

Semester-II

INDUSTRIAL ROBOTICS

Sub Code	: 16 MPT 21	IA Marks	: 20
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	Exam Marks	: 80

1. **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.
2. **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.
3. **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.
4. **TRANSFORMATIONS AND KINEMATICS:** Homogeneous Co-ordinates – Co-ordinate Reference Frames – Homogeneous Transformations for the manipulator – the forward and inverse problems of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D.H.Matrices controller architecture.
5. **ROBOT CELL DESIGN AND CONTROL:** Specifications of Commercial Robots – Robot Design and Process specifications – motor selection in the design of a robotic joint – Robot Cell layouts – Economic and Social aspects of robotics.**APPLICATIONS OF ROBOTS:** Capabilities of Robots – Robotics Applications – Obstacle avoidance – Robotics in India – The future of Robotics

TEXT 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 Gomalier R C, Lee C S G - McGraw Hill Book Co. - 1987.

REFERENCE BOOKS:

1. **Handbook of Industrial Robotics** - Shuman Y. Nof - John Wiley & Sons, New York - 1985.
2. **Robotics Technology and Flexible Automation** - Deb SR - McGraw Hill BookCo. - 1994.

AGILE MANUFACTURING

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Sub Code	: 16 MPT 22	IA Marks	: 20
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	Exam Marks	: 80

1. **Introduction** - What is agile Manufacturing? - Competitive environment of the future the business case for agile manufacturing conceptual frame work for agile manufacturing.
2. **Four Core Concepts:** Strategy driven approach - integrating organization, people technology interdisciplinary design methodology.
3. **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, Traditional organization, control technological and design paradigms traditional problems in workplace- organizational issues - role of technology.
4. **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.
5. **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) – TataMcGraw 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

SIMULATION AND MODELING OF MANUFACTURING SYSTEMS

Sub Code	: 16 MPT 23	IA Marks	: 20
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	Exam Marks	: 80

- 1. 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. **Simulation Software:** Selection of simulation software, simulation packages.
- 2. 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, continuousdistributions.
- 3. 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.*** IvicaCmkovic, Ulfaskluna and AnnitaborsenDohlgvist Publisher Artechhouse.
- 4. Random Variable Generation:** Inversion transforms technique-exponential distribution. uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution.
- 5. Empirical Discrete Distribution:** Discrete uniform -distribution poisson distribution -geometric distribution -acceptance -rejection technique for Poisson distribution gamma distribution.**Design and Evalution of Simulation Experiments:** variance reduction techniques -antithetic variables, variables-verification and validation of simulation models.

TEXT BOOKS:

- 1. Discrete Event System Simulation** - Jerry Banks & .John S Carson II - Prentice Hall Inc.-1984.
- 2. Systems Simulation** - Gordan. G. - Prentice Hall India Ltd - 1991.

REFERENCE BOOKS:

- 1. System Simulation with Digital Computer** - NusingDeo - Prentice Hall of India - 1979.
- 2. Computer Simulation and Modeling** - Francis Neelamkovil - John Wiley& Sons - 1987.
- 3. Simulation Modeling with Pascal** - RathM.Davis& Robert M O Keefe - Prentice Hall Inc. - 1989.

LEAN MANUFACTURING SYSTEMS

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Sub Code	: 16 MPT 24	IA Marks	: 20
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	Exam Marks	: 80

1. **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.
2. 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.
3. 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.
4. 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.
5. 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 – 9th edition - 2001.
2. **Toyota 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.

NON-DESTRUCTIVE TESTING

Sub Code	: 16 MPT 251	IA Marks	: 20
No. of Lecture Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 40	Exam Marks	: 80

1. **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
2. **Eddy current inspection:** principles, operation variables, procedure, inspection coils, and detectable discounts by the method. **Microwave inspection:** Microwave holography, applications and limitations.
3. **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,
4. **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.
5. **Optical Holography:** Basics of Holography, recording and reconstruction - Acoustical Holography: systems and techniques applications.Indian standards for NDT.

REFERENCE BOOKS:

1. **Non Destructive Testing** - McGonnagle 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 & FINISHING

Sub Code	: 16 MPT 252	IA Marks	: 20
No. of Lecture Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 40	Exam Marks	: 80

1. **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
2. **Properties of sprayed metals, plasma coating. Plastic coating of metal** - PVC coating Spherodising process details, phosphate coating - mechanism of formation.
3. **Testing of surface coating**-methods.**Heat treatment methods**, Annealing, Normalizing, Tempering, Case hardening methods, flame hardening sub zero treatment.
4. **Heat treatment methods for gears, spindles, cutting tools.**
5. **Advanced coating technologies:** Hard facing, electro deposition technique, Nano-coatings, 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.

NON-TRADITIONAL MACHINING PROCESS

Sub Code	: 16 MPT 253	IA Marks	: 20
No. of Lecture Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 40	Exam Marks	: 80

- 1. 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.
- 2. 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 spark surface finish. Applications.
- 3. 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.
- 4. 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 metals removal, 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.
- 5. 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-electrohydraulics forming magnetic pulse forming.

REFERENCE BOOKS:

1. **New technology Institution of Engineers** - Bhattacharya - India
2. **Production Technology** - HMT - Tata McGraw 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 - ASM International.
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.

PRODUCT DATA MANAGEMENT

Subject Code	: 16 MPT 254	IA Marks	: 20
No. of Lecture Hours/Week	: 03	ExamHours	: 03
Total No. of Lecture Hours	: 40	Exam Marks	: 80

Module – 1

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

Module – 2

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.

Module – 3

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.

Module – 4

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

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

Module – 5

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 Bed worth. 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.