

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM**

**PROPOSED SCHEME OF TEACHING AND EXAMINATION 2012 - 2013**

**M.TECH - MANUFACTURING SCIENCE & ENGINEERING (MSE)**

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM**  
**SCHEME OF TEACHING AND EXAMINATION 2012 -2013**  
**M.TECH - MANUFACTURING SCIENCE & ENGINEERING (MSE)**

**I Semester : (18 weeks)**

| Subject Code | Name of the subject                            | Teaching hours/week |  | Duration of Exam in hrs | Marks for  |            | Total Marks |
|--------------|--|---------------------|--|-------------------------|------------|------------|-------------|
|              |  | Lecture             | Practical / Field Work / Assignment/ Tutorials |                         | I.A        | Exam.      |             |
| 12 MSE 11    | Quality & Reliability Engineering              | 4                   | 2*   | 3                       | 50         | 100        | 150         |
| 12 MSE 12    | Quantitative Techniques in Decision Making     | 4                   | 2#   | 3                       | 50         | 100        | 150         |
| 12 MSE 13    | Theory of Metal Forming                        | 4                   | 2#   | 3                       | 50         | 100        | 150         |
| 12 MSE 14    | Computer Integrated Manufacturing & Automation | 4                   | 2*   | 3                       | 50         | 100        | 150         |
| 12 MSE 15x   | Elective – I                                   | 4                   | 2  | 3                       | 50         | 100        | 150         |
| 12 MSE 16    | Seminar  | --                  | 3  | --                      | 50         | --         | 50          |
| <b>Total</b> |  | <b>20</b>           | <b>13</b>                                      | <b>15</b>               | <b>300</b> | <b>500</b> | <b>800</b>  |

| <b>Elective – I</b> |                                    |
|---------------------|------------------------------------|
| <b>Subject Code</b> | <b>Name of the subject</b>         |
| 12 MSE 151          | Applied Probability and Statistics |
| 12 MSE 152          | Composite Materials                |
| 12 MSE 153          | Theory of Metal Cutting            |
| 12 MSE 154          | Advanced Materials & Processing    |
| 12 MSE 155          | Advanced Foundry Technology        |
| 12 MSE 156          | Operations Management              |

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**II Semester: (18 weeks)**

| Subject Code | Name of the subject                             | Teaching hours/week |  | Duration of Exam in hrs | Marks for  |            | Total Marks |
|--------------|---|---------------------|--|-------------------------|------------|------------|-------------|
|              |   | Lecture             | Practical / Field Work / Assignment/ Tutorials |                         | I.A        | Exam.      |             |
| 12 MSE 21    | Industrial Robotics                             | 4                   | 2*   | 3                       | 50         | 100        | 150         |
| 12 MSE 22    | Non-Traditional Machining Processes             | 4                   | 2#   | 3                       | 50         | 100        | 150         |
| 12 MSE 23    | Simulation & Modeling of Manufacturing Systems. | 4                   | 2#   | 3                       | 50         | 100        | 150         |
| 12 MSE 24    | Finite Element Methods                          | 4                   | 2*   | 3                       | 50         | 100        | 150         |
| 12 MSE 25x   | Elective – II                                   | 4                   | 2  | 3                       | 50         | 100        | 150         |
| 12 MSE 26    | **Project Phase – I (6 weeks duration)          | -                   |  | -                       | -          | -          | -           |
| 12 MSE 27    | Seminar   | --                  | 3  | --                      | 50         | --         | 50          |
| <b>Total</b> |   | <b>20</b>           | <b>13</b>                                      | <b>15</b>               | <b>300</b> | <b>500</b> | <b>800</b>  |

| <b>Elective - II</b> |                               |
|----------------------|-------------------------------|
| Subject Code         | Name of the subject           |
| 12 MSE 251           | Non-Destructive Testing       |
| 12 MSE 252           | Surface Treatment & Finishing |
| 12 MSE 253           | Agile Manufacturing           |
| 12 MSE 254           | Advanced Joining Processes    |
| 12 MSE 255           | Product Data Management       |
| 12 MSE 256           | Lean Manufacturing Systems    |
| 12 MSE 257           | Applied Micro-Economics       |

**\*\* Between the II Semester and III semester. After availing a vacation of 2 Weeks**

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**III Semester : (22 weeks)**

| Subject Code | Name of the subject            | No. of Hrs./Week |                                     | Duration of Exam in hrs | Marks for  |            | Total Marks |
|--------------|--------------------------------|------------------|-------------------------------------|-------------------------|------------|------------|-------------|
|              |                                | Lecture          | Field Work / Assignment / Tutorials |                         | I.A        | Exam.      |             |
| 12 MSE 31    | Design of Jigs and Fixtures    | 4                | -                                   | 3                       | 50         | 100        | 150         |
| 12 MSE 32x   | Elective – III                 | 4                | 2                                   | 3                       | 50         | 100        | 150         |
| 12 MSE 33x   | Elective – IV                  | 4                | 2                                   | 3                       | 50         | 100        | 150         |
| 12 MSE 34    | Project Phase-II               | -                | \$                                  | -                       | -          | -          | -           |
| 12 MSE 35    | Evaluation of project phase -I | -                | 3                                   | -                       | 50         | -          | 50          |
| <b>Total</b> |                                | <b>12</b>        | <b>07</b>                           | <b>09</b>               | <b>200</b> | <b>300</b> | <b>500</b>  |

| Elective – III |                                | Elective - IV |                                      |
|----------------|--------------------------------|---------------|--------------------------------------|
| Subject Code   | Name of the subject            | Subject Code  | Name of the subject                  |
| 12 MSE 321     | Industrial Design & Ergonomics | 12 MSE 331    | Advanced Manufacturing Practices     |
| 12 MSE 322     | Human Resource Management      | 12 MSE 332    | Smart Materials & Structures         |
| 12MSE 323      | Advanced Fluid Power Systems   | 12 MSE 333    | Modern Trends in Management          |
| 12 MSE 324     | Project Management             | 12 MSE 334    | Maintenance Engineering & Management |
| 12 MSE 325     | Nano Technology                | 12 MSE 335    | Financial Management                 |

\$3 Days Course work and 3 days for Project work

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**IV Semester : (22 weeks)**

| Subject Code                                   | Name of the subject                 | No. of hrs /week |                          | Duration of Exam in hrs | Marks for  |              | Total Marks |
|--|-------------------------------------|------------------|--------------------------|-------------------------|------------|--------------|-------------|
|  |                                     | Lecture          | Practical/<br>Field work |                         | IA         | Exam.        |             |
| 12 MSE 41                                      | Seminar on Project Phase-II         | -                | -                        | -                       | 50         | -            | 50          |
| 12 MSE 42                                      | Seminar on Project Phase – III      | -                | -                        | -                       | 50         | -            | 50          |
| 12 MSE 43                                      | Project work Evaluation & Viva Voce | -                | -                        | 3                       |            | 100 +<br>100 | 200         |
| <b>Total</b>                                   |                                     | -                | -                        | <b>03</b>               | <b>100</b> | <b>200</b>   | <b>300</b>  |
| <b>Grand Total ( I to IV Semester ) = 2400</b> |                                     |                  |                          |                         |            |              |             |

**Note:** Project work shall be continuously evaluated for phase I, phase II and after completion of the project.

**Note :**

- \* Lab Classes for any two core subjects are compulsory (practical will be evaluated for 20 marks and internal assessment for 30 marks. Lab journals should be maintained).
- # For the remaining two core subjects, it can be field work, assignment, tutorials.
- 1) Project Phase – I : 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalise the topic of dissertation. Evaluation of the same shall be taken up during beginning of III Semester. Total Marks shall be 50. Colleges have to send the synopsis after Phase – I.
- 2) Project Phase – II : 16 weeks duration. 3 days for project work in a week during III Semester. Evaluation shall be taken during the first two weeks of the IV Semester. Total Marks shall be 50.
- 3) Project Phase – III : 24 weeks duration in IV Semester. Evaluation shall be taken up during the middle of IV Semester. Total Marks shall be 50. At the end of the Semester Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be  $50 + 50 + 100 = 200$  (50 marks for guide, 50 marks for external and 100 for viva-voce).

Marks of Evaluation of Project:

- The Marks of Project Phase – I shall be sent to the University along with III Semester I.A. Marks of other subjects.
- The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- 4) During the final viva, students have to submit all the reports.
- 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
  - a) Head of the Department (Chairman)
  - b) Guide
  - c) Two Examiners appointed by the university. (out of two external examiners at least one should be present).

# FINAL SYLLABUS

## FIRST SEMESTER

### QUALITY AND RELIABILITY ENGINEERING

(Common to 12 MSE 11 / 12 MPT 11 / 12 MPE 11 / 12 MPY 11)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE 11 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Basic Concepts:** Definitions of quality and Reliability, Parameters and Characteristics, Quality control, statistical Quality Control, Reliability concepts.

**Concepts in Probability and Statistics :** Events, Sample Space, Probability rules, Conditional probability, Dependent and Independent Events, Application of Probability concepts in Quality Control, Problems.

**Statistical Aspects and Probability Distributions :** Statistical Tools in Quality Control, The concept of Variation, Graphical Tools for data representation and analysis, Discrete and Continuous Distributions, Normal, Poisson, Binomial, Weibull Distribution, Problems, Control charts, Variable charts X chart, R chart,  $\sigma$  chart, Attribute charts, – P chart, NP chart, C chart.

**Failure Data Analysis :** Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis.

**Acceptance Sampling:** Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL, LTPD, AOQL.

**System Reliability :** Series, parallel and mixed configuration, Block diagram concept, r- out-of-n structure solving problems using mathematical models.

