JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.TECH IN ELECTRONICS & INSTRUMENTATION
EFFECTIVE FROM ACADEMIC YEAR 2017- 18 ADMITTED BATCH

COURSE STRUCTURE AND SYLLABUS

I Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-1	Smart Industrial Instrumentation	25	75	4	0	0	4
PC-2	Analysis and Design of Signal Conditioning Circuits	25	75	4	0	0	4
PC-3	Analytical Instrumentation	25	75	4	0	0	4
PE-1	Transform Techniques Real Time Embedded Systems Electronic System Design	25	75	**3**	0	0	3
PE-2	Digital Instrumentation Linear and Nonlinear Systems Embedded System Design	25	75	**3**	0	0	3
OE-1	***Open Elective – I**	25	75	3	0	0	3
Laboratory I	Advanced Instrumentation Laboratory-I	25	75	0	0	3	2
Seminar I	Seminar - I	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

II Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-4	Industrial Automation	25	75	4	0	0	4
PC-5	Sensors and Actuators	25	75	4	0	0	4
PC-6	Advanced Process Control Instrumentation	25	75	4	0	0	4
PE-3	Advanced Instrumentation Systems Quality and Reliability Engineering Instrumentation Practices in Industries	25	75	**3**	0	0	3
PE4	MEMS and Applications Robotic Design and Control Advanced Image Processing	25	75	**3**	0	0	3
OE-2	***Open Elective – II**	25	75	3	0	0	3
Laboratory II	Advanced Instrumentation Laboratory-II	25	75	0	0	3	2
Seminar II	Seminar - II	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

III Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Technical Paper Writing	100	0	0	3	0	2
Comprehensive Viva-Voce	0	100	0	0	0	4
Project work Review II	100	0	0	0	22	8
Total	**200**	**100**	0	**3**	22	**14**

IV Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Project work Review III	100	0	0	0	24	8
Project Evaluation (Viva-Voce)	0	100	0	0	0	16
Total	**100**	**100**	**0**	**0**	**24**	**24**

***Open Elective subjects must be chosen from the list of open electives offered by OTHER departments.**

 # For Project review I, please refer 7.10 in R17 Academic Regulations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION

INDUSTRIAL AUTOMATION (PC - 4)

UNIT - I

Programmable Logic Controllers (PLCs): Evolutions of PLCs– Sequential and Programmable Controllers, Architecture, Communication Networks for PLC, Comparative study of Industrial PLCs.

UNIT - II

PLC Programming: PLC Programming- Ladder logic, Functional block, Sequential Function Chart, Structured Text, and Instruction list.

UNIT - III

SCADA: Hardware and software, Remote terminal units, Master station, Communication architectures and open SCADA protocols.

UNIT - IV

Distributed Control System (DCS): Various Architectures– Comparison, Local control unit, Operator Interface, Displays, Engineering interface, Study of any one DCS available in market, Factors to be considered in selecting DCS.

UNIT - V

Advanced Topics in Automation: Study of Distributed Control Systems available in market, Factors to be considered in selecting DCS, OLE for Process Automation (OPC), Internet of Things, Cloud based Automation.

TEXT BOOKS:

1. F. D. Petruzella, “Programmable Logic Controllers”, Tata Mc-Graw Hill, Third Edition, 2010.
2. Michael P. Lukas,” Distributed Control Systems: Their Evaluation and Design”, Van Nostrand Reinhold Co., 1986.
3. Clarke, G., Reynders, D. and Wright, E.,” Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Newnes, 1st Edition, 2004.

REFERENCE BOOKS:

1. Hughes, T, “Programmable Logic Controllers”, ISA Press, 2000.
2. Mc-Millan, G.K., “Process/Industrial Instrument and Controls Handbook”, McGraw-Hill, New York, 1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION

SENSORS AND ACTUATORS (PC - 5)

UNIT - I

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges, Inductive Sensors- Sensitivity and Linearity of the Sensor, Types- Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors using Quartz Resonators, Ultrasonic Sensors.

