**(3rd semester)**

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd semester)**

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| **(MANUFACTURING SCIENCE & ENGINEERING)** |
| **MTMSE–665 FINITE ELEMENT METHODS** |

**L T P/D Hrs. Internal Marks 40**

**4 0 - 4 External Marks 60**

**Time- 3 Hrs**

**Unit I**

**Introduction**: Historical background, Stresses and equilibrium, Boundary conditions, Strain-displacement, Relations, Stress- strain relations, Temperature effects, Potential energy and equilibrium; The Rayleigh-Ritz method, Galerkin’s method, Saint Venant’s principle, Matrix algebra, Gaussian elimination.

**One-Dimensional Problems**: Finite element modeling, Coordinates and a shape functions, The potential energy approach; The Galerkin approach, Assembly of the global stiffness matrix and load vector. Properties of stiffness matrix, The finite element equations, Treatment of boundary conditions, Quadratic shape functions; Temperature effects.

**Unit II**

**Two-Dimensional Problems using Constant Strain Triangles:** Introduction, Finite element modeling, Constant strain triangle, Problem modeling and boundary conditions.

**Axis Symmetric Solids subjected to Axis Symmetric Loading:** Introduction, Axis symmetric formulation: Finite element modeling, Triangular element, Problem modeling and boundary conditions.

**Unit III**

**Two Dimensional Isoparametric Elements and Numerical Integration:** Introduction, The four- node quadrilateral, Numerical integration stress calculations, High order element, Nine-node quadrilateral, Eight-node quadrilateral, Six-node triangle, Comment on midside node, problems.

**Three-Dimensional Problems in Stress Analysis:** Introduction, Finite element formulation, Stress calculations, Mesh preparation, Hexahedral elements and higher- order elements, Problem modeling.

**Unit IV**

**Scalar Field Problems**: Introduction, Steady-state heat transfer: Introduction one-dimensional heat conduction, Heat transfer in thin Fins, Two-dimensional steady-state heat conduction, Potential flow, Seepage, Fluid flow in ducts.

**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.

**RECOMMENDED 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 - 2nd 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.

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd semester)**

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| **(MANUFACTURING SCIENCE & ENGINEERING)** | |  |  |
| **MTMSE–667 INDUSTRIAL ROBOTICS** | | |  |
| **L T P/D Hrs. Internal Marks 40**  **4 0 - 4 External Marks 60**  **Time- 3 Hrs** |  |  |  |
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**Unit I**

**Fundamental Concepts of Robotics:** History, Present status and future trends in Robotics, Robot definition. Robotics systems, Robot anatomy, Specification of robotics, Resolution, Repeatability and Accuracy of a manipulator.

**Robot Drives:** Power transmission systems, Control robot drive mechanisms, Hydraulic-electric-pneumatic drives. Mechanical transmission method, Rotary to rotary motion conversion, Rotary-to-linear motion conversion, End effectors, Remote-centered compliance, Devices control of actuators in robotic Mechanisms.

**Unit II**

**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.

**Unit III**

**Computer Vision for Robotics Systems:** Robot vision systems, Imaging components, Image representation, Hardware aspects, Picture coding, Object recognition, Categorization, Visual inspection, Software considerations, Applications, Commercial Robotics, Vision systems.

**Considerations for Robotic Systems:** Computer architecture for robots, Hardware, Computational elements in robotic applications, Robot programming, Sample programs path planning, Robot’s computer system.

**Unit IV**

**Transformations and Kinematics:** Homogeneous co-ordinates, Coordinate reference, Frames homogeneous, Transformations for the manipulator, The forward and inverse problem of manipulator kinematics, Motion generation, Manipulator dynamics, Jacobian in terms of D.H.Matrices, Controller architecture.

**Robot Cell Design and Control:** Specifications of commercial robots, Robot design, Process specifications, Motor selection in the design of a robotic joint, Robot cell layouts, Economic and social aspects of robotics

**RECOMMENDED 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.

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–669 SURFACE TREATMENT AND FINISHING**

**L T P/D Hrs. Internal Marks 40**

**4 0 - 4 External Marks 60**

**Time- 3 Hrs**

**Unit I**

**Surface Engineering:** Introduction to surface engineering, Scope of surface engineering for different engineering materials, Surface preparation methods such as chemical, Electrochemical, Mechanical, Sand blasting, Shot peening, Shot blasting, Hydro-blasting, Vapor phase degreasing etc., **S**urface integrity, Wear and its treatments, Lubricants and its selection for reducing wear, Principles of corrosion, Remedial measures, Laser application for surface modifications.