**Reliability Improvement and Allocation :** Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems.

**Maintainability and Availability:** Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems

### **Laboratory**

1. Testing the goodness of fit for the given quality characteristic of component using normal distribution.
2. Testing the goodness of fit for the given quality characteristic using Poisson distribution.
3. Testing the goodness of fit for the given quality characteristic using Binomial distribution.
4. Testing the goodness of fit for the given quality characteristic using Uniform distribution.
5. Application of 7 QC tools as applied to manufacturing and service operations.
6. Assessment of process capability of the given manufacturing process using normal probability paper method.
7. Assessment of process capability of the given manufacturing process using process capability indices.
8. Assessment of process capability of the given manufacturing process using Digital motorized multifunctional height gauge.
9. Construction of control chart for variable quality characteristic using Digital motorized multifunctional height gauge.
10. Construction of control chart for variable quality characteristic using SQC display unit?
11. Construction of control chart for variable quality characteristic using SQC software.
12. Construction of control chart for attribute quality characteristic using SYSTAT statistical software package.
13. Determination of producer's risk and consumer's risk using single and double sampling plans.
14. Conduction of Repeatability and Reproducibility studies for appraiser and instrument using R & R software.
15. Process Mapping – Input and output Models



## REFERENCE BOOKS:

1. **The Assurances Sciences** - Halpern, Seigmund - Prentice Hall International, New Jersey, U.S.A - 1978.
2. **Quality Planning and Analysis** - Juran, J.M and Gryna, F.M. - Tata McGraw Hill publishing Coimpany Ltd., New Delhi, India – 1982.
3. **Logistics Engineering and Management** - Blanchard, Bejamin S. - Prentice Hall International, New Jersey, U.S.A – 1986.
4. **Maintainability and Reliability Handbook of Reliability Engineering and Management** - Kraus, John W - Editors – Ireson. W.G. and Cooms, C.F. - McGraw Hill Book Company Inc. U.S.A – 1988.
5. **Concepts in Reliability Engineering** - Srinathm K.S. - Affiliated East-West Press Private Limited, New Delhi, India -1985.

## QUANTITATIVE TECHNIQUES IN DECISION MAKING

(Common to 12 MSE 12 / 12 MPT 12 / 12 MPE 12 / 12 MPY 12)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE 12 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Introduction:** Statistics and managerial decisions, statistical data and Operations Research techniques.

**Fundamentals of Statistics, probability and probability distributions:** Measures of central tendency and location, Measure of dispersion, skewness and kurtosis, Probability and rules of probability, Random variables and probability distributions - Binomial, Poisson, Hyper geometric and Normal.

**Decision Making under Uncertainty:** Alternative criteria for decision under uncertainty, Bayesian approach and Incremental analysis.

**Linear Programming Problem:** Formulation of L.P.P., Solution of L.P.P. by graphical method, Solution of L.P.P. by simplex method, Concept of duality and solution of dual problems, Solution of L.P.P. by dual simplex method and Sensitivity analysis.

**Transportation and Assignment Problems:** Structure of transportation problem and various methods to find LB.F.S., Optimality test of transportation problems by MODI method, Solution of degeneracy and unbalanced transportation problems, Assignment problems and solution by

Hungarian method and Traveling Salesman problem.

**Theory of Games:** Two person zero sum game, Minimax & maximin strategies, Solution of game by dominance rules, arithmetic and algebraic methods, Solution of game by graphical method and method of matrices, Solution of game by Linear programming approach and approximate method to solve game problems.

**Network Analysis:** PERT and CPM, Network construction and determination of critical path, Calculation of ES, EF, LS, LF, TF, FF and IF, Crashing of a project, Scheduling of a project and resource leveling.

**Waiting Line:** Basic structure of queuing systems and characteristics, Expressions for M/M/1 queuing model.

**Simulation of Management Systems:** Simulation and Monte Carlo method, Waiting line and inventory simulation models

#### REFERENCE BOOKS:

1. **Quantitative Techniques for Managerial Decisions** - Srivastava U.K. - New Age International Private Limited - ISBN Number: 8122401899.
2. **Operations Research** - H. Taha - Prentice Hall India – 8 Edition.
3. **Operations Research: An Introduction** - Gupta and Heera - S.Chand and Company - 2002
4. **Introduction to Operations Research** - Hillier and Liberman - McGraw Hill International. - ISBN 10: 0072321695

#### THEORY OF METAL FORMING

(Common to 12 MSE 13 / 12 MPT 13 / 12 MPE 13 / 12 MPY 13)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE 13 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Introduction to Forming Process:** Introduction to metal forming, Effect of temperature on forming process-hot working, cold working. Effect of Metallurgical structure, Effect of speed of deformation work of Plastic deformation, Friction in forming operation

**Forging:** Classification, various stages during forging, Forging equipment, brief description, deformation in compression, forging defects. Residual

stresses in forging.

**Rolling of Metals:** Classification, forces and geometrical relationships in rolling.

**Variables in Rolling:** Deformation in rolling, Defects in rolled products, Residual stresses in rolled products. Torque and Horsepower.

**Extrusion:** Classification, Extrusion equipment, variables in extrusion, Deformation in extrusion, Extrusion defects, Work done in extrusion.

**Drawing:** Principles of Rod and wire drawing, variables in wire drawing, Residual stresses in rod, wire and tube drawing, Defects in Rod and wire drawing.

**Sheet Metal Forming:** Introduction, Forming methods, shearing and Blanking, Bending, stretch forming, Deep drawing, redrawing operations, Defects in formed products.

#### REFERENCE BOOKS:

1. **Mechanical Metallurgy** - Dieter G.E. - Mc Graw Hill Publications.
2. **Principles of Metal Working** - R.Rowe - Arnold London – 1965.
3. **Metals Handbook** – ASM - Volume II -.ASM
4. **Fundamentals of working of Metals** - Sach G. - Pergamon Press.

#### COMPUTER INTEGRATED MANUFACTURING AND AUTOMATION

(Common to 12 MSE 14 / 12 MPT 14 / 12 MPE 14/ 12 MPY14)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE 14 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Production Development Through CIM:** Computers in Industrial manufacturing, Product cycle & Production development cycle, Introduction of CAD/CAM & CIM, sequential and concurrent engineering, soft and hard prototyping.

**Computer Process Monitoring:** Process control methods, direct digital control, supervisory computer control, steady state optimal control, on line search strategies, adaptive control.

**Computer Aided Quality Control:** The computer in Q.C, automated inspection principles and methods, Contact inspection methods, non-contact inspection methods, machine vision system, optical inspection method, sensors, coordinate, measuring machine, Computer-Aided testing, Integration of CAQL with CAD/CAM.

**Computer Integrated Manufacturing:** Fundamentals of CAD/CAM, Computerized Manufacturing planning systems, shop floor control & automatic identification techniques. Computer Network for manufacturing and the future automated factor.

**Detroit Type of Automation:** Flow lines, Transfer Mechanisms, work pattern transfer, Different methods, & Problems.

**Analysis of Automated Flow Lines:** Analysis of transfer lines without storage with storage buffer single stage, Double stage, Multistage with problems, Automated assembly systems, Design for automated assembly, parts feeding devices, analysis of Multi station assembly machine, Analysis of Single stage assembly machine,

**Automated Material Handling Storage:** Material functions, types of material handling equipment, analysis of material handling systems, design of system, conveyor system, automated guided vehicle systems, automated storage/retrieval systems, caroused storage systems work in process storage, interfacing handling & storage with manufacturing.

#### **Laboratory Exercises**

1. To become familiar with the use of a kinematics graphics simulator in order to perform robot motion and programming .
2. To use trajectory planning concepts on the model of a single-link robotic manipulator.
3. To familiarize students with the use of a vision system
4. Simulation of Cutting/Milling operations on a computer using CAM packages.
5. To simulate a manufacturing system using discrete-event simulation techniques. To enable students to have a Systems-Wide View of manufacturing systems. A 3-D graphics manufacturing-oriented simulation software on a PC-type computer should be used. A

simple manufacturing system is modelled first and the effects of local changes examined.. Then, students make changes to the manufacturing system in order to increase throughput, reduce in-process inventories, and so on. The effects of resource failure and repair times are also examined.

#### REFERENCE BOOKS:

1. **CAD/CAM** - Zimmers & Grover – PHI.
2. **CAD/CAM/CIM** - P.Radhakrishna - New Age International - 2<sup>nd</sup> edition.
3. **Automation, Production systems & Computer Aided Manufacturing** - M.P. Grover - Prentice Hall - 1984.
4. **CAD/CAM** - Zeid – Mc-Graw Hill - 2005.
5. **CAD/CAM** - P.N.Rao - TMH.- 2<sup>nd</sup> edition, 2004.
6. **Robotics for Engineering** - Koren.Y - Mc-Graw Hill - 1985.
7. **Robot Vision & Sensory Controls** - Rooks B. - North Holland. - (ed) vol-3

#### ELECTIVE – I

##### APPLIED PROBABILITY AND STATISTICS

(Common to 12 MSE 151 /12 MPT 151 / 12 MPE 151 / 12 MPY 151)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 151 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Introduction to Statistics:** Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display.

**Discrete Random Variables and Probability Distribution:** Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, discrete uniform distribution, Binomial distribution, Hyper Geometric distribution, Poisson distribution, Applications.

**Continuous Random Variables and Probability Distributions:** Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution,

Normal approximation to Binominal and Poisson distribution, Exponential distribution.

**Testing of Hypothesis:** Estimation theory, Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion, Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions.

**Simple Linear Regressions and Correlation:** Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Transformation to a straight line, Correlation. Multiple linear regressions model, least square estimation of parameters, Matrix approach to multiple linear regression, properties of least square estimators and estimation of variance.

