II SEMESTER

INDUSTRIAL ROBOTICS

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**Module 1**


**Module 2**


**Module 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.

**Module 4**

**TRANSFORMATIONS AND KINEMATICS:** Homogeneous Co-ordinates – Co-ordinate 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.

**Module 5**


**APPLICATIONS OF ROBOTS:** Capabilities of Robots – Robotics Applications – Obstacle avoidance – Robotics in India – The future of Robotics

**TEXT BOOKS:**

REFERENCE BOOKS:


**NON-TRADITIONAL MACHINING PROCESSES**

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**Module 1**


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

**Module 2**

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


**Module 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, Electro Chemical Grinding-Electro Chemical holding Electrochemical deburring.

**Module 4**

**Plasma arc Machining**: Introduction-Plasma-Generation of Plasma and equipment Mechanism of metals removal, PAN parameters-process characteristics - type of torches applications.  
**Electron Beam Machining (EBM)**: Introduction-Equipment for production of Electron beam - Theory of electron beam machining , applications.  
**Laser Beam Machining (LBM)**: Introduction-principle of generation of lasers Equipment and Machining procedure-Types of Lasers-Process characteristics-advantages and limitations-applications  
**Ion Beam Machining**: Introduction-Mechanism of metal removal and associated equipment-process characteristics applications

**Module 5**

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

- New technology Institution of Engineers - Bhattacharya - India
- High Velocity Forming of Metals - F.M Wilson - ASTMEPrentice Hall.

SURFACE TREATMENT & FINISHING

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Module 1

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

Module 2

Vacuum coating, FVD & CVD metal spraying - Methods, surface preparation, mechanical Properties of sprayed metals, plasma coating.

Module 3


Module 4


Module 5

Advanced coating technologies: Hard facing, electro deposition technique, nanocoatings, coating characterization

REFERENCE BOOKS:

- Handbook of metal treatment and testing - John wiley& sons.
• **Heat Treatment of Metals** – Zakrov - MIR Publications.
• **Metals Hand Book** – ASM.

### ADVANCED JOINING PROCESSES

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**Module 1**

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

**Welding and Cladding of dissimilar materials**, overlaying and surfacing.

**Module 2**


**Advanced soldering and Brazing processes different types, Welding of plastics.**

**Module 3**

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

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

**Module 4**


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

**Module 5**


### REFERENCE BOOKS:

• **Welding Engineering Handbook** - A.W.S.
• **Welding Engineering** - Rossi - McGraw Hill.
• **Advanced Welding processes** - Nikodaco&Shansky - MIR Publications.
• **Welding Technology** - O.P. Khanna
• **Welding for Engineers** - Udin, Funk &Wulf
ELECTIVE II
NON-DESTRUCTIVE TESTING

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**Module 1**

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

**Module 2**

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

**Module 3**

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

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

**Module 4**

**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.

**Module 5**

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

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

**REFERENCE BOOKS:**

SIMULATION AND MODELING OF MANUFACTURING SYSTEMS.

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Module 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.

Module 2

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

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

Module 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-Smirnov test, the Chi-square test.

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

Module 4

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

Module 5

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

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

**TEXT BOOKS:**


**REFERENCE BOOKS:**

PRODUCT DATA MANAGEMENT

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**Module 1**

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

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

**Module 2**

**Configuration Management:** Base lines-product structure configuration management - 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**

**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:**

AGILE MANUFACTURING

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Module 1
Introduction - What is agile Manufacturing? - Competitive environment of the future the business case for agile manufacturing conceptual frame work for agile manufacturing.

Module 2
Four Core Concepts: Strategy driven approach - integrating organization, people technology interdisciplinary design methodology.

Module 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.

Module 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.

Module 5

REFERENCE BOOKS:
Laboratory Exercises

14 MPE 26

• Study of pick and place Robot- basic components, configuration, and work volume.

• Experiments with Robot. Kit for minimum four assembly activities and programming.

• Programming of robots by manual, lead through and off line methods.

• Programming languages for stacking of objects in increasing or decreasing size. Palletizing operations, assembly and inspection operation etc.

• To become acquainted with the operation of a revolute-type 6 DOF robot. To program a robotic system using a teaching pendant and a high level programming language. Emphasis is made on the constraints associated when positioning and orienting an object within a 3-D space. The practical includes point-to-point tasks and continuous robot motion.