**Unit II**

**Surface Treatments:** Pretreatment of metal surface, chemical and mechanical methods of pretreatment, Surface treatment, electrochemical surface treatment of metals, Electrochemical surface treatment, Thermal surface treatment, radiative and flame surface treatment, Flame spraying, Detonation surface treatment, Spraying of molten metal, Arc spraying, Plasma spraying, Diffusion metal plating, Physical methods of creation of functional thin films, Vacuum evaporation and deposition, Chemical methods of creation of functional thin films, Surface pretreatment before deposition of thin films, Properties of thin films.

**Unit III**

**Surface Coatings**: Case hardening and surface coating, Thermal spraying, vapor deposition, Ion Implantation, Diffusion coating electroplating, Electro less plating, Electro forming, Ceramic, Organic and diamond coating.

**Unit III**

**Optical Measuring Instruments:** Tool maker’s microscope and its uses, Collimators, Optical projector, Optical flats and their uses, Interferometer.

**Flat Surface Measurement:** Measurement of flat surfaces, Instruments used Straight edges, Surface plates, Optical flat and Auto collimator.

**Unit IV**

**Surface Roughness Measurement:** Differences between surface roughness and surface waviness, Numerical assessment of surface finish, CLA,R, R.M.S Values, Rz value, Methods of measurement of surface finish, Profilograph, Talysurf, ISI symbols for indication of surface finish.

**RECOMMENDED 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 - MlR Publications.

5. Metals Hand Book – ASM.

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–671 COMPOSITE MATERIALS**

**L T P/D Hrs. Internal Marks 40**

**4 0 - 4 External Marks 60**

**Time- 3 Hrs**

**Unit I**

**Introduction:** Definition of composites material, Classification based on matrix and topology, Constituents of composites, Interfaces and interphases, Distribution of constituents, Hybrid and Nano-composites.

**Performance of Structural Composites:** Combination effects(Summation, complementation and interaction), Basic analytical concepts (Qualitative black box approach and quantitative analytical approach), Performance analysis by various models (Law of mixtures, Shear lag model, Laminated plate model, Eshelby’s models and other models, Thermoelasticity, Plasticity and creep), Strengthening mechanisms, Stress distribution in fibre, The matrix (shear stress and axial tensile stress in the fibre along its length), Critical length of fibre for full strengthening, Analysis of uniaxial tensile stress-strain curve of unidirectional continuous, Short fibre composites, Estimation of the required minimum amount of fibre, Critical amount of fibre to gain a composite strength, Analysis of strength of a composite during loading at an angle to the fibres, Nano-structured composites.

**Unit II**

**Performance of Composites in Nonstructural Applications:** Composites in electrical, superconducting and magnetic applications, Nano-composite devices.

**Fabrication of Composites:** Fabrication of metal matrix composites, Commonly used matrices, Basic requirements in selection of constituents, Solidification processing of composites, XD process, Spray processes, Osprey Process, Rapid solidification processing, Dispersion processes, Stir-casting, Compocasting, Screw extrusion, Liquidmetal impregnation technique, Squeeze casting, Pressure infiltration, Lanxide process, Principle of molten alloy infiltration, Rheological behavior of meltparticle slurry, Synthesis of In situ Composites, Fabrication of polymer matrix composites, Commonly used matrices, Basic requirements in selection of constituents, Moulding method, Low pressure closed moulding, Pultrusion, Filament winding, Fabrication of ceramic matrix composites, Various techniques of vapour deposition, Liquid phase method, Hot pressing, Fabrication of nano-composites

**Unit III**

**Characterization of Composites:** Control of particle/fibre, Porosity content, particle/fibre distribution, Interfacial Reaction of matrix-reinforcing component, Coating of reinforcing component, Strength analysis.

**Secondary Processing and Joining of Composites:** Forging and extrusion of composites, Critical issues, Dynamic recovery, Dynamic recrystallization, Mechanical properties, Induction Heating, Fusion bonding, Ultrasonic welding, Gas tungsten arc welding, Gas metal arc welding, Resistance spot & seam welding, Resistance brazing, Resistance spot joining, Resistant spot brazing, Resistance welding of thermoplastic graphite composites, Weld bonding, Brazing of MMC.