Introduction to DOE: Completely Randomised Block Design (CBD) and Randomised Block Design(RBD)

#### **REFERENCE BOOKS:**

1. **Applied statistics and Probability for Engineers** – Douglas C Montgomery, George C Runger, 2<sup>nd</sup> Edn, John Wiley and Sons, ISBN-0-471-17027-5, 1999.
2. **Statistics for Management** - Richard I Levin, David S Rubin, 6<sup>th</sup> Edn, Prentice Hall India, ISBN-81-203-0893-X.
3. **Probability and Statistics in Engineering** - William W Hines, Douglas C Montgomery - John Wiley and Sons - 2<sup>nd</sup> Edn,.
4. **Business Statistics for Management and Economics** - Daniel, Terrell - Houghton Mifflin Company - 6<sup>th</sup> Edn, ISBN-0-395-62835-
5. **Probability and Statistics** - by Walpole & Mayer - MacMillan Publishing Company - 1989.

## COMPOSITE MATERIALS

(Common to 12 MSE 152 /12 MPT 152 / 12 MPE 152 / 12 MPY 152)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 152 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Introduction to Composite Materials:** Definition, Classification, Types of matrices & reinforcements, characteristics & selection, Fiber reinforced composites, laminated composites, particulate composites, prepegs, sandwich construction.

**Micro Mechanical Analysis of a Lamina:** Introduction, Evaluation of the four elastic moduli – Rule of mixture, Macro mechanics of a lamina: Hooke's law for different types of materials, number of elastic constants, Laminate code, Failure criterion.

**Manufacturing: Lay up and Curing of Polymer Composites** – open and closed mould processing – Hand lay up techniques Bag moulding and filament winding. Pultrusion, Pulforming, Thermoforming, Injection moulding, Cutting, Machining and joining, tooling, Quality assurance Introduction, material qualification, types of defects, NDT methods.

**Fabrication of Polymer Composites:** Cutting, machining, drilling, mechanical fasteners & adhesive bonding joining computer aided design manufacturing tooling fabrication equipment

**Design of Fibre Reinforced Polymer Composite Structures:** Introduction, Composite structural design, Design criteria, Laminate design, Mathematical analysis of the laminate, Design of composite stiffeners.

**Metal Matrix Composites:** Re-enforcement materials, types, Characteristics & Selection, base metals-selection, applications. Powder metallurgy technique, liquid metallurgy technique

**Application Developments** – Aircrafts, missiles, space hardware, automobile, electrical and electronics, marine, recreational and sports equipment-future potential of composites.

## REFERENCE BOOKS:

1. **Composite Materials Handbook** - Mein Schwartz - Mc Graw Hill Book Company - 1984.
2. **Mechanics of Composite Materials** - Autar K.Kaw - CRC Press New York - 1<sup>st</sup> edi, 1997.

### THEORY OF METAL CUTTING

Common to 12 MSE 153 / 12 MPT 153 / 12 MPE 153 / 12 MPY 153

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 153 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Mechanics of Metal Cutting:** Mechanism of chip formation, Orthogonal & Oblique cutting, types of chips, built-up edge, Determination of shear plane angle, forces on the chips, forces in orthogonal cutting, Merchant circle diagram and analysis, Theory of Lee & Shaffer, co-efficient of friction, power & energy relationship, velocity relationship, shear-strain, factors affecting forces and power, problems.

**Geometry of Cutting Tools:** Single point and multi point cutting tools, tools nomenclature, tool point reference systems, tool angle specifications –ISO and ASA systems, conversion from one system to another. Recommended tool angles, Effect of cutting parameters on tool geometry.

**Tool Materials and Their Properties:** Characteristics of tool materials, types of tool materials – carbon tool steels, high speed steels, cast alloys, cemented carbides, ceramics, diamonds, SIALON, CBN, UCON, recommended cutting speeds for the above tools, discussion on steels,air, water, oil hardening of tools and their applications.

**Measurement of Cutting Forces:** Reasons for measuring cutting forces, Classification of cutting force dynamometers – mechanical, hydraulic, pneumatic, optical, inductance, piezoelectric, and strain gage type dynamometers, Dynamometers for lathe, drilling, and milling, Calibration of dynamometers.

**Tool Wear, Tool Life:** Mechanisms of tool wear, Sudden & gradual wear, crater wear, flank wear, tool failure criteria, tool life equations, effect of process parameters on tool life, tool life tests, conventional & accelerated tool wear measurement, machinability index



**Thermal Aspects in Metal Cutting:** Heat sources in metal cutting, temperature in chip formation, temperature distribution, experimental determination of tool temperatures.

**Cutting Fluids:** Basic actions of cutting fluids, properties of cutting fluids, selection of cutting fluids, application of cutting fluids, filtration of fluids, recommended cutting fluids.

**Economics of Machining:** Introduction, elements of total production cost, optimum cutting speed and tool life for minimum cost, optimum cutting speed and tool life for maximum production, problems.

#### REFERENCE BOOKS

1. **Metal Cutting Principles** - M.C. Shaw - Oxford Publication – 1985.
2. **Fundamentals of Metal Cutting & Machine Tools** - by B.L.Juneja & G.S – Sekhar - Wiley Eastern.
3. **Metal Cutting** - V.C.Venkatesh & S.Chandrasekhanan - Pantice Hall – 1991.
4. **Metal Cutting** - Dr. B.J.Ranganath -Vikas Publications

#### ADVANCED MATERIALS AND PROCESSING

(Common to 12 MSE 154 / 12 MPT 154 / 12 MPE 154 / 12 MPY 154)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 154 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Classification and Characteristics:** Metals, Ceramics, Polymers and composites.

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

**Ferrous Alloys:** iron carbon equilibrium diagrams - Steels and cast irons - properties, structure, composition and applications transformation hardening

in steels - TTT diagrams - Heat treatment processes - Effect of alloying elements - High alloy steels, Stainless steel types, tool Steels, Manganese steels, heat resistant steels, HSLA, Maraging steels.

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

**Polymers and Polymerizations:** Structure and properties of thermoplastics and thermo sets – Engineering Applications - property modifications - Mechanical and thermal behavior – processing methods.

**Ceramics :** Nature and structure of Ceramics - Refractory Abrasives glasses - glass ceramics - Advanced ceramics processing methods.

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

**Processing of Polymers:** composites, ceramics - thermal spraying - Ion beam machining diamond coating techniques-tribological Applications.

#### **REFERENCE BOOKS:**

1. **Engineering Metallurgy** - Raymond and Higgins - ELBS/EA
2. **Introduction to Material Science and Engineering** - James.F.Shackelford - Mc Millan, NY - 7<sup>th</sup> edition.
3. **Powder Metallurgy-Metals Hand Book** -ASM, USA - Vol.7, 1974.
4. **Composite Materials - Science and Engineering** - Chawla K.K. , - Springer - Verlag, Newyork - 2<sup>nd</sup> edition, 1998.
5. **Cast Metal Matrix Composites** ASM Metals Hand Book - P.K. Rohagti - VI5.
6. **Elements of Material Science and Engineering** - Van Vlack L.H. - Addison Wesley, NY - 1989.

**ADVANCED FOUNDRY TECHNOLOGY**  
(Common to 12 MSE 155 / 12 MPT 155/ 12 MPE 155 /12 MPY 155)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 155 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Solidification of Casting:** Concept of solidification of metals. Homogenous and heterogeneous nucleation. Growth mechanism. Solidification of pure metals and alloys. Mechanism of columnar and dendritic growth. Coring or Segregation. Solidification time and Chvorinov's rule. Concept of progressive and directional solidifications.

**Principles of Gating and Riser:** Purpose of the gating system. Components of the gating System and its functions. Design of the gating System. Different types of gates. Gating ratio and its functions. Definition and functions of the riser. Types of risers and their application. Design of the riser - its shape. Size and location. Use of insulating material and exothermic compounds in risers.

**Design of Casting:** Factors to be considered in casting design. Design consideration in pattern making, moulding techniques and core making and assembly. Cooling stresses and hot spots in casting and modification in casting geometry to overcome them.

**Casting Quality Control:** Casting defects and factors responsible for them. Different inspection and testing methods to evaluate the casting. Quality control activities in a foundry. Salvaging methods of defective casting.

**Furnace Technology:** Study of various furnaces used in foundry, construction and operation of crucible and hearth furnaces. Resistance, Arc and Induction furnaces-their construction. Operation and application. Heat treatment furnaces and drying ovens used in foundry.

**Gray Cast - Iron Foundry Practice:** Chemical Composition and structure of gray cast iron. Moulding, gating and riser techniques. Melting of gray cast iron in Cupola and induction furnace. Inoculation of gray cast iron. Application of gray cast iron castings.

**Malleable Cast Iron:** Chemical composition and structure of White-heart and black-heart malleable cast iron. Melting malleabilisation heat treatment and application of malleable cast iron.

**Ductile Cast Iron:** Chemical composition and structure of ductile cast iron. Melting and spheroidisation treatment. Inoculation of 'ductile' iron Properties and application of ductile iron casting.

**Steel Casting Practice:** Common steel casting, their composition, structure and properties. Melting and refining of steel. Gating and risering of steel castings cleaning of steel castings.

**Aluminium Foundry Practice:** Composition, properties and application of common aluminum alloy casting. Melting and casting of Al-alloys. Gating and risering of Al-alloy casting.

**Copper Alloy Foundry Practice:** General characteristics of common cast copper alloys. Melting and casting of copper alloys. Gating and risering of Cu-alloy castings.

**Foundry Mechanization and Modernization:** Introduction to modernization. Mechanization of foundry and its advantages. Mechanization of sand plant, moulding and core making mechanization in melting, pouring and shakeout units. Material handling equipments and conveyor systems. Brief sketches and description of layouts of job. Captive and mechanized foundries.

#### **REFERENCE BOOKS:**

1. **Principle of Metal Casting** - Heine, et. al - Tata-McGraw-Hill Publication - 2003.
2. **A Text Book of Foundry Technology** - Lal, M. Khanna, P.O - Dhanpat Rai & Sons Publication.
3. **Foundry Technology** - Beeley, P.R. – Butterworth.

