MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)

SEMESTER-I	Subject	L	T	P/D	Total	Internal marks	External marks	Cr.
MTIP-611	Advanced Welding Processes	4		-	4	40	60	4
MTIP-613	Product Design & Development	4		-	4	40	60	4
MTIP-615	Computer Aided Design and Manufacturing	4		-	4	40	60	4
MTME-717	**Advanced Engineering Material (Common with Thermal)**	4		-	4	40	60	4
MTIP-619	Maintenance & Reliability Engineering	4		-	4	40	60	4
MTIP-621	CAD/CAM Lab	-	-	2	2	40	60	1.0
					Total	**240**	**360**	**21**

SEMESTER-II	Subject	L	T	P/D	Total	Internal marks	External marks	Cr.
MTIP-612	Non Conventional Machining	4		-	4	40	60	4
MTIP-614	Industrial Automation And Robotics	4		-	4	40	60	4
MTME-716	**Metrology and Computer Aided Inspection (Common with Thermal)**	4		-	4	40	60	4
MTME-718	**Management Information System (Common with Thermal)**	4		-	4	40	60	4
MTIP-620	Mechatronics Lab	-	-	2	2	40	60	1.0
MTIP-622	Seminar	-	-	2	2	100		1.0
					Total	**300**	**300**	**18.0**

SEMESTER-III	Subject	L	T	P/D	Total	Internal marks	External marks	Cr.
-	Elective-I (I&P)	4	0	-	4	40	60	4
-	Elective-II (I&P)	4	0	-	4	40	60	4
MTIP-623	Project			8	8	40	60	4.0
MTIP-625	Dissertation (starts)	-	-	2	2	100	-	1.0
					Total	**220**	**180**	**13**

LIST OF ELECTIVES- I & II (INDUSTRIAL & PRODUCTION)		
1.	MTIP-627	Supply Chain Management
1.	MTIP-629	Finite Element Methods
2.	MTIP-631	Sequencing and Scheduling
3.	MTIP-633	Work Design and Ergonomics
4.	MTIP-635	Research Methodology and Optimization techniques
5.	MTIP-637	Strategic Entrepreneurship
6.	MTIP-639	Advanced Metal Casting
7.	MTIP-641	Simulation of Industrial Systems
8.	MTIP-643	Operations Management
9.	MTIP-645	Productivity Management
10.	MTIP-647	Advanced Metal Cutting

SEMESTER-IV	**Subject**	
MTIP-624	Dissertation	Report: Accepted/Rejected

INSTRUCTIONS FOR PAPER SETTER

1. The question paper is to be attempted in ***THREE Hours***.
2. Maximum Marks for the paper are ***60***
3. The syllabus for the course is divided into ***FOUR units***
4. The paper will have a total of ***NINE questions.***
5. **Question No. 1,** which is compulsory, shall be OBJECTIVE Type **and have content from the entire syllabus (all Four Units).**

   Q. No. 2 & 3 from Unit I

   Q. No 4 & 5 from Unit II

   Q. No. 6 & 7 from Unit III

   Q. No 8 & 9 from Unit IV
6. All questions will have equal ***weight of 12 marks*.**
7. The candidate will attempt a total of ***FIVE questions***, each of 12 marks. Q. No. 1 is compulsory. *The candidate shall attempt remaining* ***four*** *questions by selecting* ***only one question from each unit.***
8. A question may have any number of sections labeled as 1(a), 1(b), 1(c), 1(d), ---- 2(a), 2(b),-----. A section may further have any number of subsections labeled as (i), (ii), (iii),------.
9. **SPECIAL INSRUCTIONS FOR Q. No. 1 ONLY**

   Question No. 1, which is compulsory, shall be OBJECTIVE Type **and have content from the entire syllabus (all Four Units).**

   Emphasis is to be given on the basic concepts; analytical reasoning and understanding of the various topics in the subject This question may have a number of parts and/or subparts. The short questions could be combination of following types:

   i. Multiple Choice
   ii. Yes/ No choice
   iii. Fill in Blanks type
   iv. Short numerical computations
   v. Short Definitions
   vi. Matching of Tables

   The above mentioned question types is **only a Guideline**. Examiner could set the question as per the nature of the subject.

1st Semester

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (1st semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–611 ADVANCED WELDING PROCESSES

L	T	P/D	Cr.
4	0	-	4

UNIT-I

WELDING METALLURGY: Introduction, Weld Metal Zone, Theory of solidification of metals and alloys, Homogeneous Nucleation, Heterogeneous Nucleation, Freezing of alloys, Epitaxial Solidification; Effect of Welding speed on Grain structure, Fusion boundary zone, Heat affected zone, Underbead zone, Grain Refined Zone, Partial transformed zone, Properties of HAZ

WELDING ARC: Definition of Arc, Structure and characteristics, Arc efficiency, arc blow , Electrical Characteristics of arc, , Types of Welding Arcs, mechanism of arc initiation and maintenance, role of electrode polarity on arc behavior and arc stability, analysis of the arc. Arc length regulation in mechanized welding processes.

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UNIT-II

WELDING POWER SOURCES: Requirement of an Arc welding power sources, basic characteristics of power sources for various arc welding processes, duty cycles, Selection of a static Volt-Ampere characteristic for a welding process, AC/DC welding power source, DC rectifiers, thyristor controlled rectifiers, transistorized units, inverter systems, Mathematical Problems on Static volt ampere characteristics

.

UNIT-III

COATED ELECTRODES: Electrode coatings, classification of coatings of electrodes for SMAW, SAW fluxes, role of flux ingredients and shielding gases, classification of solid and flux code wires.

METAL TRANSFER & MELTING RATE: Mechanism and types of metal transfer, forces affecting metal transfer, modes of metal transfer, metal transfer in various welding processes, effective of polarity on metal transfer and melting rate.