**Unit IV**

**Industrial Application of Composites Materials** : Civil constructions of structures/pannels, Aerospace industries, Automobile and other surface transport industries, Packaging industries, House hold and sports components etc.

**Fracture & Safety of Composites:** Fracture behavior of composites, Mechanics and weakest link statistics, Griffith theory of brittle fracture and modification for structural materials, Basic fracture mechanics of composites (Fracture toughness, COD and J-integral approaches, Fatigue crack growth rate), Fracture mechanics of brittle matrix fibre composites, Fracture mechanics of metal matrix, Fibre composites, Experimental evaluation (composites), Elementary reliability analysis.

**RECOMMENDED BOOKS:**

1. Composites Materials Handbook - Mein Schwartz - Mc Graw Hill Book Company - 1984.

2. Mechanics of Composites Materials – AutarK.Kaw - CRC Press New York - 1st edition, 1997.

3.Analysis and performance of fiber composites- BD Agarwal, LJ Broutman and K. Chandrashekhara, Wiley Pub.

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–673 INDUSTRIAL SAFETY LAWS AND PATENT ACTS**

**L T P/D Hrs. Internal Marks 40**

**4 0 - 4 External Marks 60**

**Time- 3 Hrs**

**UNIT-I**

**Industrial Safety Management**: Evolution of modern safety concept, Safety policy, Safety Organization, Line and staff functions for safety, Safety committee, Budgeting for safety.

**Techniques**: Incident recall technique (IRT), Disaster control, Job safety analysis (JSA), Safety survey, Safety inspection, Safety sampling, Safety Audit.

**UNIT-II**

**Accident Investigation and Reporting:** Concept of an accident, Reportable and non reportable Accidents, Unsafe act and condition, Principles of accident prevention, Supervisory role, Role of safety committee, Accident causation models, Cost of accident, Overall accident investigation process, Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, Functions of investigator, Four types of evidences, Records of accidents, Accident reports- Class exercise with case study.

**UNIT-III**

**Regulations for Health, Safety and Environment:** Factories act and rules, Workmen compensation act, Indian explosive act, Gas cylinder rules, SMPV Act, Indian petroleum act and rules, Environmental pollution act Manufacture, Storage and import of hazardous chemical rules 1989, Indian electricity act and rules, Overview of OHSAS 18000 and ISO 14000

**UNIT-IV**

**Intellectual Property Right**: Introduction to IPR, Patents and methods of application of patents, Trade secret copyrights, Trademarks, Legal implications, Intellectual property issues in cyber space, Cyber laws, Law of digital contracts, Role and function of certifying authorities, Legal implications, Trade secret copyrights, Trademarks, Copyright and related rights under existing and prospective treaties and conventions (particularly Berne, WIPO Treaties, TRIPs), WTO, dispute settlement and TRIPs.

**RECOMMENDED BOOKS:**

1.The Factories Act 1948, Madras Book Agency, Chennai, 2000 M. Tech. (Industrial Safety Engineering) Department of Mechanical Engineering, National Institute of Technology, Tiruchirappalli – 620 015.

2. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.

3. N.R. Subbaram, “Patent law – Practices and Procedures”, Wadhwa, Second Edition, 2007

4. “Accident Prevention Manual” – NSC, Chicago, 1982.

5. “Occupational safety Manual” BHEL, Trichy, 1988.

6. “Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989. 4. “Safety in Industry” N.V. Krishnan JaicoPublishery House, 1996.

7. Accident Prevention Manual for Industrial Operations”, N.S.C.Chicago, 1982.

8. Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York, 1980.

9. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay, 1997

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–675 MECHANICAL WORKING OF MATERIALS**

**L T P/D Hrs. Internal Marks 40**

**4 0 - 4 External Marks 60**

**Time- 3 Hrs**

**UNIT-I**

**Metal Forming Technology:** Metallurgical aspects of metal forming, slip, twinning mechanics of plastic deformation, effects of temperature, strain rate, microstructure and friction in metal forming-yield criteria and their significance, Classification of Metal Forming Processes, Advantages and Limitations, Stress strain relations in elastic and plastic deformation, concept of flow stresses, deformation mechanisms, Hot and Cold Working Processes and Its Effect on Mechanical Properties.