## OPERATIONS MANAGEMENT

(Common to 12 MSE 156 /12 MPT 156 /12 MPE 156 / 12MPY 156)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE156 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Operations Concepts:** Introduction to operations management, Operations function in organizations, Brief history of operations management, Functions of an Operations Manager, Scope of Operations management, Operations management in an E-business environment (Trends in business), Productivity, Factors affecting productivity, Computation of total factor productivity and partial factor productivity.

**Operations Decision Making :** Introduction, Characteristics of decisions, Framework for decision making, Decision types, Decision Tree Problems, Economic models-Break Even Analysis in operations, Statistical models.

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

**Forecasting Demand:** Forecasting objectives and uses, Elements of a good forecast, Steps in the forecasting process, Classification of forecasting methods – Qualitative (subjective) and Quantitative (objective) methods, Application and control of forecasts-Mean Absolute Deviation, BIAS, Tracking Signal.

**Aggregate Planning and Master Scheduling:** Introduction, Objectives of aggregate planning, Pure and mixed strategies of aggregate planning, Aggregate planning for services; Master scheduling objectives, Master scheduling methods.

**Material and Capacity Requirements Planning:** An overview of MRP, MRP inputs, MRP processing, MRP outputs, Benefits and requirements of MRP; Capacity Requirement Planning - CRP process, CRP inputs and outputs.

**Operations Scheduling:** Introduction, Objectives of scheduling, Activities in operations scheduling, Graphical tools used in scheduling, Types of scheduling and loading, Types of scheduling problems and solution methods, Single machine scheduling using priority decision rules.

**Flow Shop Scheduling and Job Shop Scheduling:** Introduction, Johnson's rule for sequencing 'n' jobs on 2 and 3 machines, CDS heuristic method, Assignment method, Scheduling 2 jobs on 'm' machines by graphical method.

**REFERENCE BOOKS:**

1. Operations Management – Roberta Russell and Bernard Taylor, Pearson publishers, 2011.
2. Operations Management – William Stevenson, Tata McGraw Hill, latest edition
3. Production and Operations Management – Kanishka Bedi, Oxford University Press, 2007.
4. Operations Management – Norman Gaither and Greg Frazier, Thomson South-Western, latest edition.
5. Operations Management – Joseph Monks, McGraw Hill, latest edition
6. Operations Management – Buffa and Sareen, Wiley Eastern Ltd.
7. Operations Management – James Dilworth
8. Operations Management for Competitive Advantages – Chase and Aquilano, Tata McGraw Hill.
9. Operations Management - Jay Heizer, Barry Render, and Jagadeesh Rajashekhar, Published by Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education South Asia, 9<sup>th</sup> Edition.

## SECOND SEMESTER

### INDUSTRIAL ROBOTICS

(Common to 12 MSE 21 / 12 MPT 21 / 12 MPE 21 / 12 MPY 21)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE 21 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Fundamental Concepts of Robotics:** History, present status and future trends, Robotics. Robot, Definition. Robotics Systems and Robot Anatomy, Specification of Robotics. Resolution, Repeatability and Accuracy of a Manipulator

**Robot Drives:** Power transmission systems and control Robot drive mechanisms, hydraulic-electric-pneumatic drives. Mechanical transmission method – Rotary-to-Rotary motion conversion. Rotary-to-linear motion conversion end effectors – types-grip pind problem Remote-Centered compliance Devices-Control of Actuators in Robotic Mechanisms.

**Sensors and Intelligent Robots:** Sensory devices – Non-optical-Position sensors – Optical position sensors – velocity sensors – proximity sensors: Contact and non-contact type-Touch and slip sensors – Force and Torque Sensors – AI and Robotics.

**Computer Vision for Robotics Systems:** Robot vision systems – Imaging components – Image representation – Hardware aspects-Picture coding – Object Recognition and Categorization- Visual inspection – software considerations – applications – commercial – Robotics vision systems.

**Computer Considerations for Robotic Systems:** Computer architecture for robots, hardware, Computational elements in robotic applications – Robot programming – sample programs path planning – Robot's computer system.

**Transformations and Kinematics:** Homogeneous Co-ordinates – Co-ordinate Reference Frames – Homogeneous Transformations for the manipulator – the forward and inverse probleme of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D.H.Matrices controller architecture.

**Robot Cell Design and Control:** Specifications of Commerical Robots – Robot Design and Process specifications – motor selection in the design of a robotic joint – Robot Cell layouts – Economic and Social aspects of robotics.

### **Laboratory Exercises**

1. Study of pick and place Robot- basic components, configuration, work volume
2. Experiments with Robot. Kit for minimum four assembly activities and programming
3. Programming of robots by manual, lead through and off line methods
4. Programming languages for stacking of objects in increasing or decreasing size. Palletizing operations, assembly and inspection operation etc.
5. To become acquainted with the operation of a revolute-type 6 DOF robot. To program a robotic system using a teaching pendant and a high level programming language. Emphasis is made on the constraints associated when positioning and orienting an object within a 3-D space The practical includes point-to-point tasks and continuous robot motion.

### **REFERENCE BOOKS:**

1. **Robotics Engineering An Integrated Approach** - Richard D Klafter, Thomas A Chmielewski, Michael Negin – Prentice Hall of India Pvt. Ltd. - Eastern Economy Edition, 1989.
2. **Robotics: Control Sensing, Vision, Intelligence** - Fu KS Gomaler R C, Lee C S G - McGraw Hill Book Co. - 1987.
3. **Handbook of Industrial Robotics** - Shuman Y. Nof - John Wiley & Sons, New York - 1985.
4. **Robotics Technology and Flexible Automation** - Deb SR - McGraw Hill BookCo. - 1994.



**NON-TRADITIONAL MACHINING PROCESS**  
(Common to 12 MSE 22 / 12 MPT 22 / 12 MPE 22 / 12MPY 22)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE 22 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Introduction:** Need for non-traditional machining processes. Processes selection classification on – comparative study of different processes.

**Mechanical Process:** Ultrasonic Machining-Definition-Mechanism of metal elements of the process- Tool feed mechanism. theories of mechanics of causing effect of parameter applications.

**Abrasive Jet Machining:** Principles - parameters of the process applications-advantages and disadvantages.

**Thermal Metal Removal Process:** Electric discharge machining Principle of operation – mechanism of metal removal basic EDM circuitry-spark erosion get Analysis of relaxation type of circuit material removal rate in relaxation circuits- critical resistance parameters in RC Circuit-Dielectric fluids-Electrodes for surface finish. Applications.

**Electro Chemical and Chemical Processes:** Electro chemical machining (ECM) Classification ECM process-principle of ECM Chemistry of the ECM parameters of the processes-determination of the metal removal rate - dynamics of ECM process-Hydrodynamics of ECM process-polarization-Tool Design-advantages and disadvantages - applications. Electro Chemical Grinding-Electro Chemical holding Electrochemical deburring.

**Chemical Machining:** Introduction-fundamental principle types of chemical machining Maskants- Etchants- Advantages and disadvantages-applications.

**Plasma Arc Machining:** Introduction-Plasma-Generation of Plasma and equipment Mechanism of metal removal, PAN parameters-process characteristics - type of torches applications.

**Electron Beam Machining (EBM):** Introduction-Equipment for production of Electron beam - Theory of electron beam machining Thermal & Non thermal types characteristics - applications.

**Laser Beam Machining (LBM):** Introduction-principle of generation of lasers Equipment and Machining procedure-Types of Lasers-Process characteristics-advantages and limitations-applications

**Ion Beam Machining:** Introduction-Mechanism of metal removal and associated equipment-process characteristics applications

**High Velocity Forming Process:** introduction - development of specific process selection-comparison of conventional and high velocity forming methods - Types of high velocity forming methods- explosion forming process-electro hydraulics forming magnetic pulse forming.

**REFERENCE BOOKS:**

1. **New Technology Institution of Engineers** - Bhattacharya - India
2. **Production Technology** - HMT - Tata Mc Graw Hill - ISBN-10; 0070964432
3. **Modern Machining Process** - P.C Pandey & H.S. Shan - Tata McGraw Hill - ISBN: 0070965536 - Publishing Date: Feb-80
4. **Metals Hand Book** - ASM - Vol-3.
5. **High Velocity Forming of Metals** - F.M Wilson - ASTM Prentice Hall.
6. **Modern Manufacturing Method** - Adithan - New Age International (p) Limited - ISBN: 8122408176, 2007.
7. **Modern Machining Processes** - P.K. Mishra - Narosa Publishing House, New Delhi - 1997.

**SIMULATION AND MODELING OF MANUFACTURING SYSTEMS**

(Common to 12 MSE 23 / 12 MPT 23 / 12 MPE 23 / 12 MPY 23)

|                            |                    |            |       |
|----------------------------|--------------------|------------|-------|
| Subject Code               | : <b>12 MSE 23</b> | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04               | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52               | Exam Marks | : 100 |

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**Principle of Computer Modelling and Simulation:** Monte Carlo simulation. Nature of computer- modeling and simulation. Limitations of simulation, areas of applications.

**System and Environment:** Components of a system -discrete and continuous systems, Models of a system -a variety of modeling approaches.

**Discrete Event Simulation:** Concepts in discrete event simulation, manual simulation using event scheduling, single channel queue, too server queue, simulation of inventory problem.

**Statistical Models in Simulation:** Discrete distributions, continuous distributions.

**Random Number Generation:** Techniques for generating random numbers-Mid square method -the mod product method -Constant multiplier technique -Additive congruential method -Linear congruential method -Tests for random numbers -The Kolmogorov-Smimov test -the Chi-square test.

**Random Variable Generation:** Inversion transforms technique-exponential distribution. uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution.

**Empirical Discrete Distribution:** Discrete uniform -distribution poisson distribution -geometric distribution -acceptance -rejection technique for Poisson distribution gamma distribution.

**Design and Evaluation of Simulation Experiments:** variance reduction techniques -antithetic variables, variables-verification and validation of simulation models.

