



ख्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
(Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956 & B.Tech. Approved by (AICTE))

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Paper Code- MTM-101
Credit- 3

MATERIAL CHARACTERIZATION

COURSE OUTCOME

1. To understand various material characterization techniques and their importance.
2. To be able to understand and apply various thermal analysis and optical microscopy techniques.
3. To understand Electron microscopic and techniques for replica preparation.
4. To be able to understand the basics of spectroscopic techniques and other associated aspects.
5. To understand the basics of diffraction methods and surface characterization methods.

UNIT-I:

Importance of Material characterization, Classification of techniques for characterization. Vacuum systems: Vacuum range, Vacuum Pumps: Rotary, Sorption, Turbomolecular, Diffusion, Ion, Cryo. Vacuum measurement gauge: Pirani, Penning, Ionization etc. Use of Vacuum systems in Material Characterization techniques

UNIT-II:

Thermal Analysis techniques: Principle, Working and application of DTA, TGA, TMA and DSC. Optical microscopy techniques: Metallurgical Microscopes, Aberration in Optical microscopy & its remedies, Polarized light in microscopy, Differential Interference Contrast Illumination, Hot Stage Microscopy, color metallography, and image analysis techniques.

UNIT -III:

Electron microscopy: Electron beam, Principle, Construction and Working of TEM, SEM, STEM, with their merits, limitations and applications. Techniques of replica preparation. Atomic Microscopy: Field Ion Microscope, Working of AFM and STM with their merits, limitations and applications.

UNIT-IV:

Spectroscopic Techniques for chemical analysis: UV-Visual(UV-VIS), IR, FTIR, EDS & WDS, X-ray Fluorescence (XRF), Atomic absorption spectrometer(AAS), Atomic Emission spectroscopy (AES), Secondary Ion mass spectrometry (SIMS), Rutherford backscattering spectroscopy (RBS)

UNIT-V:

Diffraction method: Bragg's Law, X-ray diffraction methods, determination of crystal structure, lattice parameter, crystallite size, merits and demerits. Surface characterization: XPS (ESCA), UPS, Auger Electron Spectroscopy, Electron Probe Micro Analysis (EPMA), LEED.

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REFERENCE BOOKS:

1. F. Weinberg Editor, Tools & Techniques in Physical Metallurgy, Vol. I & II, Marcel Dekker
2. John P. Sibilis, A guide to Material Characterization & Chemical Analysis, VCH Publishers, 1988.
3. J.M. Walls, Editor, Methods of Surface Analysis : Techniques & Applications, Cambridge University Press, 1990.
4. B.D. Cullity, Elements of X-ray diffraction, Addison-Wesley Publishing Company, INC.
5. Bernhard Wunderlich, Thermal Analysis, Academic Press, INC, 1990.
6. B.L. Gabriel, SEM : A user's manual for materials Science, American Society for Metals
7. An Introduction to Materials Characterization by P. R. Khangaonkar, Penram International Publishing (India) Pvt. Ltd.

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Paper Code- MTM-102
Credit- 3

ADVANCED CNC TECHNOLOGY

COURSE OUTCOME

1. To understand features and programming of NC machines.
2. To be able to understand NC part programming and its related aspects
3. To understand the basics of DNC system and adaptive controls.
4. To understand and visualise the Rapid prototyping and all other associated techniques.
5. To be able to understand the basics of post processors and the necessity of it.

UNIT I:

Features of NC Machines : Fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features on N/C Machine Tools, design consideration of NC machine tool, methods of improving machine accuracy.

UNIT II:

NC part Programming: Manual programming-Basic concepts, Point to Point contour programming, canned cycles, parametric programming. Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers.

UNIT III:

DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

UNIT IV:

Rapid Prototyping: Introduction, Stereo-lithography, Selective Laser Sintering, Fusion Deposition Modeling (FDM), LOM, Rapid Tooling.

UNIT V:

Post Processors for CNC: Introduction to Post Processors: The necessity of a Post Processor, the general structure of a Post Processor, the functions of a Post Processor, DAPP-based-Post Processor: Communication channels and major variables in the DAPP-based Post Processor, the creative of a DAPP Based Post Processor.