UNIT-IV

SOLID STATE WELDING: Theory and mechanism of solid state welding. Techniques and scope of friction welding, diffusion welding, cold pressure welding and ultrasonic welding. High energy rate welding. Analysis of the Process.

WELDING TECHNIQUES: Technique, scope and application of the electron beam and laser welding processes. Under water welding - process & problem.

RECOMMENDED BOOKS :

1. R.S.Parmar, “Welding processes & Technology”, Khanna Publishers.
2. S.V. Nandkarni, “Modern Arc Welding Technology”, Oxford & IDH publishing Co.
3. L.M.Gourd, “Principles of Welding Technology”, ELBS/ Edward Arnold.
4. Richard L. Little, “Welding & Welding Technology”, Mc-Graw Hill.
5. Rossi, “Welding Technology”, Mc-Graw Hill.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (1st semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP-613: PRODUCT DESIGN & DEVELOPMENT

L	T	P/D	Cr.
4	0	-	4

UNIT-I

INTRODUCTION: Introduction to Product Design, Design by Evolution and Innovation, Essential factors of product design, Production consumption cycle, Flow and value addition in Production consumption cycle.

FUNCTIONAL & AESTHETICS CONSIDERATION: Basic design considerations, Role of Aesthetics in product design, Basic concept and elements of Visual design, Functional design practice.

UNIT-II

MANUFACTURING CONSIDERATION: Producibility Requirements in the design of machine components, Forging design, Pressed component design, Design for machining, Ease of location and Clamping, Some additional aspects of production design, Design of powder metallurgical parts, Redesigning on basis of production consideration.

LEGAL & ECONOMIC CONSIDERATIONS: Product value, Design for safety, reliability and Environmental considerations, Economic analysis, profit and competitiveness, break even analysis, Economics of a new product design, Concurrent Design, Quality function deployment, Reverse engineering.

UNIT-III

VALUE ENGINEERING: Value, Nature and measurement of value, Maximum value, Normal degree of value, Importance of value, The value Analysis Job Plan, Creativity, Steps to problem solving and value analysis, Value Engg., Idea generation check list, Cost reduction, materials and process selection in value engineering.

UNIT-IV

PRODUCT DEVELOPMENT: Definition and Objective, Role of designer in product development, Manufacturing & economic aspects of product development, Product promotion & development.

RECOMMENDED BOOKS :

1. Kail T Ulrich and Steven D Eppinger, “Product Design and Development.”
2. AK Chitale and Gupta, “Product Design and Engineering”
3. Niebel & Draper, “Product Design and Process Engineering”
4. Middendorf Marcel Dekker, “Design of Systems and Devices”

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (1st semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–615 COMPUTER AIDED DESIGN AND MANUFACTURING

L	T	P/D	Cr.
4	0	-	4

Unit I

Fundamentals of CAD: Introduction, Design Process, Application of computers in design, Creating manufacturing database, Benefits of CAD. Computer Hardware, Graphic input devices, display devices, Graphics output devices, Central processing unit (CPU).

Geometric transformations: 2D and 3D; transformations of geometric models like translation, scaling, rotation, reflection, shear; homogeneous representations, concatenated representation; Orthographic projections, Numerical Problems

Unit II

Introduction to Manufacturing
Basic definitions, design activities for manufacturing systems, Planning and control activates for manufacturing system, Manufacturing control, Types of production – low, Medium and high quantity production.

Group Technology and Cellular Manufacturing
Part families, parts classifications and coding, Production flow Analysis, cellular Manufacturing-composite part concept, machine cell design, applications of group technology, Grouping parts and machines by Rank order clustering technique, Arranging machines in a G.T. cell.

Unit III

Process Planning
Introduction, Manual process planning, Computer aided process planning – variant, generative, Decision logic- decision tables, decision trees, Introduction to Artificial intelligence.

Flexible Manufacturing
Introduction, FMS components, Flexibility in Manufacturing – machine, Product, Routing, Operation, types of FMS, FMS layouts, FMS planning and control issues, deadlock in FMS, FMS benefits and applications. Rapid Prototyping.

Unit IV

CNC Basics and Part Programming
Introduction, Principle of CNC, Classification of CNC/NC – point to point and continuous path, positioning system- fixed zero and floating zero, Dimensioning- absolute and incremental, Coordinate system, Basic requirements of CNC machine control, CNC/NC words, Manual part programming, (G&M codes only) canned cycles, tool length and radius compensation.

RECOMMENDED BOOKS:

1. **Chris McMahon and Jimmie Browne**, CAD/CAM – Principle Practice and Manufacturing Management, Addision Wesley England, Second Edition, 2000.
2. **Ibrahim Zeid**, CAD/CAM theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
3. **Ibrahim Zeid**, Matering CAD/CAM, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. **Rogers, D.F. and Adams, A**., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989
5. **P.Radhakrishnan, S.Subramanayan and V.Raju**, CAD/CAM/CIM, New Age International (P) Ltd., New Delhi.
6. **Groover M.P. and Zimmers E. W.**, CAD/CAM: Computer Aided Design and Manufacturing,Prentice Hall International, New Delhi, 1992.
7. **Dr. Sadhu Singh**, Computer Aided Design and Manufacturing, Khanna Publishers, New Delhi, Second Edition, 2000.
8. Automation, Productions systems and Computer-Integrated Manufacturing by **M.P. Groover**, Prentice – Hall
9. Computer Aided Manufacturing by Chang, Wang & WySK
10. **Kubdra** & **Rao**, Numerical Control and Computer – Aided Manufacturing by, Rao and Tiwari, Tata Mc-Graw Hill.
11. **Mattson**, CNC programming Principles and applications ,Cengage Learning India Pvt. Ltd. Delhi

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMMON)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTME–717 ADVANCED ENGINEERING MATERIAL

L	T	P/D	Cr.
4	0	-	4

UNIT-I

Introduction: Definition of composite material, Classification based on matrix and topology, Constituents of composites, Interfaces and Interphases, Distribution of constituents, Nano-composites, Stitched composites, 3D composites. Introduction to fibrous composites: Fibre, matrix: materials, properties and fabrication processes, types/classification of composites, fabrication methods of composites, advantages and applications.