**UNIT-II**

**Forging Processes**: Introduction and Classification, operation and principle of Forging Processes and Equipment, Methods of forging, Open and Close Die Forging Processes, Defects, Structure and Properties of Forged Products. Force Analysis in forging. Other Related Processes like Cold Heading, Rotary Swaging, Sizing, Coining, Embossing and Roll Forging, Homogeneous upsetting, Analysis of plane strain, Upset forging of rectangular billet , Upsetting of rectangular plate-analysis, Analysis of Axi-symmetric forging of a disk, Axi-symmetric forging of a disc-analysis, Forging die design, Forging defects, Forging die-design aspects, Forging defects, Introduction to powder forging.

**UNIT-III**

**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, Analysis of Wire Drawing Process and Load Calculations.

**Sheet Metal Forming:** Principle, process parameters, equipment and application of the following processes: spinning, stretch forming, plate, V and edge bending, Curling, Ironing, Roll Bending, Metal Spinning. Press brake forming, explosive forming, Hydro forming, electro hydraulic forming, and magnetic pulse forming, High Velocity forming of metals and High energy Rate forming.

**UNIT-IV**

**Extrusion**: Introduction and Classification, Extrusion Equipment, Forces in extrusion, Analysis of Extrusion Process, Extrusion of components including Seamless Pipes and Tubes. Extrusion of pipes by cold working, Other Related Processes like Impact Extrusion, Hydrostatic Extrusion, Piercing, Drawing, cupping and bending.

**Rolling:** Introduction and Classification, Types of Rolling Mills, Forces and Geometrical Relationships in Rolling, Calculation of Rolling Load, Roll Pass Design, Defects in Rolled Products, Residual stresses in rolled products, Other Related Processes like Roll Piercing, Ring Rolling, Pipe and tube production by rolling processes.

**RECOMMENDED BOOKS:**

1. Mechanical Working of Metals- Theory and Practice Harris J.N

2. Engineering Metallurgy and Higgens - ELBS/EA

3. Mechanical MetalIurgy - Dieter G.E. - Mc Graw Hill Publications.

5. Principles of Metal Working - R.Rowe - Amold London – 1965.

6. Metals Handbook – ASM - Volume II -.ASM

7. Fundamentals of working of Metals - Sach G. - Pergamon Press.

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–677 INTELLIGENT MANUFACTURING SYSTEMS**

**L T P/D Hrs. Internal Marks 40**

**4 0 - 4 External Marks 60**

**Time- 3 Hrs**

**UNIT-I**

**Scope of Machine Intelligence**: Modeling and control of processes and machines, Machine learning for system modeling from incomplete, Ambiguous information, Neuro fuzzy expert systems for uncertain reasoning, Concept learning, Associative memory, Connectionist learning systems, Data abstraction in parallel distributed architectures, Model based optimizations using evolutionary algorithms, Genetic algorithms.

**UNIT-II**

**Sensors in Intelligent Manufacturing Systems**: Sensor-based Robotic systems for assembly, welding, Machining, mobile robots, Task level planning, Path planning, Multi-sensor integration for environmental interaction and Error recovery.

**UNIT-III**

**Principles and Applications of Sensors**: Displacement, Force, Tactile, Temperature, Acoustic, Vision, Range sensors, Visuo-motor coordination, Navigation problems, Intelligent structures, Behavioural approach and subsumption architecture for learning from environment.

**UNIT-IV**

**Design, Analysis and Manufacturing issues of Smart Structures:** Analysis, Manufacturing, Application issues involved in integrating smart materials and devices with signal processing, 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.

**RECOMMENDEDBOOKS:**

1. The Assurances Sciences - Halpern, Seigmund - Prentice Hall International, New Jersey, U.S.A - 1978.

2. Robots manufacturing and application -Paul Afonh, John Wiley.

3. Logistics Engineering and Management - Blanchard, Bejamin S. - Prentice Hall International, New Jersey, U.S.A – 1986.

4. Smart Materials and Structures- M. V. Gandhi and B. So Thompson - Chapman & Hall, London; New York - 1992.

5. Robotic technology and flexible automation -S.R Deb, TMH

6. Smart Structures and Materials-B. Cui shaw-Artech House,Boston, - 1996.

7. Smart Structures: Analysis and Design-V. Srinivasan -Cambridge University Press, Cambridge; New York - 2001.

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–679 APPLIED PROBABILITY AND STATISTICS**

**L T P/D Hrs. Internal Marks 40**

**4 0 - 4 External Marks 60**

**Time- 3 Hrs**

**UNIT-I**

**Introduction to Statistics**: Statistical thinking, Collecting data, Statistical modeling frame work, Measure of central tendency, Variance, Importance of data summary and display, Tabular and graphical display.