TEXT BOOKS:

1. Computer Control of Manufacturing Systems / Yoram Korem / Mc Graw Hill Int.1983.
2. Machine Tools Hand Book vol 3, (Automation & Control) / Manfred Weck / John Wiley and Sons, 1984.

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Paper Code- MTM-103
Credit- 3

SENSORS AND SIGNAL CONDITIONING

COURSE OUTCOME

1. To understand the basics of measurement and the classification of sensors.
2. To understand the basics of motion and proximity sensors.
3. To understand the basics force magnetic and heading sensors.
4. To understand the basics optical, pressure and temperature sensors.
5. To understand the basics of signal conditioning and aspects of data acquisition system.

UNIT I: INTRODUCTION

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types

UNIT II: MOTION, PROXIMITY AND RANGING SENSORS

Motion Sensors – Brush Encoders, Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer, – GPS, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR)

UNIT III: FORCE, MAGNETIC AND HEADING SENSORS

Strain Gage, Load Cell Magnetic Sensors – types, principle, requirement and advantages: Magneto resistive – Hall effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclination meters

UNIT IV: OPTICAL, PRESSURE AND TEMPERATURE SENSORS

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric, Temperature – IC, Thermistor, RTD, Thermocouple.

UNIT V: SIGNAL CONDITIONING

Need for Signal Conditioning – DC and AC Signal conditioning – Filter and Isolation Circuits – Operational Amplifier Specifications, Characteristics and Circuits – Voltage and Current Amplifiers – Transmitting Circuits – Fundamentals of Data Acquisition System.

REFERENCES:

1. Patranabis D., Sensor and Actuators, Prentice Hall of India (Pvt) Ltd. 2005.
2. Ernest O. Doebelin, Measurement system, Application and design, Tata McGraw Hill Publishing Company Ltd., Fiftieth Edition, 2004
3. Bradley D.A., and Dawson, Burd and Loader, Mechatronics, Thomson Press India Ltd., 2004
4. Renganathan S., Transducer Engineering, Allied Publishers (P) Ltd., 2003.
5. Bolton W., Mechatronics, Thomson Press, 2003.



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ELECTIVE - I

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Paper Code- MTM-011
Credit- 3

MTM-011 PRECISION ENGINEERING

COURSE OUTCOME

1. To understand the basics of accuracy and its wide application in various control systems.
2. To analyze datum system and types of datum planes along with basics computations of various accuracy.
3. To understand the basics of tolerance analysis and other tolerance charting techniques.
4. To understand the basics of surface finish and the utilization of tolerance in it.
5. To understand the basics of nanotechnology and measuring system processing.

UNIT I:

Concepts of Accuracy : Introduction – Concept of Accuracy of Machine Tools – Spindle and Displacement Accuracies – Accuracy of numerical Control Systems – Errors due to Numerical Interpolation Displacement Measurement System and Velocity Lags, Geometric Dimensioning and Tolerancing Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datums – Datum Feature of Representation – Form Controls, Orientation Controls – Logical Approach to Tolerancing.

UNIT II:

Datum Systems: Design of freedom, Grouped Datum Systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped Datum system with spigot and recess pair and tongue – slot pair – Computation of Transnational and rotational accuracy. Geometric analysis and application.

UNIT III:

Tolerance Analysis: Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects, Feature Tolerances, Geometric Tolerances, Tolerance Charting Techniques – Operation Sequence for typical shaft type of components, Preparation of Process drawings for different operations, Tolerance worksheets and centrally analysis, Examples, Design features to facilitate machining; Datum Features – functional and manufacturing, Components design – Machining considerations, Redesign for manufactured, Examples

UNIT IV:

Surface finish, Review of relationship between attainable tolerance grades and different machining process, Cumulative effect of tolerances sure fit law, normal law and truncated normal law.

UNIT V:

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Fundamentals of Nanotechnology: System of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing.

Measuring Systems Processing : In processing or in-situ measurement of position of processing point- Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

TEXT BOOKS:

1. Precision Engineering in Manufacturing/Murthy R. L./New Age International(P) Ltd, 1996.
2. Geometric Dimensioning and Tolerancing / James D.Meadows / Marcel Dekker Inc.1995.