UNIT-II

Nano materials and Nano manufacturing: Structural size and its importance, Bulk nano structured materials by Severe Plastic Deformation (SPD), Unique features of SPD and properties, Nanostructured Materials Prepared by Solid State Processing, Properties, benefits and application of nano crystalline microstructures in structural materials.

UNIT-III

Introduction and Elevated temperature characteristics of engineering materials. High temperature creep, thermal and thermo-mechanical fatigue of structural alloys. Super-alloys: their processing, high temperature mechanical properties, corrosion behavior, micro-structural degradation behavior of super alloys. Application of super alloys and elevated temperature alloys.

UNIT-IV

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 and Hot pressing etc., Fabricationof nano-composites.

RECOMMENDED BOOKS ::

1. Nanocomposite Science and Technology, P. M. Ajayan, L. S. Schadler, P.V. Braun, (2003), Wiley-VCH Verlag GmbH Co. KGaA, Weinheim.
2. Advances in composite materials, G. Piatti, (1978) Applied Science Publishers Ltd., London.
3. Ceramic matrix composites, K.K. Chawala, 1st ed., (1993) Chapman & Hall, London. Analysis and Performance of Fiber Composites - BD Agarwal, L JBroutman and K Chandrashekhara
4. Nanostructured materials: basic concepts and microstructureby HGleiter, ActaMaterialia, 2000 – Elsevier
5. Materials Science in Manufacturing by R. Asthana, A. Kumar and N. Dahotre Butterworh-Heinemann, Elsevier
6. Composite materials, K.K. Chawala, 2nd ed., (1987) Springer-Verlag, NewYork.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (1st semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–619 MAINTENANCE AND RELIABILITY ENGINEERING

L	T	P/D	Cr.
4	0	-	4

UNIT-I

Maintenance in context: maintenance and profitability, terro-technology, application of terro-technology.

Principles: the structure of plant, reason for nature of maintenance work, the production maintenance system a dynamic model.

Establishing a maintenance plan-preliminary consideration: items, classification of items, maintenance procedure, guidelines for machine procedures to items.

UNIT-II

Maintenance planning and control: Basic requirements, Management information, labour costs, computer based Management information system, work planning and work control, basic rules for success.

Introduction: Reliability concepts and patterns of failure, reliability Management, reliability for system effectiveness.

UNIT-III

Reliability and hazard rates: Failure data, reliability function, failure rate and hazard rate, common distributions in failure mechanisms – experimental, Welbull, gamma,

Normal, log normal, extreme value, model selection for components failure, failure analysis.

UNIT-IV

Reliability prediction and analysis: reliability prediction based on exponential distribution, system reliability analysis – block diagram method, fault tree and success tree methods, event tree method, failure model, failure mechanism.

Reliability design: Design for reliability, design process, assessment methodology, reliability allocation, reliability improvement, selection of components to improve system reliability.

RECOMMENDED BOOKS:

1. Industrial Engineering and Management Khanna O.P Dhanpat Rai & Sons 1994
2. A textbook of Reliability and Maintenance Engineering by Dr. Alakesh Manna, I K International.
3. Maintenance Planning and Control, Kelly A Buttersworth & Co. 1984
4. Maintenance and Spare parts Management, Krishnan G. Prentice Hall 1991
5. Reliability Engineering and Technology, Gupta, A.K Macmillan India Ltd. 1996
6. Introduction to Reliability Engineering Lewis E.E John Willey & Sons
7. Reliability Engineering, Srinath L.S., East West Press 1991

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (1st semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–621 CAD/ CAM LAB

L	T	P/D	Cr.
-	-	2	1

List of Experiments:

The students will be required to carry out the following exercises using software packages (e.g. Solidwork, Pro Engineer/ Ideas/ Solid Edge, CATIA etc.).

1. Implement simple programmes for the graphics representation of
   (i) Transformation and projections.
   (ii) Conic Sections, cubic splines, and B-splines.
   (iii) Surfaces- Bilinear, Bicubic surface patch and Bezier surface.

2. CAD Modelling Assignments.
   (i) Construction of simple machine parts and components.
   (ii) Modelling of machine components.
   - Surface of a Diffuser section, Propeller.
   - Gear blank and other mechanical parts.
   - Mechanical assembly of parts.

2nd Semester

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (2nd Semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–612 NON-CONVENTIONAL MACHINING

L	T	P/D	Cr.
4	0	-	4

Unit I

New Technology: Introduction, Mechanical Processes, Abrasive jet Technology, Ultrasonic machining, whirling jet machining. Fundamental principles, process parameters, characteristics, Tool design, Metal removal rate-analysis, important part design, Analysis of the Process.

Unit II

Electrochemical and Chemical Processes: ECM: Process principle, Analysis of material removal, dynamics of ECM Process, of operation, etch ants and mask ants, photochemical process, equipment, applications. tool design, applications.; ECG; Electro stream Drilling; Electrochemical Deburring; Chemical Machining: equipment, applications, Electoplating of Plastic Component.

Unit III

EDM: Introduction-basic principles & scheme, circuitry controls, metal removal rate, machining accuracy, optimisation, selection of tool material and tool design, Di-electric, Analysis. Electric Discharge Diamond Grinding; Wire EDM, applications;

Unit IV

Laser Beam Machining & Electron beam machining, Back ground, production of Laser, machining by Laser and other applications, Electron beam action, Dimensionless analysis to establish correlation, behaviour EBM parameters.
High Velocity forming of metals, explosive forming principles and applications, Electro-hydraulic and other applications, Analysis of the process.