**Simulation Software:** Selection of simulation software, simulation packages.

#### **REFERENCE BOOKS:**

1. **Discrete Event System Simulation** - Jerry Banks & John S Carson II - Prentice Hall Inc.-1984.
2. **Systems Simulation** - Gordon. G. - Prentice Hall India Ltd - 1991.
3. **System Simulation with Digital Computer** - Nusing Deo - Prentice Hall of India - 1979.
4. **Computer Simulation and Modeling** - Francis Neelamkovil - John Wiley & Sons - 1987.
5. **Simulation Modeling with Pascal** - Rath M.Davis & Robert M O Keefe - Prentice Hall Inc. - 1989.

## FINITE ELEMENT METHODS

(Common to 12 MSE 24 / 12 MPT 24 / 12 MPE 24 / 12 MPY 24)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE 24 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Introduction:** Equations of equilibrium, stress-strain relations for 2-D and 3-D, Potential energy and equilibrium, Boundary conditions, Von Misses Stresses

**FEM for 1-D Problems:** General procedure for FEA, Raleigh Ritz method, Galerkin Approach, shape functions, stiffness matrix, load vectors, temperature effects, Applications of boundary conditions using elimination, penalty and multi-constraint approaches, Application problems – 1-D bar element. Trusses and beams

**FEM for 2-D Problems:** Shape functions, stiffness matrix, strain matrix, load vectors for CST Elements and application problems

**FEM for Axisymmetric Problems:** Axisymmetric formulation, triangular elements, PE approach, Body force term, application problems

**FEM for Scalar Field Problems:** 1-D Steady state heat transfer, torsion, potential flow and fluid flow in ducts and application problems

**Dynamic Analysis:** Equations of motion for dynamic problems --consistent and lumped mass matrices --formulation of element mass matrices free vibration and forced vibration problems formulation,

### Laboratory Exercises

1. Static (Structural) Analysis of 1-D problems
2. Static (Structural) Analysis of plane stress and Plane Strain problems
3. Structural Analysis of Trusses
4. Static Analysis of Axisymmetric problems
5. Transient Heat Transfer Analysis of 1D problems
6. Transient Heat Transfer Analysis of 2D problems
7. Heat Transfer Analysis of Axisymmetric Problems
8. Dynamic Analysis of 1D problems – Free vibration Analysis
9. Non-linear Static Analysis – Typical problems in geometric and material non-linear Analysis
10. Buckling Analysis of Shell Structures

## REFERENCE BOOKS:

1. **Introduction to Finite Elements in Engineering** - Tirupathi R. Chandrupatla, Ashok D Belegundu - Prentice Hall India Pvt. Ltd., New Delhi – Third Edition, 2003.
2. **Concepts and Applications of finite Element Analysis** - Cook R.D, Malkus D.S & Plesha M.E - John Wiley & Sons - 1989.
3. **Applied Finite Element Analysis** - Segerlind L .J - John Wiley & Sons Edition - 1984.
4. **The Finite Element Method in Engineering** - Rao SS - Pergomon Press, Oxford - 2<sup>nd</sup> Edition, 1984.
5. **Finite Element Procedures in Engineering Analysis** - Bathe K .J - prentice Hall, NewJersey -1982.
6. **Energy and Finite Element Methods in Structural mechanics** - Shames III & Dym C L - Wiley Eastern ltd – 1995.

## ELECTIVE – II

### NON DESTRUCTIVE TESTING

(Common to 12 MSE 251 / 12 MPT 251 / 12 MPE 251 / 12 MPY 251)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 251 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Introduction to ND Testing:** selection of ND methods, visual inspection, leak testing, Liquid penetration inspection, its advantages and limitation.

**Magnetic Particle Inspection:** Methods of generating magnetic field, types of magnetic particles and suspension liquids steps in inspection – application and limitations

**Eddy Current Inspection:** principles, operation variables, procedure, inspection coils, and detectable discounts by the method.

**Microwave Inspection:** Microwave holography, applications and limitations.

**Ultrasonic Inspection:** Basic equipment characteristics of ultrasonic waves, variables inspection, inspection methods pulse echo A,B,C scans transmission, resonance techniques, transducer elements couplets, search

units, contact types and immersion types inspection standards-standard reference blocks.

**Radiography Inspection:** principles, radiation source X-rays and gamma rays, X-ray-tube, radio graphic films, neutron radiography, Thermal inspection principles, equipment inspection methods applications.

**Optical Holography:** Basics of Holography, recording and reconstruction - Acoustical Holography: systems and techniques applications. Indian standards for NDT.

#### REFERENCE BOOKS:

1. **Non Destructive Testing** - Mc Gonnagle JJ – Garden and reach New York.
2. **Non Destructive Evolution and Quality Control** - volume 17 of metals hand book 9 edition Asia internal 1989.
3. **The Testing Instruction of Engineering Materials** - Davis H.E Troxel G.E wiskovil C.T - McGraw hill.

#### SURFACE TREATMENT AND FINISHING

(Common to 12 MSE 252 / 12 MPT 252 / 12 MPE 252 / 12 MPY 252)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 252 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Fundamentals of Electro Plating,** galvanizing, Hot dip metal coating, thin coating, thin coating, chromium plating, Nickel plating.

**Vacuum Coating,** FVD & CVD metal spraying - Methods, surface preparation, mechanical

**Properties of Sprayed Metals, Plasma Coating.**

**Plastic Coating of Metal** - PVC coating Spherodising process details, phosphate coating - mechanism of formation.

**Testing of Surface Coating**-methods.

**Heat Treatment Methods,** Annealing, Normalizing, Tempering, Case hardening methods, flame hardening sub zero treatment.

Heat treatment methods for gears, spindles, cutting tools.

**Advanced Coating Technologies:** Hard facing, electro deposition technique, nanocoatings, coating characterization

**REFERENCE BOOKS:**

1. **Surface Preparations & Finishes for Metals** - James A Murphy - McGraw Hill.
2. **Principles of Metal Surface Treatment and Protection** - Pergamon Press Gabe, David Russell - Description, Oxford ; New York - 2d ed., 1978.
3. **Handbook of Metal Treatment and Testing** - John wiley & sons.
4. **Heat Treatment of Metals** – Zakrov - MIR Publications.
5. **Metals Hand Book** – ASM.

**AGILE MANUFACTURING**

(Common to 12 MSE 253 / 12 MPT 253 / 12 MPE 253 / 12 MPY 253)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 253 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Introduction** - What is agile Manufacturing? - Competitive environment of the future the business case for agile manufacturing conceptual frame work for agile manufacturing.

**Four Core Concepts:** Strategy driven approach - integrating organization, people technology interdisciplinary design methodology.

**Agile Manufacturing and Change Management:** The change implications. Post failures in advanced manufacturing, changes on the way, traditional management accounting, paradigm, investment appraisal, product costing - performance, measurement and control systems, Traditiosal organization, control technological and design paradigms traditional problems in workplace- organizational issues - role of technology.

**Agile Manufacturing Enterprise Design:** Agile manufacturing - enterprise design.. system concepts as the basic manufacturing theory - joint technical & organizational design and a model for the design of agile manufacturing enterprise, enterprise design process insights into design processes, what is interdisciplinary design, Main issues - simple design example.

**Skill & Knowledge Enhancing Technologies for Agile Manufacturing:**  
Skill and Knowledge enhancing Technologies - scheduling - technology design strategic-Design Concepts. Design and Skill of Knowledge enhancing Technologies for machine tool systems - Historical overview, Lessons, problems and Future development.

**REFERENCE BOOKS:**

1. **Agile manufacturing - Forging new Frontiers** - Paul T. Kidd - Addison Wesley Publication -1994.
2. **Agile Manufacturing – Proceedings of International Conference** - Dr. M.P Chowdiah (Editor) – Tata Mc Graw Hill Publications - 1996.
3. **On agile manufacturing** - Tata McGraw Hill Publications -1996
4. **Agile manufacturing - Forging Neat Furniture's** - Paul T Kidd – Addition Wesley Pub – 1994.
5. **World Class Manufacturing** - Paul T Kidd - Washington: National - 1994

**ADVANCED JOINING PROCESSES**

(Common to 12 MSE 254 / 12 MPT 254 / 12 MPE 254 / 12 MPY 254)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE254 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Distortion**- methods to avoid distortion. Stresses in Joint Design.

**Welding and Cladding of Dissimilar Materials**, overlaying and surfacing.

**Electro Slag**, Welding Electron Beam Welding, Plasma arc Welding, Laser Beam Welding, Explosion Welding, Diffusion Welding, Ultrasonic Welding, Friction welding and Thermit welding.

**Advanced Soldering and Brazing** : Processes Different Types.

**Welding of Plastics**.

**Inspection of Welds**: Destructive techniques like Tensile, Bend, Nick break, Impact & Hardness. Non-Destructive techniques like 'X' rays, Ultrasonic, Magnetic particle, Dye Penetrant, Gamma ray inspection.

**Welding Symbols**- Need for, Representing the welds, Basic weld symbols, Location of Weld, Supplementary symbols, Dimensions of welds, Examples

**Welding Design** - Introduction, Principles of sound welding design, Welding joint design. Welding positions, Allowable strengths of welds, under steady loads.



**Quality Control in Welding** - Introduction, Quality assurance v/s Quality control, Weld quality, Discontinuities in welds, their causes and remedies and Quality conflicts.

**Computer-Aided Welding Design** - Introduction. Principles of sound welding design, Wilding joint design. Welding positions. Allowable strengths: of welds. 1D1der steady loads. Weld throat thickness. Solved and um solved examples.