REFERENCE BOOKS:

1. Nano Technology / Norio Taniguchi / Oxford University Press, 1996.
2. Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd, London.

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Paper Code- MTM-012
Credit- 3

CONCEPT OF MECHANISMS AND MACHINES

COURSE OUTCOME

1. To understand the basics machine and structure, degree of freedom, inversions of simple mechanism.
2. To understand the concept of friction and its types, brakes, and bearing.
3. To understand the basics gears and its classification along with the basics of cams.
4. To understand the basics of vibration and the methods to reduce the effect of vibration.
5. To understand the basics of machine tools and its construction features.

UNIT I: MECHANISMS

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion - Degrees of freedom – Slider crank – Single and double – Crank rocker mechanisms – Inversions – applications. Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II: FRICTION

Types of friction – friction in screw and nuts – pivot and collar – thrust bearings – collar bearing – plate and disc clutches – belt (flat & vee) and rope drives – creep in belts – Jockey pulley – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tension – condition for maximum power transmission – basics of brakes, journal and rolling element bearings hydrostatic and aerostatic bearings – recirculating ball screw and nut assembly.

UNIT III: GEARING AND CAMS

Gear profile and geometry-nomenclature of spur and helical gears – law of gearing – interference requirement of minimum number of teeth in gears-gear trains-simple and compound gear trains determination of speed and torque in epicyclic gear trains-Cam profile-different types of followers.

UNIT IV: VIBRATION

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

UNIT V: MACHINE TOOLS

Machine tool construction-features – operations of lathe, milling machine, drilling machine – Drive system for machine tools – mechanical, hydraulic and electric stepped and variable speeds – spindle speeds and feed drives-linear and reciprocation motion generation.

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REFERENCES:

1. Dr.R.K.Bansal "Theory of Machines" Laxmi Publications (P) Ltd., New Delhi, 2011.
2. G.C.Sen . and A. Bhattacharya, "Principles of machine tools" , New Central book Agency, 1999.
3. Joseph Edward Shigley, Charles R.Mischke, "Mechanical Engineering Design" Mcgraw Hill International Edition, 2008 .
4. Malhotra .D.R. and Gupta .H.C. "The Theory of machines" SatyaPrakasam, Tech. India Publications, 1989.
5. R.S.Khurmi and Gupta . " Theory of Machines" Eurasia Publishing House Pvt Ltd. 2012

The block contains several handwritten signatures and initials in blue ink. On the left, there is a signature that appears to be 'R. K. Bansal'. In the center, there are two sets of initials, one of which is 'Abhi'. On the right, there is a large, stylized signature that appears to be 'Rajiv'.



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Paper Code- MTM-013
Credit- 3

METROLOGY & COMPUTER AIDED INSPECTION

COURSE OUTCOME

1. To understand the basics of metrology and instruments to measure surface metrology.
2. To understand the use of laser in metrology and topography measurements.
3. To understand the special measuring instruments and techniques.
4. To understand the basics of co-ordinate measuring machine.
5. To understand the basics of sensors and its utilization in inspection.

UNIT I:

Metrology and Techniques: Standards in metrology, definitions, Traceability, Characteristics Length & Angular measurements-Review of standard instruments, GD and tolerance procedure- Review of dimension & form tolerance and methods of measurement, Tolerance analysis, Surface metrology- Instruments, Methods and new approaches.

UNIT II:

Laser Applications in Metrology: LASER light source, LASER interferometer, LASER alignment telescope, LASER micrometer, On-line and in-process measurements of diameter, Roundness and surface roughness using LASER, Micro holes and topography measurements.

UNIT III:

Special Measuring Instruments and Techniques: Optoelectronic devices, contact and non-contact types, Applications in on-line and in-process monitoring systems, Tool wear measurement, Surface measurement, Machine vision, shape identification, Edge detection techniques, Normalization, gray scale correlation, Template Techniques, Surface roughness using vision system, Interfacing robot and image processing system.

UNIT IV:

Co-ordinate Measuring Machine: Types of CMM, Probes used, Applications, Non-contact CMM using electro optical sensors for dimensional metrology, Non-contact sensors for surface finish measurements, statistical evaluation of data using computer, Data integration of CMM and data logging in computers.