UNIT - II

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermo-sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo-EMF Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermo-electric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

Magnetic Sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto-resistive Sensing, Semiconductor Magneto-resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchronous, Synchronous-resolvers, Eddy Current Sensors, Electromagnetic Flow meter, Switching Magnetic Sensors, SQUID Sensors.

UNIT - III

Radiation Sensors: Introduction – Basic Characteristics – Types of Photosensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors

Electro Analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential – Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization-– Reference Electrodes - Sensor Electrodes – Electro ceramics in Gas Media .

UNIT - IV

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.

Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

UNIT - V

Actuators: Pneumatic and Hydraulic Actuation Systems- Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators, Mechanical Actuation Systems- Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Electrical Actuation Systems, Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

TEXT BOOKS:

1. D. Patranabis," Sensors and Transducers", PHI Learning Private Limited.
2. W. Bolton, "Mechatronics", Pearson Education Limited.

REFERENCE BOOK:

1. Patranabis , “Sensors and Actuators”, 2nd Edition, PHI, 2013.

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M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION

ADVANCED PROCESS CONTROL INSTRUMENTATION (PC - 6)

UNIT - I

Process Dynamics: Process variables, Load variables, Dynamics of simple pressure, Flow, Level and temperature process, Interacting and non-interacting systems, Continuous and batch process, Self-regulation, Servo and Regulator operation, Problems.

UNIT - II

Control Actions and Controllers and Types of Controllers: Basic control actions, Characteristics of two position, three position, Proportional, Single speed floating, Integral and Derivative control modes, PI, PD, PID control modes, Problems, Types of controllers, Pneumatic, Hydraulic and Electronic Controllers to realize various control actions.

UNIT - III

Controller Settings and Tuning of Controllers: Evaluation criteria – $1/4^{th}$ decay ratio, IAE, ISE,ITSE, ITAE, Determination of optimum settings of mathematically described process using time response and frequency response, Tuning of controller process curve reaction method, Continuous oscillation method, Damped oscillation method, Problems.

UNIT - IV

Final Control Elements and Control Valves: I/P Converter, P/I converter, Pneumatic, electric and hydraulic actuators, Valve Positioned, Control valves – characteristic of control valves – valve body – Globe, Butterfly, diaphragm, Ball valves, Control valve sizing, Cavitations, Flashing, Problems.

UNIT - V

Multi loop Control System: Feed forward control, Ratio control, Cascade control, Split range, Multivariable control and examples from distillation column, Boiler system and heat exchanger, Plant wide control issues, Hypothetical plant for plant wide control studies, Internal feedback for material and energy, Interaction of plant design and control system design, Systematic Procedure for plant wide control system design, Case Study- The Reactor/Flash Unit plant, Effect of control structure on Closed loop performance.

TEXT BOOKS:

1. Stephanopoulos, "Chemical Process Control: An introduction to Theory and Practice", Prentice Hall, New Delhi, 1999.
2. Harriott P., "Process Control", TMH, 1991.

REFERENCE BOOKS:

1. Liptak B.G., Chilton, "Process Control", 3rd Edition, Book Company, Pennsylvania, 1995.
2. Pollard A., "Process Control", Heinemann Educational Books, London, 1971.
3. Eckman D.P, "Automatic Process Control", Wiley Eastern Ltd., New Delhi, 1993.
4. D. Patranabis, "Principles of Process Control", 2012, 3rd Edition, McGraw Hill.
5. Coughanowr, "Process System Analysis and Control", McGraw Hill, Singapore, 1991.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION

ADVANCED INSTRUMENTATION SYSTEMS (PE - 3)

UNIT - I

Measurement of Process Parameters: Measurement of temperature, pressure, flow and level- Application, Selection, Calibration methods.

UNIT - II

Instruments for Analysis: Ion selective electrodes- Gas & Liquid Chromatography, Oxygen analyzers for gas and liquid, CO,CO_2 , NO and SO Analyzers, Hydrocarbon and H_2S Analyzers, Dust, Smoke, Toxic gas and radiation monitoring.

