory Management; Supplier Relationship Management; Production Planning and Execution; Supply Chain Planning; Sales and Service; Warehouse and Transport Management; Customer Relationship Management; Quality Management; Maintenance Management and Enterprise Asset Management; Product Lifecycle Management.

Module – III
Portal, Content Management and Knowledge Management; Data Warehousing, Data Mining, Business Intelligence and Analytics - Data Warehousing, Data Extraction, Transformation, Online Transaction Processing (OLTP) and Online Analytical Processing (OLAP), Data Mining, Analytics, Business Intelligence-Types, Business Performance Management, The Balanced Scorecard; ERPs for Manufacturing Industries and Service Industries; Cases of ERP and Enterprise Application, Failed ERP Implementations.

Module – IV
ERP Auditing and Risk: Key Risks and Control Issues, Audit Methodology, Audit Scope, Integrated Audit, Audit Process, Internal Control Regulation, IT Application Controls and General Controls, Program Change Controls, Information Security Controls, Computer
Operations Controls, Controls over Outsourcing Business and IT Functions, Control Objectives for Information and related Technology (COBIT), Governance, Risk, and Compliance, Roles for the Auditor. ERP and the cloud: Cloud/SaaS ERP, Benefit of Cloud-Based ERP Implementations. Overview and comparison of market leading ERP Software Packages; ERP and E-Business; Emerging trends in ERP.

References:


Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern: *(Maximum Marks: 100)*

*Examination duration: 3 hours*                              *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

Course outcome:

After completion of this programme, students will identify basic business functional areas and explain how they are related, understand how Enterprise Resource Planning software is used to optimize business processes.
13.706.1 ENTREPRENEURSHIP DEVELOPMENT (N) (Elective III)

Teaching Scheme: 3(L)-1(T)-0(P)  
Credits: 4

Course Objectives:

- To provide basics on the process of entrepreneurship.
- To make the students aware of the scope of an entrepreneur and current areas of development.
- To provide the students some basic ideas on financial assistance, taxation and tax benefits.

Module – I

Entrepreneurship: Concepts, Definition, Characteristics, Role of entrepreneurs, Growth of entrepreneurs, Environment for entrepreneurship, Entrepreneurial initiative, Entrepreneurial involvement, Entrepreneurial skills, Traditional managers vs. Entrepreneurs, Entrepreneur vs. Intrapreneurs, Qualities of an Entrepreneur, Entrepreneurial network, Entrepreneurship stimulants.

Module – II

Entrepreneurial functions, Steps to improved innovation, Elements of innovation management, Classification of entrepreneurs, Role of Information for Entrepreneurial transformation, Use of Information systems. Growth of small industries in developing countries, Role of small scale industries in the national economy, Characteristics and types of small scale industries, Government policies for small scale industries, Indian small industry sector.

Module – III


Module – IV

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern: (Maximum Marks: 100)**

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

*Note*: If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

**Course outcome:**

After the completion of this course, the student shall be able to get an idea of the entrepreneurship process and introduce them to various areas involved in new business ventures. The subject encourages students to take up new ventures in diverse fields.
13.706.2 TOTAL PRODUCTIVE MAINTENANCE (N) (Elective III)

Teaching Scheme: 3(L)-1(T)-0(P)  
Credits: 4

Course Objectives:
- Should develop knowledge on principles and practices of Total Productive Maintenance.
- Should be able to use TPM tools for effective maintenance.
- Should acquire knowledge on autonomous maintenance and its implementation.
- Should be able to use equipment improvement techniques.

Module – I
Overview of TPM implementation: TPM Basic Policy & Objectives, Maximize Equipment Effectiveness through Total Employee Involvement, Improvement, Improve Equipment Reliability, Maintainability & Productivity, Aim for Economical Life cycle costs, Enhance Equipment Expertise & skills, Create a vital, Enthusiastic work environment, Companywide TPM Goals, TPM Promotion Organization & management.

Module – II

Module – III
Equipment improvement: Equipment Improvement objectives, Promoting Successful Equipment Improvements, Four levels of Equipment Improvement Activity, Effect of Equipment Improvements. Quality maintenance (QM): Relation between Quality Assurance & QM, conceptual approach QM, preconditions for promoting QM, techniques for developing QM, implementing QM. Education and training: Education & training system, studies in general inspection, studies in PM analysis, cultivating in-house maintenance techniques, training in equipment, diagnostic techniques using vibration measurements, results of TPM education and training.

Module – IV
management, Collecting and using maintenance prevention (MP) data, product set-up procedure & daily management. Overall effects of TPM implementation: Striving for overall equipment effectiveness, defects prevention systems, relationship between TPM and tero technology.