**REFERENCE BOOKS:**

1. **Welding Engineering Handbook** - A.W.S.
2. **Welding Engineering** - Rossi - McGraw Hill.
3. **Advanced Welding processes** - Nikodaco & Shansky - MIR Publications.
4. **Welding Technology** - O.P. Khanna
5. **Welding for Engineers** - Udin, Funk & Wulf

**PRODUCT DATA MANAGEMENT**

(COMMON TO 12 MSE 255 / 12 MPT 255 / 12 MPE 255 / 12 MPY 255)

|                            |                    |            |       |
|----------------------------|--------------------|------------|-------|
| Subject Code               | : <b>12 MSE255</b> | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04               | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52               | Exam Marks | : 100 |

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**Introduction:** Introduction to PDM-present market constraints need for collaboration- Internet and developments in server-client computing.

**Components of PDM:** Components of a typical PDM set-up hardware and software- document management creation\_and viewing of documents - creating parts-version control of parts and documents –case studies.

**Configuration Management:** Base lines-product structure configuration management -case studies.

**Projects and Roles:** Creation of projects and roles -life cycle of a product-life cycle management -automating information flow -work flows-Creation of work flow templates -life cycle -work flow integration -case studies.

**Change Management:** Change issue -change request-change investigation-change proposal-change activity-case studies.

**Generic Products and Variants:** Products configuration comparison

between sales configuration mild products generic-generic product modeling in configuration modeler-use of order generator for variant creation - registering of variants in product register-case studies.

**REFERENCE BOOKS:**

1. **Computer Integrated Design and Manufacturing** - David Bedworth, Mark Henderson & Philips Wolfe - McGraw Hill Inc. - 1991.
2. **Visual Modeling with Rational Rose and UML** - Terry Quatrain - Addison Wesley - 1998.
3. **Wind-chill** - RS.O Reference manuals - 2000.

**LEAN MANUFACTURING SYSTEMS**

(Common to 12 MSE 256 / 12 MPT 256 / 12 MPE 256 / 12 MPY 256)

|                            |                     |            |       |
|----------------------------|---------------------|------------|-------|
| Subject Code               | : <b>12 MSE 256</b> | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04                | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52                | Exam Marks | : 100 |

**Just in Time Production System.** JIT Logic -Pull system Japanese approach to production elimination of waste - JIT implementation requirements JIT application for job shops, Case studies

**Kanban System:-** Kanban rules supplier Kanban and sequence schedule used by supplier. Monthly information & daily information. Later replenish system by Kanban sequenced withdrawal P system by sequence schedule table -problems & counter measures in applying Kanban system to subcontractors -Supplier Kanban circulation in the paternal manufacturer - structure of supplier Kanban sorting office.

The rise & fall of Mass Production Mass production, work force, organization, tools, product –logical limits of mass production, Sloan as a necessary compliment to Ford. Case study:- Rouge Production Plant.

**The Rise of Lean Production:** - Birth place, concrete example, company as community, Final assembly plant, product development and engineering. Changing customer demand, dealing with the customer, future of lean production.

**Shortening of Production Lead Times** -reduction of setup times, practical procedures for reducing setup time.

**Standardization of Operations.** Machine layout, multi function workers and job rotation. Improvement activities to reduce work force and increase worker morale -foundation for improvements.

**Elements of Lean Production viz G M Framingharn** -Toyota Takaoka Mass Production v/s lean production, diffusing lean production.

**Managing Lean Enterprise:-** Finance, Career ladders, geographic spread and advantages of global enterprise.

**Prospects for Catching up.** Simplicity in the natural state -institutional factors -life time employment -educational commodities -quality & productivity in full circle.

**An Action Plan :** Getting started - Creating an organization to channel your streams. Install business system to encourage lean thinking. The inevitable results of 5 year commitment.

#### **REFERENCE BOOKS:**

1. **Productions and Operations Management** - Chasel Aquilino - Mcgra-hill company – 9<sup>th</sup> edition - 2001.
2. **Toyoto Production System -An integrated approach to Just in Time** - Yasuhiro Monden - Engineering aild Management Press, Institute of Industrial Engineers Norcross Georgia.- 1983
3. **The Machine that Changed the World. The Story of Lean Production** - James P Womack, Daniel T Jones, and Daniel Roos - Harper Perennial edition published - 1991.
4. **Lean Thinking** - James Womack - Simon & Schuster Adult - ISBN: 0743249275, 2003.
5. **Japanese Manufacturing Techniques. The Nine Hidden Lessons by simplicity** - Richard Schourberger. - Free Press - 1st edition, ISBN-10: 0029291003, 1982.
6. **Quality Function Development** - James Bossert - ASQC Press – 2000.

## APPLIED MICRO-ECONOMICS

(Common to 12 MSE 257 / 12 MPT 257 / 12 MPE 257 / 12 MPY 257)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 257 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

**Introduction:** Circular Flow of Economic Activity, Nature of the Firm, Concept of Economic Profit.

**Demand:** Demand Theory and Analysis, Individual and Market Demand, Price Elasticity, Income Elasticity and Cross Elasticity.

**Production and Costs:** Production Theory and Analysis, Production Function, Production with one variable Input and two variable inputs, Economies of Scale and Scope, Estimation of Production Function. The Economic Cost Concept, Opportunity Costs, Explicit & Implicit, Marginal, Incremental and Sunk Cost Functions, Long run Cost Functions, Profit Contribution Analysis. Numerical Problems.

**Market Structure:** Perfect Competition and Monopoly, Monopolistic Competition, Oligopoly - Numerical Problems. Barriers to Entry.

**Pricing Decisions:** Pricing of Multiple Products, Price Discrimination, Product Bundling, Peak Load Pricing and Cost Plus Pricing, Pricing and Employment of Inputs. Numerical Problems.

### REFERENCES:

1. H C Peterson and W C Lewis, Managerial Economics, PHI, New Delhi.
2. Samuelson W F, and S G Marks, Managerial Economics, Dryden Press, Fort Worth.

## THIRD SEMESTER

### DESIGN OF JIGS AND FIXTURES

(Common to 12 MSE 31 / 12 MPT 31 / 12 MPE 31 / 12 MPY 31)

|                            |             |            |       |
|----------------------------|-------------|------------|-------|
| Subject Code               | : 12 MSE 31 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04        | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52        | Exam Marks | : 100 |

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**Introduction:** Production equipment, The economics approach to the provision of special equipment. The design of jigs and fixtures, principles of jig and fixtures design, construction methods and materials used. The function and organization of the jig office.

**Location and Location Devices:** The six degrees of freedom, The duty of the location system. The choice of location system, Redundant location. The six point location principle. Locators, locators that control work piece from flat surfaces or form its profile, location from cylindrical surfaces or from its profile, location from cylindrical surfaces, conical location, cylindrical locators in combination, Vee location

**Clamping and Clamping Devices:** Requirements of the clamping system, position of the clamps, clamping devices, examples of typical clamping devices.

**Design of Drill Jigs:** Introduction, Definition of drill jig, Types of drill jig, Chip formation in drilling, General consideration in the design of drill jig, drill bushings, Methods of construction, Drill jigs and modern manufacturing.

**Design of Fixtures:** Introduction, Fixtures and Economics.

**Types of Fixtures:** Vise Fixtures, Milling Fixtures, Boring Fixtures, Broaching Fixtures, Lathe Fixtures, Grinding Fixture.

**Indexing Jigs & Fixtures:** Introduction, Typical applications of indexing, the essential features of an indexing jig or Fixture. Indexing devices, Examples of indexing equipment..

**Form Tools :** The flat form tool, calculations for profile. The tangential form tool; calculations for profile. The circular form tool, calculations for profile, general remarks regarding calculations.

## REFERENCE BOOKS:

1. **An Introduction to Jig and Tool Design** – M H A Kempster, ELBS, 3<sup>rd</sup> Edition.
2. **Tool Design** – Cyril Donaldson George H Lecain V C Goold – Tata McGraw-Hill, Edition, 3<sup>rd</sup> Edition.
3. **Jigs and Fixtures** – Hiram E Grant - McGraw Hill- 1971 edition, ISBN-13:978-0-07-099329-7 New Delhi
4. **Tool Engineering and Design** – Nagpal, Kanna publication, Edn 1998.

## ELECTIVE – III

### INDUSTRIAL DESIGN AND ERGONOMICS

(Common to 12 MSE 321 / 12 MPT 321 / 12 MPE 321 / 12 MPY 321)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 321 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Introduction:** An approach to industrial design - elements of design - structure for industrial design in engineering application in modern manufacturing systems.

**Ergonomics and Industrial Design:** Introduction - general approach to the man-machine relationship-workstation design-working position.

**Control and Displays:** shapes and sizes of various controls and displays-multiple displays and control situations - design of major controls in automobiles, machine tools etc., - design of furniture design of instruments.

**Ergonomics and Production:** Ergonomics and product design ergonomics in automated systems-expert systems for ergonomic design, Anthropomorphic data and its applications in ergonomic design limitations of anthropomorphic data - use of computerized database.

**Visual Effects of Line and Form:** The mechanics of seeing psychology of seeing, general influences of lined and form.

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

**Aesthetic Concepts:** Concept of unity - concept of order with variety - concept of purpose style and environment - Aesthetic expressions. Style-components of style - house style, observations style in capital goods.

**Industrial Design in Practice:** General design - specifying design equipments - rating the importance of industrial design – industrial design in the design process.

**REFERENCE BOOKS:**

1. **Industrial design for Engineers** - Mayall W.H. - London Cliffee Books Ltd. - 1988.
2. **Applied Ergonomics Hand Book** - Brien Shakel (Edited) - Butterworth Scientific, London – 1988.

**HUMAN RESOURCE MANAGEMENT**

(Common to 12 MSE 322 / 12 MPT 322 / 12 MPE 322 / 12 MPY 322)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 322 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**HRM in Perspective,** competitive challenges, uses of HR information, Demographics and employee concerns, social issues, diversity in. HRM,

**Relationship of Job Requirements and HRM Functions,** Job Analysis, Job Description, Job Design, Designing work for groups, flexible work schedules, Industrial engineering and ergonomic consideration, HR Planning, Effective HRP, Forecasting and balancing supply and demand of HR, recruiting from inside and outside, Recruiting protected class, Recruiting older people.