UNIT - III

Safety Instrumentation: Introduction to Safety Instrumented Systems, Hazards and Risk, Process Hazards Analysis (PHA), Safety Life Cycle, Control and Safety Systems, Safety Instrumented Function, Safety Integrity Level (SIL – Selection, Verification and Validation.

UNIT - IV

Instrumentation Standards: Instrumentation Standard- Significance of codes and standards, Overview of various types, Introduction of various Instrumentation standards- Review, interpretation and significance of specific standards, Examples of usage of standards on specific applications.

UNIT - V

Documentation in Process Industries: Block Diagram of a Typical Process, Instrumentation Symbols, Abbreviations and Identification for Instruments- Mechanical Equipment, Electrical Equipment, Instruments and Automation Systems, Process Flow Diagram (PFD), Piping and Instrumentation Diagram (P&ID), Instrument Lists and Specification– Logic Diagrams, Instrument Loop Diagrams, Instrument Hook-up Diagrams, Location Plans for Instruments, Cable Routing Diagrams, Typical Control/Rack Rooms Layout, Vendors Documents and Drawings.

TEXT BOOKS:

1. B. G. Liptak- Instrumentation Engineers Handbook (Process Measurement & Analysis), 4th Edition, Chilton Book Co., CRC Press, 2005.
2. Al. Sutko, Jerry. D. Faulk- Industrial Instrumentation, Delmar Publishers, 1996.
3. Paul Gruhn, P.E., CFSE and Harry Cheddie. P.E. - Safety Instrumented Systems: Design, Analysis, and Justification, 2nd Edition, ISA, 2006.

REFERENCE BOOKS:

1. Safety - ANSI/ISA84.00.01-2004, Part 1: Framework, Definitions, System Hardware and Software Requirements; ANSI/ISA84.00.01-2004, Part 2: Functional Safety: Safety Instrumented Systems for the Process Industry Sector; ANSI/ISA84.00.01-2004, Part 3:Guidance for the Determination of the Required Safety Integrity Levels-Informative Standards - ANSI/ISA-75.01.01 -2002 (60534-2-1 Mod): Flow Equations for Sizing control Valves; ISA84 Process Safety Standards and User Resources, Second Edition, ISA, 2011; ISA88 Batch Standards and User Resources, 4th Edition, ISA, 2011.
2. Documentation Standards - ANSI/ISA5.4-1991 - Instrument Loop Diagrams; ANSI/ISA5.06.01-2007 - Functional Requirements Documentation for Control SoftwareApplications; ANSI/ISA20-1981 - Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION

QUALITY AND RELIABILITY ENGINEERING (PE - 3)

UNIT - I

Elements of Probability Theory Probability Distributions: Random variables, density and distribution functions, Mathematical expectation, Binominal distribution, Poisson distribution, Normal distribution, Exponential distribution, Weibull distribution.

Reliability: Definition of Reliability, Significance of the terms appearing in the definition, Component reliability, Hazard rate, Derivation of the reliability functions in terms of the hazard rate, Hazard models.

UNIT - II

Failures: Causes of failures, Types of failures (early failures, chance failures and wear-out failures), Modes of failure, Bath tub curve, Effect of preventive maintenance.

Measures of Reliability: Mean Time to Failure (MTTF) and Mean Time between Failures (MTBF).

UNIT - III

Reliability Logic Diagrams(reliability block diagrams): Classification of engineering systems-Series, Parallel, Series-Parallel, Parallel-Series and non-series-parallel configurations (mainly for Electronic system configurations), Expressions for the reliability of the basic (Electronic Systems) configurations.

UNIT - IV

Reliability Evaluation of Non-Series-Parallel Configurations (Mainly for Electronic Systems Configurations): Minimal tie-set, Minimal cut-set and decomposition methods, Deduction of the minimal cut sets from the minimal path sets.

More than Two Components Electronics Systems Reliability Evaluation: Series systems, Parallel systems with two and more than two components, Network reduction techniques, Minimal cutest / failure mode approach.

UNIT - V

Discrete Markov Chains: General modelling concepts, Stochastic transitional probability matrix, Aime dependent probability evaluation and limiting state probability evaluation, absorbing states (mainly for Electronic systems).