UNIT V:

Sensors in Inspection: Manufacturing applications of photo detectors, deflection methods-beam detection, Reflex detection, & Proximity detection, Applications of Inductive and Capacitive proximity sensors, Understanding microwave sensing applications laser sensors and limit switches, Advanced sensor technology-Bar code systems, Principles and applications of Colour sensors, electro-magnetic identifier, Tactile sensors, Ultrasonic sensors, Odour sensors.

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Books:

1. Fundamentals of dimensional Metrology T. Busch and R. Harlow Delmar, 3e
2. Engineering Metrology G. Thomas and G. Butter Worth PUB
3. Sensors and Control systems in Manufacturing Sabne Solomon McGraw Hill Book
4. Measurement systems: Applications & Design Doebelin International Student Edition
5. Optoelectronics for Technology and Engineering Robert G. Seippel Prentice Hall India
6. Interface Technology for Computer Controlled Manufacturing processes Ulrich-Remhold, Armbruster and Ulzmann Marcel Dekker Publications, NY
7. Optoelectronics J. Watson Van Nostrand Rein Hold (UK) Company

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Paper Code- MTM-014
Credit-3

INDUSTRIAL AUTOMATION

COURSE OUTCOME

1. Understand basic concepts of automation, levels of automation, use of automation in production system and production economics.
2. Apply appropriate automation techniques to solve industry problems.
3. Analyze different materials handling and product identification techniques in automation.
4. Design automated assembly systems, inspection and testing methods to solve the specific need of automation in industries.
5. Assess current s and future challenges in the field of industries automation.

UNIT I:

Introduction: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, Production Economics.

UNIT II:

Material Transport: Automated Flow lines, Methods of work part Transport, Transfer Mechanism, and Buffer Storage.

UNIT III:

Material handling and Identification Technologies: The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems, Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Product identification system: Barcode, RFID etc.

UNIT IV:

Automated Assembly Systems: Design & Types of Automated Assembly Systems. Different control technologies in automation:

UNIT V:

Automated Inspection and Testing: Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision and other optical Inspection Methods.

REFERENCES AND TEXT BOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing"- M. P. Grover, Pearson Education.
2. "Computer Based Industrial Control" – Krishna Kant, EEE-PHI
3. Principles and Applications of PLC – Webb John, Mcmillan 1992
4. "An Introduction to Automated Process Planning Systems" – Tiess Chiu Chang & Richard A. Wyck
5. "Anatomy of Automation" – Amber G.H & P.S. Amber, Prentice Hall.

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Paper Code- MTM-015
Credit- 3

MECHATRONICS SYSTEMS DESIGN

COURSE OUTCOME

1. Understand the key elements of mechatronic systems, design optimization and identify possible applications of mechatronic systems
2. Apply the analytical skills to develop mathematical model of electrical, mechanical, electro-mechanical and fluid systems.
3. Analyse the developed mathematical model of electrical, mechanical, electro- mechanical and fluid systems through simulations and optimise the design
4. Design the circuits to interface various sensors to mechatronic systems. Develop the control system for DC motor position control.
5. Assess the current research issues and future directions in the field of automation for washing machine, digital cameras, pH controller, temperature controller etc.

UNIT I:

Mechatronic systems, Key elements, Mechatronic design process, Application types, Interfacing issues, Man Machine Interfaces, Safety features, optimization of Mechatronic design, Fault diagnosis.

UNIT II:

Mathematical models, Block diagram modelling, Analogy approach, Impedance diagrams, Models for Electrical, Mechanical, Electro-mechanical and Fluid systems, System Identification, Least square method, Closed loop identification, joint input/output identification, State estimators, Model Validation.

UNIT III:

Simulation basics, Probability concepts in simulation, Discrete event simulation, Simulation Methodology, Queuing system model components, Continuous system modelling, Monte Carlo simulation, Analysis of simulation results, Simulation life cycle.

UNIT IV:

Mass-Spring-Oscillation and Damping system, Position Control of Permanent magnet DC motor using Hall sensor and optical encoder, Auto-control system for Green House Temperature, Transducer Calibration system, Strain Gauge Weighing system, Solenoid Force-Displacement Calibration system.