**Selection, Matching People and Job,** sources of information about job candidate, The US Employee Polygraph Protection Act, graphology, Medical examination, Drug test, Interview methods Guidelines for interviewers, appropriate and inappropriate interview questions, selection decision.

**Developing Effectiveness in HR,** Investment in Training, System approach, Conducting the .needs assessment, designing training programs, trainee readiness and motivation, principles of learning, characteristics of trainees, training methods for non-managerial employees, OJT, Technology for training, training methods for MDP, Evaluating, benchmarking HR training.

**Career Development and Appraisal,** identifying career opportunity and requirements, gauging employee potential, career development initiative, Mentor check list, career development for women and minorities, dual career

couples, personal career development, Behavioral methods of appraisal, balanced score card, personal score card appraisal interviews; performance diagnosis

**International HRM**, Managing across borders, International staffing, Skills of a global manager, content of training program. Non-verbal communications, developing local resources, compensation of host country employees, managers and expatriate managers.

**Case Studies on Appraisal System**, developing a training session, evaluating a given training program. preparation of structured and unstructured interviews

#### REFERENCE BOOKS:

1. **Managing Human Resources** - Wayne F Cascio - Tata McGraw Hill, New Delhi .
2. **Managing Human Resources** - George Bohlander and Scot Snell - Thompson South western.
3. **Human Resource Management** - Biswajeet Pattanayak - Prentice Hall of India Pvt. Ltd.
4. **Human Resource Management** - K. Ashwathappa,
5. **Personnel Management** - C.B.Memoria - Himalaya Publishing.

#### ADVANCED FLUID POWER SYSTEMS

(Common to 12 MSE 323 / 12 MPT 323 / 12 MPE 323 / 12 MPY 323)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 323 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Introduction:** Pascal Law, Advantages of Fluid Power, Applications of Fluid Power, Components of a Fluid Power.

**Hydraulic Power Unit:** Introduction, Pumping Theory, Pump Classification, Gear Pumps, (Vane Pumps- simple, balanced & pressure compensated vane pump, Vane design) Piston Pumps- Radial, Axial (Bent axis & Swash plate), Pump Performance, Pump Noise, Ripple in pumps.



**Hydraulic Actuators:** Linear actuator- cylinders, Mechanics of Hydraulic cylinder loading, limited rotation hydraulic actuator, cylinder cushioning, Gear, Vane & Piston motor, Motor performance, Hydrostatic transmission.

**Power Controlling Elements – Valves**

i) Directional Control Valves – Classification, 2/2, 3/2, 4/2 & 4/3 ways DCV's, Different Centre configurations in 4/3 way valves, actuation of DCV's, Indirect actuation, Valve Lap – Lap during Stationary and during switching.

ii) Pressure Control Valves: Classification, opening & Closing Pressure difference, Cracking Pressure, Pressure Relief Valve – Simple & Compound type, Pressure reducing valve, sequence, unloading & Counter balance valve, Pressure switches.

iii) Flow Control valves – Fixed throttle, Variable throttle, Pressure Compensation principles, pressure compensated Flow control valve – Reducing & Relief type.

iv) Check valve, Pilot operated check valve.

**Study of Various Hydraulic Circuits:** Control of Single & double acting cylinder, Regeneration circuit, cylinder sequencing & Synchronizing circuit. Speed control of cylinder & Motors, Analysis of Hydraulic system with frictional losses, Accumulators & accumulator circuits.

**Pneumatic System:** Introduction, – Generation of compressed air, air receiver, servicing FRL unit, Air filter, pressure regulation, lubricator, Pneumatic cylinder & air motor – different types of cylinder, cushion assembly. Cylinder performance.

**Pneumatic Valve:** Directional control valves, impulse valve, Quick exhaust valve, shuttle valve, Twin pressure valve, Time delay valve,

**Pneumatic Circuit & Logic Circuits:-** Control of single and double acting cylinder, impulse operation, speed control, sequencing, Pneumatic Vacuum system AND, OR, NOT, NAND, NOR, YES Function, Logic circuits design using shuttle valve & twin pressure valve, Binary Arithmetic, logic & Boolean Algebra, use of Karnaugh map for pneumatic circuit design.

**Electrical Control in Fluid Power:** Contactors, & Switches, Relays, Limit switch, Electro hydraulic & Electro Pneumatic Circuits, Simple Cylinder reciprocation, interlocking using relays, Proximity switches, application of proximity switches, Time dependent and travel dependent circuits.

## REFERENCE BOOKS:

1. **Fluid Power with Application** - Anthony Esposito - Peason Education - 5<sup>th</sup> edition.
2. **Oil hydraulics -Principles & maintenance** - S.R. Majumdar - Tata M C Graw Hill
3. **Components & Application** - Bosch Rexroth didactic - Hydraulics Trainer - vol 1. Publication
4. **Pneumatic System, Principles and Maintenance** - S.R. Majumdar - Tata M C Graw Hill Publication.
5. **Pneumatics: Theory and Applications** - Bosch Rexroth didactic - Publication
6. **Electro Pneumatics** - Bosch Rexroth didactic - Vol. 2, Publication.

## PROJECT MANAGEMENT

(Common to 12 MSE 324 / 12 MPT 324 / 12 MPE 324 / 12 MPY 324)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 324 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Introduction:** Projects, types of projects- public and private projects, project organization, structure and processes. Identification of Investment Opportunities, Market and Demand Analysis – Technical Analysis – Investment Outlay.

**Means of Financing:** Profitability and Breakeven Analysis – Cash Flows of Projects – Tax factor in investment Analysis – Interest – Compounding and Discounting.

**Appraisal Criteria and Selection of Investment:** Cost of Capital – Analysis of Risk – Financial Projection, Social Cost Benefit Analysis.

**Manpower Management in Projects:** Functional Approach to Manpower Management – The Element of decision Process – Project Team Concepts – Field Autonomy – Policies Governing Projects.

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

## REFERENCE BOOKS:

1. **Projects**– Appraisal, preparation, budgeting and implementation  
Prasannachandra – Tata McGraw Hill.
2. **Hand book of Project Management**– Dennis Lock.
3. **Project Management** – Dennis lock.

## NANO TECHNOLOGY

(Common to 12 MSE 325/ 12 MPT 325 / 12 MPE 325 / 12 MPY 325)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 325 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Metal Based Nanocomposites**- Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Metal-metal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties.

**Design of Super Hard Materials**- Super hard nanocomposites, its designing and improvements of mechanical properties.

**Nanofiller synthesis**, applications, Polymer nanocomposites, particulate and fibre modified nanocomposites, matrices and fibres, polymer- filler interphase, pull- out strength, effect of various treatments.

**Mechanics of Polymer Nanocomposites**, Interfacial adhesion and charecterisation, factors influencing the performance of nanocomposites, physical and functional properties. Nano composite fabrication, matrices, methods, additives, moulding processes.

**Polymer-Carbon Nanotubes Based Composites**, processing methods and characterization using SEM, XRD, TEM

**Characterization of Polymer Nanotubes Based Composites** for Mechanical, Electrical and Thermal Properties and their applications - Polymer / nanofillers (metallic nanopowders) systems, Rheological measurements, processing characteristics

**Testing of Nanocomposites**, Thermal analysis such as TGA, TMA, DSC, DMTA

## REFERENCE BOOKS:

1. **Text Book of Polymer Science** - Fred W. Billimeyer, Jr - Wiley Interscience Publication - third edition , 1994.
2. **Polymer Science and Technology** - Joel R. Fried - Prentice- Hall, Inc. Englewood Cliffs, N. J., USA - 2000.
3. **New Developments and Technology** -Hand book of Elastomers - (Eds. A. K. Bhowmic and H. C. Stephense), Marcel - Dekker Inc., New York - 1995.
4. **Polymer Blends** - D. R. Paul and S. Newman - Academic Press, New York - 1978.
5. **Short Fibre Reinforced Thermoplastics** - M. J. Folkes - John Wiley, New York - 1982.
6. **Nanocomposites Science and Technology** Physical Properties of Carbon Nanotubes - P. M. Ajayan, L.S. Schadler, P. V. Braun , R. Saito, Carbon Nanotubes (Carbon, Vol 33) - M. Endo, S. Iijima, M.S. Dresselhaus

## ELECTIVE - IV

### ADVANCED MANUFACTURING PRACTICES

(Common to 12 MSE 331 / 12 MPT 331 / 12 MPE 331/ 12 MPY 331)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 331 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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

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

**Sequence and Scheduling Used by Suppliers:** Monthly and daily Information. Sequenced withdrawal system by sequenced schedule table, problems and counter measures in applying the Kanban system to sub contractors.

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

- a) Kanban Number under Constant Quantity Withdrawal System.
- b) Constant Cycle, Non-constant Quantity Withdrawal System.

**Supplier Kanban and the Sequence Schedule for Use by Suppliers.**

- a) Later Replenishment System by Kanban.
- b) Sequenced Withdrawal System.
- c) Circulation of the Supplier Kanban within Toyota.

Production Smoothing in TPS

Production Planning

Production Smoothing

Adaptability to Demand Fluctuations

**Sequencing Method for the Mixed Model** Assembly Line to Realize Smoothed Production of Goal.

**Just-in-Time Production** with Total Quality Control just in time concept, cutting lot sizes, cutting set-up times, cutting purchase order costs, the JIT cause-Effect chain, Scrap/Quality Improvements, Motivational effects, Responsibility effects, small Group improvement Activities, withdrawal of Buffer Inventory, the total Quality Control Concept.