RECOMMENDED BOOKS:

1. Advanced Machining Processes by V.K. Jain. Allied Publishers Pvt Ltd
2. Modern Machining Processes by P.C. Pandey and H.S. Shan. Tata McGraw- Hill

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (2nd Semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–614 INDUSTRIAL AUTOMATION AND ROBOTICS

L	T	P/D	Cr.
4	0	-	4

Unit I

Programmable Manufacturing Automation: CNC machine tools, Machining centres, Programmable robots, Robot time estimation in manufacturing operations.
Flexible Manufacturing Automation: Introduction to Group Technology, Grouping methods, Cell Design, Flexible manufacturing system.

Unit II

Assembly Automation: Assembly systems, Automatic transfer, feeding and orienting devices, Flexible assembly systems, Performance evaluation and economics of assembly systems
Robotics: Review of robotic technology and applications, Laws of robotics, Robot systems and anatomy, Robot classification, End Effectors, Robot kinematics, Object location, Homogeneous transformation, Direct and inverse kinematics, Manipulator motions

Unit III

Robot drives, actuators and control, Drive systems, Hydraulic, Pneumatic Electrical DCand AC servo motors and stepped motors, Mechanical transmission method-Rotary-to-rotary motion conversion, Robot motion and path planning control and Controllers, Robot sensing, Range sensing, Proximity sensing, touch sensing, Force and torque sensing etc., Robot vision, Image representation, Image recognition approaches.

UNIT-IV

Robot Applications: Robot applications in manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Robot cell design and control, Robot cell layouts-Multiple robots & Machine interference, Economics and social aspects of robotics, Future applications.

RECOMMENDED BOOKS ::

1. Automation, Production System & Computer Integrated by Groover Prentice Hall India Manufacturing
2. Principles of Automation & Automated Production Process Malov and IvanovMir Publication
3. Automation in Production Engineering Oates and Georgy Newness
4. Stochastic Models of Manufacturing Systems Buzacott& shanty Kumar, Prentice Hall India
5. Robotics K.S. Fu, R.C. Gonzalez, C.S.G. Lee ,McGraw Hill
6. Robotics, J.J. Craig Addison-Wesely
7. Robot Engineering: An Integrated Approach R.D. Klafter, t.a. Prentice Hall India, Chmielewski and M. Negin

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (2nd Semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTME–716 METROLOGY AND COMPUTER AIDED INSPECTION
(COMMON WITH THERMAL)

L	T	P/D	Cr.
4	0	-	4

Unit I

Standards of Measurement: Line, End and Wavelength standards. Primary secondary and working standards. Limits, Fits & tolerances, Interchangeability, design & manufacture of gauges, use of slip gauges, dial indicators, sine bars, auto-collimators, taper gauges, optical projectors and microscopes, straightness, flatness and square ness testing.

Unit II

Instruments for Measuring Surface finish & Roughness: Classes of instruments, the Taylor-Hobson telesurf, plastic replica techniques, numerical assessment of roundness.
Calibration of Working Standards by Interferrometry : Application of interferometry, calibration of gauges by interference, by interference method, the gauge length interferometer, obliquity correction the absolute length gauge interferometer.

Unit III

The Calibration of working standards by direct comparison in series: Different types of comparators such as the pneumatic, optical, electrical and electronic comparators principle of amplification magnification, sensitivity and response, the calibrations of end gauges in sets, ruling and calibration of standard scales.

Unit IV

Measurement of Gear and Screw Threads: Measuring methods for run out, pitch, profile, lead, backlash, tooth thickness, composite elements, inspection equipment quality control screw thread terminology, measurement over wires, one wire measurement, three wire measurement, standard specifications and formulas, tolerances, thread gauge measurement, measurement, measuring equipment, application of thread gauges.

Management of Inspection and quality control : Communication of specifications, the nature of dimensions, selection of gauging equipment, kind of inspection, quality control Management

RECOMMENDED BOOKS:

1. Metrology and Measuring Instruments - Taher
2. Dimensional Metrology - Miller
3. Dimensional Metrology - Khare & Vajpayee
4. Engineering Metrology - R.K.Jain
5. Engineering Metrology - IC Gupta
6. Industrial Inspection Methods - Michelon, Leno C. Harper & Brothers, NY 1950
7. The Science of Precision Measurement - The DoALL Co, Des Plaines Illinois.
8. Inspection & Gauging - The Industrial Press New York, 1951.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (2nd Semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTME–718 MANAGEMENT INFORMATION SYSTEMS
(COMMON WITH THERMAL)

L	T	P/D	Cr.
4	0	-	4

Unit I

Introduction: Meaning and definition of Management Information (MIS) – System Approach – role of MIS to face increased complexity of business and management – system view of business – MIS organization within the company.

Conceptual information system design: Defining the problems – Setting system objectives – Establishing system constraints – Determining information needs – Determining information sources – Developing alternate conceptual design and selecting the most preferred one – Documenting the conceptual design – preparing the conceptual Design report.

Unit II

Detailed information system design: Informing and involving the organization – Project Management of MIS – Detailed – Design – Identifying dominant and trade-off criteria – subsystems – definitions – sources – sketching the details and information flows – automation – Informing and involving the organization again – Inputs, outputs and processing Early system testing – organization to operate the system – Documentation – Revisiting the manager – user.

Unit III

Evolution of information systems: Basic information Systems – Financial information systems – Production / Operations systems – Marketing information Systems – Personal information systems.
Information systems and decision making: Decision making and MIS – Programmed and non programmed decision – MIS for making programmed decisions – decision – assisting information systems – components of decision support systems.

Unit IV

Information technology and MIS: Comparison of manual and computer based information systems – conversation of manual to computer – based systems – types of computer based applications in MIS – conceptual design of computer integrated security management Information system – application of multimedia, internet and intranet technologies in MIS.