Continuous Markov Processes: Modelling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating limiting state Probabilities, Reliability evaluation of repairable systems (mainly for Electronic systems).

TEXT BOOKS:

1. Roy Billinton and Ronald N Allan, “Reliability Evaluation of Engineering Systems”, Plenum Press.
2. Elsayed A. Elsayed, “Reliability Engineering”, Prentice Hall Publications.

REFERENCE BOOKS:

1. Alessandro Birolini, “Reliability Engineering: Theory and Practice”, Springer Publications.
2. E. Balaguruswamy, “Reliability Engineering”, TMH Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION

INSTRUMENTATION PRACTICES IN INDUSTRIES (PE - 3)

UNIT - I

An Overview of Paper Making Process: Paper making process- Raw materials, Pulp separation, Screening, Bleaching, Cooking, Chemical reaction, Chippers, Types of digesters, H factor and Kappa factors, Stock preparation, Instrumentation needs, Energy conservation and paper quality control.

UNIT - II

Paper Properties and its Measurement: Physical, electrical, optical and chemical properties of paper, Basic weight, Thickness, Density, Porosity, Smoothness, Softness, Hardness and compressibility, Stress-strain Relationship, Tensile strength, Bursting strength, Tearing resistance, Folding endurance, Stiffness and impact strength, Dielectric constant, Dielectric strength, Dielectric loss and Properties of electrical insulating paper, Brightness, Color, Gloss and capacity, Starch constant acidity and pH - Measurement techniques.

UNIT - III

Consistency Measurement: Definition of consistency, Techniques for head box consistency measurement, Stock consistency measurement and control.

Paper Making Machine: Functioning of Paper making machine- Quality parameters, Moisture, Basic weight, Caliper, Brightness, Color, Ash content, Strength, Gloss and tensile strength, Parameters monitoring Instrumentation.

UNIT - IV

Wet End Instrumentation: Conventional measurements at wet end- Pressure, Vacuum, Temperature, Liquid density, Specific gravity, Level–flow consistency measurement - pH - ORP measurement, Freeness measurement.

Dry End Instrumentation Conventional measurements: Moisture, Basis weight, Caliper, coat thickness, Optical variables, Measurement of length, Speed, Digester, Rotary, Batch type.

UNIT - V

Pumps and Control Valves: Flow box, Wet end variables, Evaporator feedback, Feed forward control, Lime mud density control, Stock proportioning system, Refiner control instrumentation, Basic pulper instrumentation, Head box, Rush/drag control, Instrumentation for size preparation, Coating preparation, Coating weight control, Batch digester, K/Kappa number control, Bleach plant chlorine stage control.

Control Aspects: Machine and cross direction control technique, Consistency, Moisture and basic weight control, Dryer control, Computer based control systems, Mill wide control.

TEXT BOOKS:

1. Sankaranarayanan, P.E., “Pulp and Paper Industries Technology and Instrumentation”, Kotharis Desk book series, 1995.
2. Britt K. W. Van Nostrand, “Handbook of Pulp and Paper technology”, Reinbold Company, 1970.
3. James P. Casey,” Pulp and Paper Chemistry and Chemical Technology”, John Wiley and Sons, 1981.

REFERENCE BOOKS:

1. Austin G.T., Shrencs,” Chemical Process Industries”, McGraw Hill International Student Edition, Singapore, 1985.

2. John R Lavigne, “An Introduction to Paper Industry Instrumentation”, Miller Freeman Publications, California, 1985 Series.
3. Robert J. McGill, “Measurement and Control in Paper Making”, Adam Hilger Limited, Bristol, 1980.
4. John R. Lavigne, “Instrumentation Applications for the Pulp and Paper Industry”, Miller Freeman Publications, California, 1990.
5. Liptak, B. G., “Instrument Engineers Handbook”, Volume 2, Process Control, Third Edition, CRC press, London, 1995.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION
MEMS AND APPLICATIONS (PE - 4)

UNIT - I
Introduction to MEMS: MEMS, Use of MEMS, Fabrication process.
The Substrate and adding material to it: Introduction, The silicon substrate, Additive technique-Oxidation, Additive technique- Physical vapor deposition, other additive techniques.