**UNIT-II**

**Discrete Random Variables and Probability Distribution**: Discrete random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean, 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.

**UNIT-III**

**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.

**UNIT-IV**

**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 randomized block design (CBD) and Randomized block design (RBD)

**RECOMMENDED BOOKS:**

1. Applied statistics and Probability for Engineers – Douglas C Montgomery, George C Runger, 2nd Edn, John Wiley and Sons, ISBN-0-471-17027-5, 1999.

**2.** Statistics for Management - Richard I Levin, David S Rubin, 6thEdn, Prentice Hall India, ISBN-81-203-0893-X.

**3.** Probability and Statistics in Engineering - William W Hines, Douglas C Montgomery - John Wiley and Sons - 2nd Edition.

**4.** Business Statistics for Management and Economics - Daniel, Terrell - Houghton Mifflin Company - 6th Edn, ISBN-0-395-62835-

**5**. Probability and Statistics - by Walpole & Mayer – MacMillan Publishing Company - 1989.

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–681 INDUSTRIAL DESIGN AND ERGONOMICS**

**L T P/D Hrs. Internal Marks 40**

**4 0 - 4 External Marks 60**

**Time- 3 Hrs**

**UNIT-I**

**Introduction:** An approach to industrial design, Elements of design, Structure for industrial design in engineering application in modem manufacturing systems**.**

**Ergonomics and Industrial Design**: Introduction, General approach to the man-machine relationship, Workstation design, Working positions.

**UNIT-II**

**Control and Displays:** shapes and sizes of various controls and displays multiple displays, Control situations, Design of major controls in automobiles, Machine tools, 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.

**UNIT-III**

**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, Colour continuation, Colour on engineering equipments**.**

**UNIT-IV**

**Aesthetic Concepts:** Concept of unity, Concept of order with variety, Concept of purpose style and environment, Aesthetic expressions, Stylecomponents 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.

**RECOMMENDED 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.

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–683 HUMAN RESOURCE MANAGEMENT**

**L T P/D Hrs. Internal Marks 40**

**4 0 - 4 External Marks 60**

**Time- 3 Hrs**

**UNIT-I**

**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.

**UNIT-II**

**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.

**UNIT-III**

**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.

**UNIT-IV**

**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

**RECOMMENDED 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 - BiswajeetPattanayak – Prentice Hall of India Pvt. Ltd.

4. Personnel Management - C.B.Memoria - Himalaya Publishing

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (3rd Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–663 SYNOPSIS OF DISSERTATION**

**L T P/D Internal Marks :100**

**- - - External Marks ---**

**Total :100**

The students are required to initially work on Literature survey/ problem formulation / adopted methodology/ Industry selection/ etc. on some latest areas of Manufacturing Science and Engineering or related fields.

The students will be required to submit a synopsis report duly signed by their respective supervisors to the department, related to their dissertation work in the first week of November. The synopsis report must be at least of 3-4 pages and the cover page should include the tentative topic, name of the candidate, name of the supervisor, signature of candidate and supervisor. The students will be required to appear for comprehensive seminar & viva-voce. The synopsis report will be submitted in the same format as that of the thesis and will contain the following:

1. Introduction

2. Literature Survey

3. Gaps in Literature

4. Objectives of the Proposed Work

5. References

\* Student will choose his/her guide in the beginning of third semester

**(4th semester)**

**MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (4th Semester)**

**(MANUFACTURING SCIENCE & ENGINEERING)**

**MTMSE–664 DISSERTATION**

**L T P/D Internal Marks: 100**

**- - - External Marks: 200**

**Total: 300**

The students are required to undertake Analytical/Experimental/computational investigations in the field of Manufacturing Science and Engineering. or related fields which have been finalized in the third semester. They would be working under the supervision of a faculty member.

The final dissertation will be submitted in the end of semester. At least one publication is expected before final submission of the dissertation from every student in peer reviewed referred journals from the work done by the student in their dissertation. Every dissertation will be evaluated by the joint PG evaluation Committee of the respective college, guide, an expert from the university campus and another external expert from outside the University. The external examiner will be appointed by the University.