RECOMMENDED BOOKS:

1. Murdick R.G., Ross J. E & Claggett. J. R., Information Systems for Modern Management". Prentice Hall of India Private Ltd., India, 3rd edition, 1992.
2. Henry C Lucas Jr., "The Analysis, Design and Implementation of Information Systems". McGraw Hill Company, New York 4th Edition 1992.
3. Burch J. E., Strater F. R & Grudnikski G., "Information Systems: Theory and Practice". John Wiley and Sons, New York, 1987.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (2nd Semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–620 MECHATRONICS LAB

L	T	P/D	Cr.
-	-	2	1

List of Experiments

1. To study and conduct exercises on PLC Simulator.
2. Control of conveyor manually and through programming, also programming using sensors and conveyor.
3. Control of X-Y position table manually and through programming.
4. To study and conduct exercises on Robotic simulation software.
5. To study and conduct exercises on Pneumatic & Electro-Pneumatic Training System.
6. To study and conduct exercises on Simulation Software for Pneumatic Components (P-Simulator).
7. To study and conduct exercises on Hydraulic and Electro-Hydraulic Training System.
8. To study and conduct exercises on Simulation Software for Hydraulic Components (H-Simulator).
9. To study and conduct exercises on Educational Robot Training System.

Note: At least eight experiments should be performed from the above list.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (2nd Semester)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–622 SEMINAR

L	T	P/D	Cr.
-	-	2	1.0

Students are required to deliver a seminar on some emerging areas of Industrial Engineering or related field.

The student will deliver a power point presentation for about 30 minutes in the seminar on any of the above topics. This will be followed by question answering session for about 10 minutes. The questions/queries on the topic will be asked by the teacher and class students. The students will also prepare a detailed report in MS word and after proper binding (spiral form) will submit it to the teacher concerned. The report is to be submitted at least one week prior to the presentation. The awards will be given according to the student's presentation, report submitted, topic of presentation and the discussion or question answering after the presentation.

3rd Semester

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–623 PROJECT

L	T	P/D	Cr.
-	-	2	1.0

The project is chosen by students in consultation with their academic advisor and industrial sponsor (if appropriate). Students are encouraged to approach industry for possible project with the view to future employment. They can do their project work on the following topics:

1. Design and build fixtures and tool holding devices
2. Analysis of welding joints/ casting defects etc.
3. Simulation and stochastic analysis
4. Implementation of JIT/TQM/Six sigma or any other quality concept in any service or manufacturing industry.
5. Reliability analysis in any industry
6. Any other advanced application related with Industrial and Production Engineering

At the semester end, the students will evaluate the project, consider refinements, diagnose problems, and recommend solutions. They will submit a final report and give a formal presentation to a group of Production & Industrial Engineering professionals.
They will be also evaluated by the external examiner based upon their work done during the semester.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–625 DISSERTATION (Start)

L	T	P/D	Cr.
-	-	2	1.0

A student is required to initially work on Literature survey/ problem formulation / adopted methodology/ Industry selection/ etc. on some latest areas of Industrial & Production Engineering or related field. Viva- voce must be based on the synopsis submitted by students related to the dissertation.

* Student will choose his/her guide in the end of second semester.

ELECTIVES

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–627 SUPPLY CHAIN MANAGEMENT

L	T	P/D	Cr.
4	0	-	4

Unit I

Introduction to Supply Chain Management (SCM): Concept of Logistics Management, Concept of supply management and SCM, Core competency, Value chain, Elements of supply chain efficiency, Flow in supply chains, Key issues in supply chain management

Unit II

Sourcing and Procurement: Outsourcing benefit, Importance of suppliers, Evaluating a potential supplier, Supply contracts, Competitive bidding and Negotiation, E-procurement

Unit III

Introduction to Inventory Management: Selective Control Techniques, MUSIC-3D systems, Various costs. Deterministic Models, Quantity Discounts - all units, incremental price; Sensitivity, Make-or-buy decisions.

Unit IV

Independent Demand Systems (Probabilistic Models): Q- system, P- system, Mathematical modelling under known stock out costs and service levels, Bullwhip effect, Information and supply chain trade-offs.

Decision making and application: Decision making in SC – Applications of SCM – ware house management system – product data management – E –Commerce – Reverse logistics –
Cases in Paper industry – Furniture industry.

RECOMMENDED BOOKS :

1. Chopra, S., and Meindl, P., Supply chain Management: Strategy, Planning and Operations. Second Edition, Pearson Education (Singapore) Pte. Ltd, 2004.

2. Simchi-Levi, D., Kaminsky, P., and Simchi-Levi, E., Designing & Managing the Supply Chain: Concepts, Strategies & Case studies. Second Edition, Tata McGraw-Hill Edition, 2003.

3. Doebler, D.W. and Burt, D.N., Purchsing and Supply Chain Management: Text and Cases, McGraw-Hill Publishing Company Limited, New Delhi, 1996.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–629 FINITE ELEMENT METHODS

L	T	P/D	Cr.
4	0	-	4

UNIT-I

GENERAL PROCEDURE OF FINITE ELEMENT METHOD
Basic concept of FEM, Engineering applications, Comparison of FEM with other methods of analysis, Discretization of the domain-Basic element shapes, discretization process, Interpolation polynomials, Selection of the order of the interpolation polynomial, Convergence requirements, Linear interpolation polynomials in terms of global and local coordinates, Formulation of element characteristic matrices and vectors-Direct approach, variational approach, weighted residual approach, Assembly of element matrices and vectors and derivation of system equations together with their solution.

UNIT-II

HIGH-- ORDER AND ISO-PARAMETRIC ELEMENT FORMULATIONS
Introduction, Higher order one-dimensional element, Higher order elements in terms of natural coordinates and in terms of classical interpolation polynomials, Continuity conditions, Iso-parametric elements, Numerical integration in one, two and three-dimensions.