UNIT - II
MEMS Fabrication:
Creating and transferring patterns: Photolithography- Introduction, Keeping it clean, Photoresist, Working with resist, Masks, Resolution, Permanent resists.
Creating structures-Micromachining: Introduction, Bulk Micromachining processes, Surface Micromachining, Process Integration.

UNIT - III
MEMS Transducers - I:
Modelling: Units, The input-output concept, Physical variables and notation, Preface to the modeling chapters.
MEMS Transducers: An overview-Transducer, Distinguishing between sensors and actuators, Response characteristics of transducers, MEMS Sensors- Principles of operation, MEMS Actuators-Principles of operation, Signal conditioning, RF applications and Optical applications.
Piezoresistive Transducers: Introduction, Modeling Piezoresistive transducers, Piezoresistive pressure sensor.

UNIT - IV
MEMS Transducers - II:
Capacitive Transducers: Introduction, Capacitor fundamentals, Modeling a capacitor sensor, Capacitive accelerometer.

UNIT - V
MEMS Transducers - III:
Piezoelectric Transducers: Introduction, Modeling piezoelectric materials, Mechanical modelling of beams and plates, Cantilever piezoelectric actuator.
Thermal Transducers: Introduction, Basic heat transfer, Hot-arm actuator.

TEXT BOOKS:

1. Adams, Thomas M., Layton, Richard A., “Introductory MEMS Fabrication and Applications”, Springer.

REFERENCE BOOKS:

1. Tai-Ran Hsu, “MEMS and Microsystems- Design and Manufacture”, McGraw-Hill, 2002.
2. Mohamed Gad-el-Hak, “MEMS-Applications”, CRC Press, 29-Nov-2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION

ROBOTIC DESIGN AND CONTROL (PE - 4)

UNIT - I

Robot Fundamentals: Definitions, History of robots, Present and future trends in robotics, Robot classifications, Robot configurations, Point to Point robots, Continuous Path robots, Work volume, Issues in design and controlling robots Repeatability, Control resolution, Spatial resolution, Precision, Accuracy, Robot configurations, Point to Point robots, Continuous Path robots, Work volume, Applications of robots, Drives used in robots- Hydraulic, Pneumatic and Electric drives, Comparison of drive systems and their relative merits and demerits.

UNIT - II

Manipulator Kinematics: Matrix Algebra, Inverse of matrices, Rotational groups, Matrix representations of coordinate transformation, Transformation about reference frame and moving frame Forward & Inverse Kinematics examples of 2R, 3R & 3P manipulators, Specifying position and orientation of rigid bodies Euler's angle and fixed rotation for specifying position and orientation Homogeneous coordinate transformation and examples D-H representation of kinematics linkages, Forward kinematics of 6R manipulators using D-H representations, Inverse kinematics of 6R manipulators using D-H representations, Inverse Kinematics geometric and algebraic methods, Robotics Dynamics Velocity Kinematics, Acceleration of rigid body, Mass distribution Newton's equation, Euler's equation, Iterative Newton–Euler's dynamic formulation, Closed dynamic, Lagrangian formulation of manipulator dynamics, Dynamic simulation, Computational consideration.

UNIT - III

Trajectory Planning: Introduction, General considerations in path description and generation, Joint space schemes, Cartesian space schemes, Path generation in runtime, Planning path using dynamic model, Point to point and continuous trajectory, 4-3-4 & trapezioidal velocity strategy for robots.

UNIT - IV

Robot Sensors: Internal and external sensors, Position, Potentiometric, Optical sensors, Encoders-Absolute, Incremental, Touch and slip sensors, Velocity and acceleration sensors, Proximity sensors, Force& torque sensors, Laser range finder, Camera, Micro-controllers, DSP, Centralized controllers, Real time operating systems.