References:

1. Nahchi-Fujikoshi Corporation, Training for TPM, Japan Institute of Plant Maintenance, 1990.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern: (Maximum Marks: 100)

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

Course outcome:

- Understand the principles and practices of TPM.
- Understand the use of TPM tools for effective maintenance.
- Acquire knowledge on autonomous maintenance and its implementation.
- Able to use equipment improvement techniques.
13.706.3 ADVANCED NUMERICAL METHODS (N) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objective:

- To develop numerical skills in the solution of mathematical equations of various scientific and engineering problems.
- To acquire knowledge in the data analysis and statistical interpretation of experimental results.
- To acquire knowledge on the various prediction methods based on the experimental data.
- To get idea on how to formulate a given physical problem in mathematical equations.
- To get knowledge on how to minimize the error growth in a particular solution procedure.

Module - I

Module - II

Module - III

Module - IV
References:

Internal Continuous Assessment Pattern: *(Maximum Marks: 50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 3) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

Course Outcomes:

After the completion of this course, students will get necessary foundation on the following:

- Various Numerical strategy and its comparisons in the solution of mathematical equations.
- How to build mathematical formulations of various physical problems.
- Statistical interpretation and data analysis of experimental results.
- How to choose a particular numerical scheme for solving a physical problem.
13.706.4 CUSTOMER RELATIONSHIP MANAGEMENT (N) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P)  Credits: 4

Course Objective:

- To learn the importance of customer relationship management and customer loyalty.
- To understand various concepts, cardinal principles, architectural and other related aspects of CRM
- To familiarize the students with overall process of building and maintaining profitable customer relationships by delivering superior customer value and satisfaction.

Module – I


Module – II


Module – III


Module – IV

Information technology application in building customer relationship – emerging new trends. Integration of CRM with ERP system. Introduction to SRM and International Marketing.

References:

1. Paul Greenberg, Customer Relationship Management at the Speed of Light.
2. Bukowitz, The Handbook of Key Customer Relationship Management, Pearson Education

**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern: (Maximum Marks: 100)**

- Examination duration: 3 hours  
  Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

**Course outcome:**

- After the completion of this programme, students are expected to have knowledge about various methods that can be effectively employed for improving customer loyalty and application of these techniques in building better customer relationship.
13.706.5 NON DESTRUCTIVE TESTING TECHNIQUES (N) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objective:

- To educate the students about the importance of inspection and testing of materials and equipments in the industrial and domestic sectors.
- This course will provide the basics of the most common methods and equipments in Non-Destructive Testing.

Module – I


Module – II


Module – III


Module – IV

References:

1. Halmshaw P., *Non-Destructive Testing*

**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern: (Maximum Marks: 100)**

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

**Course outcome:**

After completion of this course the students will be conversant in understanding the fundamentals of Non Destructive Testing. They will be capable of interpreting the results of the common NDT techniques. They will be aware of the Timely intervention of inspection/testing in industrial sectors and thereby they can avoid the premature failure of the components and save the life of the occupants.
13.706.6 VALUE ENGINEERING AND ANALYSIS (N) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objective:

- To understand the theory and fundamentals of value engineering.
- To know the methodology is to be applied for cost-improving decisions.
- To understand the use of techniques through case studies.

Module – I

Value Engineering concepts: Origin and history of value engineering, SAVE and its role, Concept of Innovation and creativity, Innovation vs Invention, Relevance of value engineering in Indian scenario, Life cycle of a product.

Module – II


Module – III

Organizing the value engineering study – different industries, Value engineering and Quality, Selection of Projects – Methods used, selecting team members.

Module – IV

Use of advanced technique like FAST (Function Analysis System Technique): FAST diagramming, How, Why and When Logic, Ground rule for FAST diagram. Case studies in value engineering and analysis.

References:


**Internal Continuous Assessment** *(Maximum Marks-50)*

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern: (Maximum Marks: 100)**

*Examination duration: 3 hours*                  *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

*Part A (20 marks)* - Ten short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

*Part B (80 Marks)* - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** If use of tables and charts are permitted for the university examination for this course, proper direction of the same should be provided on the facing sheet of the question paper.

**Course outcome:**

- Acquire the knowledge of theory and fundamentals of value engineering and analysis.
- Understand the various phases of V. E. techniques
- Understand the techniques used to evaluate the value of a product.
13.707 SYSTEM SIMULATION AND ENTERPRISE RESOURCE PLANNING LAB (N)

Teaching Scheme: 0(L) - 0(T) - 2(P)                        Credits: 2

Course Objectives:

- Understand simulation model building and simulation through software packages.
- Understand how Enterprise Resource Planning software is used to optimize business processes.
- Acquire experience in using ERP software package.

Simulation Lab:

1. Statistical distribution fitting using software package (Stat::Fit/ Excel/ EasyFit/ ExpertFit).
2. Queuing and Inventory modeling in C/C++/Java.
3. Modeling and simulation in Simio/ Arena/ AnyLogic/ Vensim (Training shall be given in at least two software packages mentioned).
4. Mini project.