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

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

## REFERENCE BOOKS:

1. **Japanese Manufacturing Techniques** - Richard Schonberger - Pearson Higher Education - ISBN: 0029291003 1982
2. **Just In Time Manufacturing** – Kargoanker (manual).
3. **Wind-chill** reference manual.
4. **An Integrated Approach To Just In Time** - Yasuhiro Monden - Toyota Production system.
5. **Lean Thinking** - James Womack - Simon & Schuster Adult - ISBN: 0743249275, 2003.
6. **The machine that changed the World** - James P. Womack, Daniel T Jones, and Daniel Roos - The story of Lean production – by– Harper Perennial edition published -1991.

## SMART MATERIALS AND STRUCTURES

(Common to 12 MSE 332 / 12 MPT 332 / 12 MPE 332 / 12 MPY 332)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 332 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Overview** of Smart Materials, Structures and Products Technologies.

**Smart Materials (Physical Properties)** Piezoelectric Materials, Electrostrictive Materials, Magnetostrictive Materials, Magnetoelectric Materials. Magnetorheological Fluids, Electrorheological Fluids, Shape Memory Materials, Fiber-Optic Sensors.

**Smart Sensor, Actuator and Transducer Technologies:** Smart Sensors: Accelerometers; Force Sensors; Load Cells; Torque Sensors; Pressure Sensors; Microphones; Impact Hammers;

**MEMS** Sensors; Sensor Arrays Smart Actuators: Displacement Actuators; Force Actuators; Power Actuators; Vibration Dampers; Shakers; Fluidic Pumps; Motors Smart Transducers: Ultrasonic Transducers; Sonic Transducers.

**Measurement, Signal Processing, Drive and control Techniques** :Quasi-Static and Dynamic Measurement Methods; Signal Conditioning Devices; Constant Voltage, Constant Current and Pulse Drive Methods; Calibration Methods; Structural Dynamics and Identification Techniques; Passive, Semi-Active and Active Control; Feedback and Feed forward Control Strategies.

**Design, Analysis, Manufacturing and Applications of Engineering Smart Structures and Products :** Case studies incorporating design, analysis, manufacturing and application issues involved in integrating smart materials and devices with signal processing and control capabilities to engineering smart structures and products. Emphasis on structures, automation and precision manufacturing equipment, automotives, consumer products, sporting products, computer and telecommunications products, as well as medical and dental tools and equipment.

#### REFERENCE BOOKS:

1. **Smart Materials and Structures** - M. V. Gandhi and B. So Thompson - Chapman & Hall, London; New York - 1992 (ISBN: 0412370107).
2. **Smart Structures and Materials** - B. Cui shaw - Artech House, Boston, - 1996 (ISBN :0890066817).
3. **Smart Structures: Analysis and Design** - V. Srinivasan - Cambridge University Press, Cambridge; New York - 2001 (ISBN: 0521650267).
4. **Materials, Properties, Applications Electroceramics** - A. J. Moulson and J. M. Herbert, - John Wiley & Sons, Chichester, West Sussex; New York - 2nd Edition, 2003 (ISBN: 0471497479).
5. **Materials and Amplifiers Sensories: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors** - G. Gautschi, Piezoelectric - Springer, Berlin; New York - 2002 (ISBN: 3540422595).
6. **Piezoelectric Actuators and Ultrasonic Motors** - K. Uchino - Kluwer Academic Publishers, Boston - 1997 (ISBN: 0792398114).
7. **Handbook of Giant Magnetostrictive Materials** - G. Engdahl - Academic Press, San Diego, Calif.; London - 2000 (ISBN: 012238640X).
8. **Shape Memory Materials** - K. Otsuka and C. M. Wayman - Cambridge University Press, Cambridge; New York - 1998 (ISBN: 052144487X).
9. **Fiber Optic Sensors: An Introduction for Engineers and Scientists** - Eric Udd - John Wiley & Sons, New York - 1991 (ISBN:0471830070).
10. **Vibration Control of Active Structures: An Introduction** - Andre Preumont - Kluwer Academic Publishers, Dordrecht; Boston - 2nd Edition, 2002 (ISBN: 1402004966).
11. **Control. Optimization, and Smart Structures: High-Performance Bridg-es and Buildings of the Future** - Hojjat Adeli - John Wiley, New York - 1999 (ISBN: 047135094X).

12. **Passive Energy Dissipation Systems in Structural Engineering** - T. T. Soong - Wiley, Chichester, New York - 1997 (ISBN: 0471968218).

**MODERN TRENDS IN MANAGEMENT**

(Common to 12 MSE 333/ 12 MPT 333 / 12 MPE 333 / 12 MPY 333)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 333 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Just in Time Ideas:** Introduction of JIT Concepts, Difference between Conventional Material Control technique and IIT, Steps in implementing JIT, J.I.T. as a management Kaizen concept, Feasibility of JIT concepts to Indian Industries.

**Implementing a Program for Continuous Improvement:** Japanese concept of continuous Improvement. (KAIZEN mean continuous Improvement), Innovation concept of Improvement, Need for continuous improvement, Steps in implementing continuous improvement.

**Quality Circles:** Definition of quality circles, Quality circles as a tool for problem solving, Q.C. as a group oriented KAIZEN.

**Kanban System:** Definition of KANBAN, Difference between PULL & PUSH Systems of Material Control, KANBAN as a Push System, KANBAN as JIT concept.

**Concurrent Engineering:** Definition of Concurrent Engineering. Design for Manufacturing and Assembly (DFMA), Concurrent Engineering, Team, Advantages of concurrent Engineering.

**REFERENCE BOOKS:**

1. **Just in Time Manufacturing** - Amaldo Hernandez - PH International.
2. **Just in Time - Productivity Process** - David Hutehins - Jaco Publications.



**MAINTENANCE ENGINEERING AND MANAGEMENT**  
(Common to 12 MSE 334 / 12 MPT 334 / 12 MPE 334 / 12 MPY 334)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 334 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Failure Statistics:** Breakdown time distributions, Poisson, Exponential and Normal Distributions.

**Maintenance Planning:** Overhaul and Repair: Meaning and Difference, optimal overhaul/Repair/Replace maintenance policy for equipment subject to breakdown.

**Replacement Decisions:** Optimal interval between preventive replacements of equipment subject to breakdown, group replacement.

**Maintenance Systems:** Fixed Time Maintenance, Condition based Maintenance, Operate to Failure, opportunity maintenance, Design out maintenance, total productive maintenance.

**Inspection Decision:** Optimal Inspection frequency, (for maximization of profit and minimization of downtime) , Non-destructive Inspection, Lubrication program development, CPM and PERT in maintenance.

**Scheduling Techniques.** Spare parts Management. Repair cycle, Repair Complexity and Maintenance Control Indices. Concept of Terro-technology.

**REFERENCE BOOKS:**

1. **Management of Industrial Maintenance** - Kelly and M.J. Harris - Butterworth and Company Limited.
2. **Maintenance, Replacement and Reliability** - AKS Jardine - Pitman Publishing.
3. **Preventive Maintenance** - Joseph D. Patton - Instrument Society of America.
4. **Maintenance and Spare Parts Management** - P. Gopala Krishnan and AX. Bannerjee .
5. **Industrial Maintenance** - H.P. Garg - ISBN – 8121901685.
6. **Plant Engineering Hand Book** - Stainer - McGraw Hill.
7. **Maintenance Engineering Hand Book** - Lindley R. Higgins
8. **Maintenance Engineering Hand Book** - L.C. Morrow

## FINANCIAL MANAGEMENT

(Common to 12 MSE 335 / 12 MPT 335 / 12 MPE 335 / 12 MPY 335)

|                            |              |            |       |
|----------------------------|--------------|------------|-------|
| Subject Code               | : 12 MSE 335 | IA Marks   | : 50  |
| No. of Lecture Hours/Week  | : 04         | Exam Hours | : 03  |
| Total No. of Lecture Hours | : 52         | Exam Marks | : 100 |

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**Introduction to Financial Management:** Objectives, functions & scope, evolution interface of Financial Management with other functional areas, environment of corporate finance.

**Indian Financial System:** Financial Markets – money market, capital market, Govt., Securities market, All India Financial Institutions DBI, IFCI, ICICI, IRBI, EXIM Bank, SFCs, SIDCs Investment Institutions – LID, GIC, VTI, mutual funds Commercial banks: NBFCs.

**Time Value of Money :** Future value of a single cost flow, multiple flows and annuity, present value of a single cash flow.

**Risk & Return:** Risk & Return concepts, risk in a portfolio, context, relationship between risk & return.

**Valuation of Securities:** Concept of valuation, equity valuation Dividend: Dividend capitalization approach & ratio approach.

**Financial Statement Analysis:** Ratio analysis, time series analysis, Du pont analysis, funds flow analysis.

**Leverage:** Concept of leverage, opening leverage, financial leverage, total leverage.

**Sources of Long Term Finance:** Equity capital & preference capital, Debenture capital, term loan & deferred credit, Govt Subsidies, Sales Tax Deferrals & Exception, leasing and hire purchase.

**Cost of Capital and Capital Structure:** Cost of debentures, Term loans, Equity capital & retained earning, Weighted average cost of capital, Systems of weighing. Introduction to capital structures, factors affecting capital structure, feature of an optimal capital structure, capital structures, Capital Structure theories, tradition position, MM Position and its critique imperfections.

**Dividend Policy:** Traditional position, water model, golden model, Miller and Modigliani position, rational expectations model.

**Estimation of Working Capital** – Objectives of working capital (Conservative Vs Aggressive policies) static Vs Dynamic view of W.C. Factors affecting the composition of W.C., interdependence among Components of W.C., operating cycle approach to W.C.

**REFERENCE BOOKS:**

1. **Fundamentals of Financial Management** – James C. Van Home - ISBN – 8177587862.
2. **Financial Management** – I.M. Panday – Vikas Publishing House Pvt - 2009.
3. **Management Accounting & Financial Management** – M.Y. Khan & P.K. Jain - Mcgraw Hill – Tata - ISBN: 0471477613.

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