UNIT - V

Robot Controllers Essential components: Drive for Hydraulic and Pneumatic actuators, H-bridge drives for Dc motor, Overload over current and stall detection methods, Example of a micro-controller/microprocessor based robot Controller, Micro-robotics and MEMS (Microelectromechanical Systems), Fabrication technology for Micro-robotics, Stability issue in legged robots, Under-actuated manipulators.

Robot Vision: Introduction, Image acquisition, Illumination Techniques, Image conversion, Cameras, Sensors, Camera and system interface, Frame buffers and Grabbers, Image processing, Low level & high level machine vision systems.

TEXT BOOKS:

1. S. R. Deb," Robotics Technology and Flexible Automation", Tata McGraw Hill, 1994.
2. M. P. Groover, M. Weiss, R.N. Nagel, N.G. Odrey, "Industrial Robotics (Technology, Programming, and Applications)", McGraw Hill, 1996.

REFERENCE BOOKS:

1. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, “Robotics: Control, Sensors, Vision and Intelligence”, McGraw- Hill, 1987.
2. J. J. Craig, “Introduction to Robotics”, Addison Wesley, 1989.
3. Klafter, Richard D., et al, “Robotics Engineering”, PHI, 1996.
4. Zuech, Nello, “Applying Machine Vision”, John Wiley and Sons, 1988.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION

ADVANCED IMAGE PROCESSING (PE - 4)

UNIT- I

Fundamentals of Digital Image Processing: Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, review of morphological image processing

UNIT - II

Segmentation: Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods, and Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based segmentation methods

UNIT - III

Feature Extraction: First and second order edge detection operators, Phase congruency, Localized feature extraction- detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurence features, Run length features, Fractal model based features, Gabor filter, Wavelet features.

UNIT - IV

Registration And Image Fusion: Registration- Pre-processing, Feature selection-points, lines, regions and templates Feature correspondence-point pattern matching, Line matching, region matching Template matching. Transformation functions-similarity transformation and Affine Transformation. Resampling- Nearest Neighbor and Cubic Splines
Image Fusion-Overview of image fusion, pixel fusion, Multi resolution based fusion discrete wavelet transform, Curvelet transform, Region based fusion.

UNIT - V

3D Image Visualization: Sources of 3D Data sets, Slicing the Data set, Arbitary section planes, The use of color, Volumetric display , Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurement on 3D images.

TEXT BOOKS:

1. John C. Russ,"The Image Processing Handbook", CRC Press, 2007.
2. Mark Nixon, Alberto Aguado,"Feature Extraction and Image Processing", Academic Press, 2008.
3. Ardeshir Goshtaby, "2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications", John Wiley and Sons, 2005.

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods,"Digital Image Processing", Pearson Education, Inc., Second Edition, 2004.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson Education, Inc., 2002.
3. Rick S. Blum, Zheng Liu, "Multi sensor Image Fusion and its Applications", Taylor & Francis, 2006.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I YEAR II SEMESTER ELECTRONICS & INSTRUMENTATION

ADVANCED INSTRUMENTATION LABORATORY- II

Note: Total 15 Experiments have to be completed at least 3 from each category using Virtual Instruments.

A. Motion Control and Gear using Virtual Instruments
1. High speed motion control (on-off, PWM)
2. Measurement and processing of sensory data(revolution counter, accelerometer)
3. Automatic control and regulation of rotary speed (PID control)
4. Vibration analysis and diagnostics of gear box

B. Take-off and Landing using Virtual Instruments
1. System modeling and simulation
2. System identification
3. Tracking control and regulation
4. Root locus design
5. Frequency analysis

C. Inverted Pendulum using Virtual Instruments
1. System modeling
2. Parameter estimation
3. Friction compensation
4. Hybrid control /swing up control
5. Non-linear swing up control

D. Robotics using Virtual Instruments
1. Controlling of robot
2. Joint space programming
3. Coordinate space programming
4. Simulation of robot using image processing software
5. Robot programming using vision system

E. HVAC using Virtual Instruments
1. System modeling
2. Relay control design
3. Temperature control
4. PI control design
5. Model Validation