AUTOMATION AND ROBOTICS

NOE-084 **L T P**
3 1 0

1. Introduction: Definition, Classification of Robots, geometric classification and control classification.
2. Robot Elements: Drive system, control system, sensors, end effectors, gripper actuators and gripper design.
3. Robot Coordinate Systems and Manipulator Kinematics: Robot co-ordinate system representation, transformation, homogenous transform and its inverse, relating the robot to its world.
Manipulators Kinematics, parameters of links and joints, kinematic chains, dynamics of kinematic chains, trajectory planning and control, advanced techniques of kinematics and dynamics of mechanical systems, parallel actuated and closed loop manipulators.
4. Robot Control: Fundamental principles, classification, position, path velocity and force control systems, computed torque control, adaptive control, Seroo system for robot control,
and introduction to robot vision.
5. Robot Programming: Level of robot programming, language based programming, task level programming, robot programming synthesis, robot programming for welding, machine tools, material handing, assembly operations, collision free motion planning.
6. Applications: Application of robot in welding, machine tools, material handling, assembly operations parts sorting and parts inspection.
Text/Reference Books:
1. Coifet Chirroza, "An Introduction to Robot Technology" Kogan Page.
2. Y. Koren "Robotics for Engineers" Mcgraw Hill.
3. K. S. Fu, R.C. Gonzalez Y& CSG Lee, "Robotics" McGraw Hill.
4. J.J. Craig, "Robotics" Addison-Wesley.
5. Grover, Mitchell Weiss, Nagel Octrey, "Industrial Robots" Mcgraw Hill.
6. Asfahl, "Robots & Manufacturing Automat

Digital Image Processing

NCS-801 **L T P**
3 1 0

UNIT-I
Introduction and Fundamentals **10**

Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.

Image Enhancement in Frequency Domain

Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering.

UNIT-II **10**
Image Enhancement in Spatial Domain

Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

UNIT-III
Image Restoration **10**

A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.

UNIT-IV **10**
Morphological Image Processing

Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

UNIT-V Registration **5**

Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth

Segmentation

Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.

TOTAL: 45 PERIODS

REFERENCES:

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.
4. Sonka, Digital Image Processing and Computer Vision, Cengage Learning
5. Gonzalez and Woods, Digital Image Processing, Addison Wesley.

EMBEDDED SYSTEMS

NCS-087	**L**	**T**	**P**
	3	1	0

Unit-I **10**

Introduction to embedded systems: Classification, Characteristics and requirements, Applications

Unit-II **10**

Timing and clocks in Embedded systems, Task Modeling and management, Real time operating system issues.

Unit-III **10**

Signals, frequency spectrum and sampling, digitization (ADC, DAC), Signal Conditioning and Processing.Modeling and Characterization of Embedded Computation System.

Unit-IV **10**

Embedded Control and Control Hierarchy, Communication strategies for embedded systems: Encoding and Flow control.

Unit-V **5**

Fault-Tolerance, FormalVerification , Trends in Embedded Processor, OS,Development Language

References:

1. Prasad, Embedded /Real Time System,Concept,Design and Programming Black Book, Wiley India
2. R.Gupta, “Co-synthesis of Hardware and Software for Embedded Systems”, Kluwer
3. Shibu K.V., “Introduction to Embedded Systems”, TMH
4. Marwedel, “Embedded System Design”, Springer

REAL TIME SYSTEM

NCS-082 **L T P**
3 1 0

UNIT-I:
Introduction **5**
Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT-II:
Real Time Scheduling **10**
Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT-III:
Resources Sharing **10**
Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

UNIT-IV:
Real Time Communication **10**
Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols

UNIT-V:
Real Time Operating Systems and Databases **10**
Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases

TOTAL: 45 PERIODS

REFERENCES:

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
2. Phillip A Laplanta,SeppoJ.Ovaska Real time System Design and Analysis Tools for practitioner, Wiley
3. Mall Rajib, “Real Time Systems”, Pearson Education
4. Albert M. K. Cheng , “Real-Time Systems: Scheduling, Analysis, and Verification”, Wiley.