UNIT-III

SOLID AND STRUCTURAL MECHANICS
Introduction, Basic equations of solid mechanics, Static analysis-Formulation of equilibrium equations, analysis of trusses and frames, analysis of plates, analysis of three-dimensional problems, analysis of solids of revolution, Dynamic analysis-Dynamic equations of motion, consistent and lumped mass matrices, consistent mass matrices in global coordinate system, Dynamic response calculation using FEM

UNIT-IV

APPLICATIONS AND GENERALISATON OF THE FINITE ELEMENT METHOD
Energy balance and rate equations of heat transfer, Governing differential equation for the heat conduction in three-dimensional bodies, Derivation of finite element equations for one-dimensional, two-dimensional, unsteady state and radiation heat transfer problems and their solutions, Solution of Helmholtz equation and Reynolds equation, Least squares finite element approach.

RECOMMENDED BOOKS :

1. The Finite Element Method in Engineering – S.S. Rao, Pub.- Pergamon Press.
2. Numerical Methods in Finite Element Analysis—Klaus-Jurgen Bathe and Edwar L. Wilson, Pub.-PHI.
3. The Finite Element Method – O.C. Zienkiewicz – McGraw-Hill
4. The Finite Element Methods for Engineers – K.H. Huebner – Wiley, New York

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–631 SEQUENCING AND SCHEDULING

L	T	P/D	Cr.
4	0	-	4

Unit I

Single machine models - Scheduling function and theory – scheduling problem: objectives, constraints – pure sequencing – performance measures, sequencing theorems - SPT, EDD sequence – minimization of mean flow time, mean tardiness etc – branch and bound algorithm –assignment model.

Unit II

Parallel machine models - Independent jobs, Minimizing make span.
Job shop models – dynamic job shop simulation.

Unit III

Flow shop models - Johnson's problem – Extension of Johnsons's rule for 3 machine problem – Jackson's method – algorithm – Palmer's method.

Unit IV

Other models - Scheduling of intermittent production: Resource smoothing – Giffler Thomson algorithm – Branch and Bound method – Scheduling of continuous production - Line balancing.

RECOMMENDED BOOKS :

1. Michael Pinedoo, Scheduling: theory, algorithms and systems, Prentice Hall, New Delhi, 1995.

2. King, J.R. Production planning and control, Pergamon International Library, 1975.

3. Kenneth R.Baker, Introdution to sequencing and scheduling, John Wiley and Sons, 1974.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–633WORK DESIGN AND ERGONOMICS

L	T	P/D	Cr.
4	0	-	4

Unit I

Introduction to work study - Productivity – scope of motion and time study - Work methods design.

Unit II

Motion study-process analysis – process chart – flow diagram – assembly process chart – man and machine chart – two handed process chart - Micro motion and memo motion study.

Work measurement and its methods.

Unit III

Work sampling – Determining time standards from standard data and formulas - Predetermined motion time standards – work factor system – methods time measurement, Analytical Estimation. Measuring work by physiological methods – heart rate measurement – measuring oxygen consumption– establishing time standards by physiology methods.

Unit IV

Motion economy- Ergonomics practices – human body measurement – layout of equipment – seat design - design of controls and compatibility – environmental control – vision and design of displays. Design of work space, chair table.

RECOMMENDED BOOKS :

1. Barnes, Raeph.m., “Motion and Time Study – Design and Measurement of Work “, John Wiley & sons, New York, 1990.
2. Mc.Cormick, E.J., “Human Factors in Engineering and Design”, Mc.Graw Hill.
3. ILO, “Introduction to Work study “, Geneva, 1974.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–635 RESEARCH METHODOLOGY AND OPTIMIZATION TECHNIQUES

L	T	P/D	Cr.
4	0	-	4

Unit I

Introduction to Research Methodology , Various Types of Techniques, Alternative approaches to the study of the research problem and problem formulation. Formulation of hypotheses, Feasibility, prepration and presentation of research proposal.
Introduction to Experimental Design, Taguchi Method, Concept of Orthogonal Array, Primary and Secondary data collection, S/N ratio, validation, Regression and correlation analysis. Tests of significance based on normal. t and chi square distributions. Analysis of variance.

Unit II

Edition, tabulation & testing of hypotheses, interpolation of results, presentation, styles for figures, tables, text, quoting of reference and bibliography. Use of software for statistical analysis like SPSS, Mini Tab or MAT Lab, Report writing, preparation of thesis, use of software like MS Office.

The course will include extensive use of software, reporting writing and seminars in tutorial class.

Unit III

Integer linear programming methods and applications, Introduction to integer non-linear programming, Basics of geometric programming.

Multi-objective optimization methods and applications, Formulation of problems – Separable programming and stochastic programming.

Unit IV

Introduction to Genetic algorithms, neural network based optimization and optimization of fuzzy systems, Evolutionary Algorithm and Ant Colony Optimisation techniques.

Note:- Some of the algorithm is used to be exercised using MAT LAB

RECOMMENDED BOOKS :

1. C.R Kothari, Research Methodology, Wishwa Prakashan
2. P.G Triphati, Research Methodology, Sultan Chand & Sons, N.Delhi
3. Fisher, Design of Experiments, Hafner
4. Sadhu Singh, Research Methodology in Social Sciences, Himalya Publishers
5. Kalyanmoy Deb, Optimization for Engineering design – algorithms and examples. PHI, New Delhi, 1995.
6. Singiresu S.Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1998.
7. Garfinkel, R.S. and Nemhauser, G.L., Integer programming, John Wiley & Sons, 1972.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–637 STRATEGIC ENTREPRENEURSHIP

L	T	P/D	Cr.
4	0	-	4

Unit I

Small Scale Industries
Definition and types of SSI's ; Role, scope and performance in national economy; Problems of small scale industries.