Enterprise Resource Planning lab:

Students shall be given training in using at least two modules (Human Capital Management; Financial Management; Procurement and Inventory Management; Supplier Relationship Management; Production Planning and Execution; Supply Chain Planning; Sales and Service; Warehouse and Transport Management; Customer Relationship Management; Quality Management etc. in any ERP software package).

Internal Continuous Assessment (Maximum Marks-50)

40% - Test (minimum 1)
40% - Lab performance (evaluation of models, rough record, fair record etc.)
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours  Maximum Total Marks: 100
Questions based on the list of exercises prescribed.
Question paper shall be with or without different parts/sections.
The evaluation should be based on appropriate spilt of marks suitable to the question.
Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

The students who succeed this course:

- Will be able to analyze input data, fit statistical distribution and conduct experiments using simulation model.
- Will be able to use a simulation software package to develop a simulation model to analyze systems.
- Will have the knowledge of functional modules of an ERP system and will have a working knowledge of some functional modules of an ERP software package.
13.708 QUALITY CONTROL AND NON DESTRUCTIVE TESTING LAB (N)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:

- Understand the proof of central limit theorem using different populations.
- Understand the construction and purpose of variable control charts & attribute control charts.
- Understand the construction of OC curve and design of various sampling plans.
- Acquire knowledge on various non-destructive evaluation (NDE) techniques.
- Understand the working of various non-destructive testing (NDT) equipments.
- Conduct non-destructive evaluation on different test specimens using various NDT equipments.

Statistical Quality Control (SQC) Lab

For conducting statistical quality control (SQC) experiments data can be generated using implements like normal bowl, beads bowl, dotted sheet etc.

1. Experiments to verify central limit theorem using different distributions.
2. Experiments to verify central limit theorem using different distributions and Henry line.
3. Study and construction of variable control charts ($\bar{X}$ and $R$ charts) for actual measurements.
4. Study and construction of attribute control charts ($p$, $c$, $np$, $u$, $Q$ and $D$ charts) for actual counts.
5. Study and construction of CUSUM chart and standardized control chart.
6. Experiment on OC curve, double sampling plan and multiple sampling plan.
7. Experiment on construction of OC curve for $p$ chart.
8. Experiment on finished product inspection and certification procedures.
9. Experiments on performance testing and life testing.

Non Destructive Testing (NDT) lab

Study the working and conduct non destructive evaluation (NDE) on different test specimens (plates, pipe, T Joint etc.) using the following non destructive testing (NDT) equipments.

1. Dye penetration test.
2. Yoke type magnetic crack detector.
3. Portable magnetic crack detector.
4. Bench type magnetic crack detector.
5. Ultrasonic flaw detector.
7. Eddy current sorter.
8. Acoustic emission.

**Internal Continuous Assessment (Maximum Marks-50)**

- 40% - Test (minimum 1)
- 40% - Lab performance (continuous evaluation of rough record, fair record etc.)
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

Questions based on the list of exercises prescribed.

Question paper shall be with or without different parts/sections.

The evaluation should be based on appropriate split of marks suitable to the question.

Candidate shall submit the certified fair record for endorsement by the external examiner.

**Course Outcome:**

*The students who succeed this course will be able to:*

- Prove central limit theorem using different populations.
- Construct variable control charts & attribute control charts.
- Construct OC curve and design of various sampling plans.
- Understand the working of various non-destructive testing (NDT) equipments.
- Conduct non-destructive evaluation on different test specimens using various NDT equipments.
13.709 PROJECT AND PROJECT SEMINAR (MNPSU)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:

- To identify a problem for the final-year project, outline a solution, and prepare a preliminary design for the solution.
- To do a detailed study on the selected topic based on current journals or published papers and present seminars.
- To improve the ability to perform as an individual as well as a team member in completing a project work.
- The seminar based on the project provides students adequate exposure to presentations to improve their communication skills.

The student shall do a project (project phase 1) in the seventh semester, which shall be continued in the eighth semester. He/she shall submit an interim report at the end of the seventh semester and the final project report shall be submitted at the end of the eighth semester. The student shall present two seminars in the seventh semester on the work carried out during project phase 1. The first seminar should highlight the definition of problem, novelty of the project, literature survey and work plan/methodology. The second seminar should include preliminary results. The students may be assessed individually and in groups.

Internal Continuous Assessment (Maximum Marks-100)

40% - Assessment by the Guide
40% - Assessment by the Committee.
20% - Regularity in the class

Course Outcome:

At the end of the course, the students would have acquired the basic skills to perform literature survey and paper presentation. This course shall provide students better communication skills and improve their leadership quality as well as the ability to work in groups, and thus aid them in building a successful career as an engineer.