Industrial Sickness
Definition; Causes of sickness; Indian scenario, Government help; Management strategies; Need for trained entrepreneurs

Unit II

Entrepreneurship Development Programmes
Introduction, Origin of EDP's , Organizations involved in EDP's, Objectives of EDPs, Implementation of EDP's, Short comings of EDP's, Role in entrepreneurship development.

Step
Introduction, Origin, Status in India, Success and failure factors, Govt. polices and incentives, future prospects in India.

Unit III

Business Incubation
Introduction, Origin and development of business incubators in India and other countries, types of incubators, success parameters for a business incubator, Benefits to industries, institutes, government and society; future prospects. A few case studies (at least 2).

Unit IV

Special Aspects of Entrepreneurship
Entrepreneurship, Social entrepreneurship, International entrepreneurship, Rural entrepreneurship, Community Development, Women entrepreneurship.

Network Marketing
Introduction, E-business, E-commerce, E-auction, A basic internet e-business architecture, A multi tier e-business architecture.

RECOMMENDED BOOKS:

1. Strategic Entrepreneurship by P.K. Gupta, (Everest Publishing House)
2. Project Management – Strategic Design and Implementation by David Cleland (McGraw Hill)
3. Entrepreneurship-New Venture Creation by David H Holl (Prentice Hall of India)
4. Sustainable Strategic Management by Steed & Steed (Prentice Hall of India)
5. Marketing Management by Kotler (Prentice Hall of India)
6. Management of Technology by Tarek Khalil (McGraw Hill)
7. Engineering Economic Principles by Henry Steiner (McGraw Hill)

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–639 ADVANCED METAL CASTING

L	T	P/D	Cr.
4	0	-	4

UNIT-I

Structure of silica and different types of clays: bonding mechanism of silica – water-clay Systems. Swelling of clays, sintering adhesion and colloidal clay; silica grain shape and size distribution standard permeability, A.F.S. clay.

Characteristics, Ingredients and additives of moulding sand, core sands.

UNIT-II

Solidifications of Metals, nucleation, free energy concept, critical radius of nucleus. Nucleation and growth in metals and alloys. constitutional super cooling. Columnar equiacquiesced and dendritic structures. Freezing of alloys *centerline* feeding resistance. Rate of solidification, time of solidification, mould constant. Fluidity of metals, volumes redistribution.

Various moulding and casting processes, hot box, cold box process, investment, shell moulding, full mould process, die casting, ceramic shell mould, vacuum moulding etc.

UNIT-III

Riser design shape, size and placement. Effect of appendages on risering. Effective feeding distances for simple and complex shapes. Use of chills, gating design, filling time. Aspiration of gases. Top, bottom and inside gating. Directional solidifications stresses in castings. Metal mould reactions. Expansion scale and metal penetration.

UNIT-IV

Non-ferrous Die-casting of Aluminium and its alloys, brass and bronze.

Inspection and testing of casting i.e. visual, mechanical, ultrasonic, dye penetration, magnetic particle and x-ray., Casting Defects.

RECOMMENDED BOOKS:

1. Flimm, “Fundamentals of Metals Casting”, Addison Wesley.
2. Heine Loper and Resenthal, “Principles of Metal Casting”, Mc-Graw Hill.
3. Hielel and Draper, “Product Design & Process Engineering”, Mc-Graw Hill.
4. Salman & Simans, “Foundry Practice”, Issac Pitman.
5. ASME, “Metals Handbook- Metal Casting.”
6. P.C. Mukharjee, Fundamentals of Metal casting Technology
7. P.R.Beeley, Foundry Technology , Butterworth Heinmann

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–641 SIMULATION OF INDUSTRIAL SYSTEMS

L	T	P/D	Cr.
4	0	-	4

UNIT-I

Introduction and overview, concept of system, system environment, elements of system, system rnodeling, types of models, Monte Carlo method, system simulation, simulation - a management laboratory, advantages & limitations of system simulation, continuous and discrete systems.

Simulation of continuous systems: characteristics of a continuous system, comparison of numerical integration with continuous simulation system. Simulation of an integration formula.

UNIT-II

Simulation of discrete system: Time flow mechanisms, Discrete and continuous probability density functions. Generation of random numbers, testing of random numbers for randomness and for auto correlation, generation of random variates for discrete distribution, generation of random variates for continuous probability distributions-binomial, normal, exponential and beta distributions; combination of discrete event and continuous models.

Simulation of queuing systems: Concept of queuing theory, characteristic of queues, stationary and time dependent queues, queue discipline, time series analysis, measure of system performance,

Kendall's notation, auto covariance and auto correlation function, auto correlation effects in queuing systems, simulation of single server queues, multi-server queues, queues involving complex arrivals and service times with blanking and reneging.

UNIT-III

Simulation of inventory systems: Rudiments of inventory theory, MRP, in-process inventory. Necessity of simulation in inventory problems, forecasting and regression analysis, forecasting through simulation,generation of Poisson and Erlang variates, simulation of complex inventory situations.

Design of Simulation experiments: Length of run, elimination of initial bias, Variance, Variance reduction techniques, stratified sampling, antipathetic sampling, common random numbers, time series analysis, spectral analysis, model validation, optimization procedures, search methods, single variable deterministic case search, single variable non-deterministic case search, regenerative technique.

UNIT-IV

Simulation of PERT: Simulation of - maintenance and replacement problems, capacity planning, production systems, reliability problems, computer time sharing problem, the elevator system.

Simulation Languages: Continuous and discrete simulation languages, block structured continuous languages, special purpose simulation languages, SIMSCRIPT, GPSS SIMULA importance and limitations of special purpose languages.

RECOMMENDED BOOKS:

1. Simulation and Modelling Loffick - Tata McGraw Hill
2. System Simulation with Digital Computer, Deo Narsingh- Prentice Hall
3. System Simulation, Hira, D.S. - S. Chand & Co.
4. Computer Simulation and Modelling Meelamkavil- John Willey
5. System Simulation by Gorden - Prentice hall
6. Jerry Banks and John, S. Carson II, 'Discrete – Event System Simulation', Prentice Hall Inc., NewJersey, 1984.
7. Geoffrey Gordon, 'System simulation', Prentice Hall, NJ, 1978.
8. Law, A.M. and W.D. Keltor, 'Simulation modelling analysis', McGraw Hill, 1982.9

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING)
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–643 OPERATIONS MANAGEMENT

L	T	P/D	Cr.
3	1	-	3.5

Unit I

Basics of Production Management:
Types of production, life cycle approach to production system, Productivity and Productivity measures, types of productivity index, productivity improvement, production scheduling, MRP v/s JIT, requirements and problems in implementing JIT, Benefits of JIT, Introduction to JIT purchasing and JIT quality management

Unit II

Supply chain management, its importance, objectives and applications. Tenabled supply chain supply chain drives concepts of stockless, VRM and CRM.

Unit III

Business Process:
Re-engineering-characteristics, organizational support, responsibility of re-engineering, re-engineering opportunities, choosing the process to re-engineer, success factors and advantages.

Unit IV

ERP:
Evolution of ERP, Characteristics, approaches, methodology for implementation, Success factors.

Waste Management:
Introduction, classification of waste, systematic approach to waste reduction, waste disposal.

RECOMMENDED BOOKS:

1. Operation Research by D. S. Hira & P. K. Gupta,
2. Introduction to Operation Research by Hiller & Liebeman
3. Production and Operations Management by S.A.Chunawalla and D.R.Patel

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–645 PRODUCTIVITY MANAGEMENT

L	T	P/D	Cr.
4	0	-	4

Unit I

Introduction : Productivity Basics
Concern and the Significance of Productivity Management, the Rationale of Productivity Measurement, Productivity: Some Perspectives, Productivity Measurement: A Case for Re-appraisal

Unit II

Productivity Measurement: A Conceptual Framework
Objectives of Productivity Measurement, Management by Objectives (MBO) and Productivity Measurement, Systems Approach to Productivity Measurement, Performance Objectives – Productivity (PO-P) : The Concept, PO-P: The Model, PO-P: The Methodology.

Productivity Measurements in Manufacturing Sector
Productivity Measurement in Manufacturing Sector, Productivity Measurement in a Medium Sized Organisation, Productivity Measurement in a Large Sized Organisation.

Unit III

PO-P Application : Productivity Measurement in Service Sector
Need for measuring Productivity in Service Sector, Difficulties in measuring productivity, Productivity of an R&D System, Productivity of an Educational Institution.

Productivity Management : The Role of External Environment
External Environment and Organisation, Impact of external Environment, External Environment: Its Sub-systems, Approaches to measure Impact of External Environment.

Unit IV

Productivity Management and Implementation Strategies
Productivity Management System, Productivity Policy, Productivity: Organisation & Planning, Productivity Measurement, Productivity Measurement Evaluation, Productivity Improvement Strategies, Productivity Audit and Control

RECOMMENDED BOOKS :

1. Productivity Management by Prem Vrat, G.D.Sardana and B.S.Sahai
2. Production and Operations Management by S.A.Chunawalla and D.R.Patel

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–647 ADVANCED METAL CUTTING

L	T	P/D	Cr.
4	0	-	4

UNIT-I

Introduction, system of Tool nomenclature, Tool Geometry, Mechanism of Chip formation and forces in orthogonal cutting, Merchant's force diagram.

Oblique Cutting: Normal chip reduction coefficient under oblique cutting, true shear angle, effective rake, influx region consideration for deformation, direction of maximum elongation, effect of cutting variables on chip reduction co-efficent, forces system in oblique cutting, effect of wear land on force system, force system in milling, effect of helix angle.

UNIT-II

Fundamentals of Dynamometry, Theoretical determination of forces, angle relations, heat and temperature during metal cutting; distribution, measurement, analysis, theoretical estimation of work piece temperature, hot machining

Fundamental factors, which effect tool forces: Correlation of standard mechanized test. (Abuladze – relation), nature of contact and stagnant phenomenon, rates of strains, shear strain and normal strain distributions, cutting variables on cutting forces.

UNIT-III

Cutting Tools: Tools materials analysis of plastic failure (from stability criterion), Analysis failure by brittle fracture, wear of cutting tools, criterion, flank and crater wear analysis, optimum tool life, tool life equations, (Taylor's woxen etc) Tool life test, machining optimization, predominant types of wear; abrasive, adhesive, diffusion wear models, wear measurements and techniques, theory of tool wear oxidative mathematical modelling for wear, test of machinability and influence of metallurgy on machinability. Economics of metal machining

UNIT-IV

Abrasive Machining: Mechanics of grinding, cutting action of grit, maximum grit chip thickness, energy and grit force temperature during grinding, wheel wear, grinding, process simulation, testing of grinding wheels, mechanics of lapping and honing, free body abrasion.

RECOMMENDED BOOKS:

1. Principles of Machine tools by Sen & Bhattacharya by New Central Book Agency.
2. Machining of Metals, by Brown; Prentice hall.
3. Principles of Metal cutting by Shaw; Oxford I.B.H.
4. Metal cutting theory & Cutting tool design by Arshimov & Alekree, MIR Publications.
5. Machining Science & Application by Knowenberg Longman Press.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(INDUSTRIAL & PRODUCTION ENGINEERING)
MTIP–624 DISSERTATION

A student is required to work for one semester for analysis/synthesis/designing/ development etc. on some latest areas of Industrial & Production Engineering which has been finalized in the third semester. The student will be evaluated by internal as well as external examiner based upon his/her research work.