UNIT V:

Automatic Washing Machine, Hard Drive control, Auto-focusing in Digital Cameras, Active suspension in vehicles, Visual Servoing models, Thermal cycle fatigue of a Ceramic plate, pH Control system, De-icing temperature control system, Skip control of a CD player, Simulation of Rocket thrust control, Time delay Flow.

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REFERENCES AND TEXT BOOKS:

1. Devadas Shetty, Richard A.Kolkm, "Mechatronics system design, PWS publishing company, 2009.
2. Bolton, "Mechatronics – Electronic control systems in mechanical and electrical engineering, 2nd edition, Addison Wesley Longman Ltd., 2009.
3. Brian morriss, "Automated manufacturing Systems – Actuators Controls, sensors and Robotics", McGraw Hill International Edition, 2000.
4. Bradley, D. Dawson, N.C.Burd and A.J. Loader, "Mechatronics: Electronics in product and process", Chapman and Hall, London, 1999

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ELECTIVE - II

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Paper Code- MTM-021
Credit-3

CONTROL SYSTEM

COURSE OUTCOME

1. To be able to understand the importance of mathematical model and industrial automatic controls.
2. To understand transient response analysis and representation of transfer function.
3. To understand and utilize the stability analysis and its various methods to analyze stability.
4. To understand the basics of state space and state variables.
5. To be able to understand the state variable and analyse the state models and its associated matrix.

UNIT-I

Mathematical Model For Physical Systems - Open loop - closed loop control - Differential equations of physical systems - Transfer functions - Block diagram algebra - Signal flow graphs - Reduction using Mason's gain formula.
Industrial Automatic Controls - Classification - Proportional derivative and integral control actions - Liquid level control systems with proportional and integral control - Pneumatic, hydraulic and electronic controllers

UNIT-II

Transient Response Analysis - Standard signals - transient response of first and second order systems - Steady state errors and error constants.

UNIT-III

Transfer Function Representation: Transfer function of DC servomotor - AC servomotor - Synchronous transmitter and receiver. Block diagram representation of systems - Representation by signal flow graph.

UNIT-IV

Stability Analysis: Concepts of Stability - Necessary conditions for stability - Hurwitz stability criterion - Routh's stability criterion - Relative stability. Frequency Response Analysis - The root locus concept - Frequency response, polar plot, Bode plot - Nyquist stability criterion.

UNIT-V

State Variable Model and Analysis - Concepts of state & state variables - Derivation of state models from Block diagrams - State space representation of systems - Transfer matrix - Solution of state equation - State transition matrix - Concepts of controllability and observability.

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TEXT BOOKS

1. Control systems, Principles and Design / M Gopal / TMH.
2. Modern Control Engineering/ K.Ogata / Prentice Hall.
3. Control Systems /Anand Kumar / Prentice Hall.

REFERENCES:

1. Control Systems Engineering /Nagrath & M.Gopal/ Wiley Eastern.
2. Automatic control systems/ B.C.Kuo/John Wiley & Sons/ Modern Control Systems/ Richard Dorf and Robert H. Bishop.

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ख्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
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Paper Code- MTM-022
Credit- 3

POWER ELECTRONICS AND DRIVES

COURSE OUTCOME

1. To understand the basics of power electronics and designing circuits, rating and protection.
2. To be able to understand the circuits of converters and inverters.
3. To understand the basics of Industrial motor control and controllers.
4. To understand the basics of relays and mathematical model of it.
5. To understand and utilize the basics of process controllers and digital controller.

UNIT-I

Introduction : Introduction to Power electronics- Power electronics versus linear electronics- Review of thyristors- Power FETS – Turn on and off circuits- Microprocessor based firing circuits- Series and Parallel operation –protection circuits- Design of snubber circuits- rating and protection.

UNIT-II

Converters and Inverters: Analysis of half controlled and fully controlled converters- Dual converters- Analysis of voltage source and current source- Current source and series converters.

UNIT-III

Industrial Motor Control : Methods of controlling speed – Introduction and DC Motor controls- use of Microcontroller for speed control- Feedback and Feed forward control- Step-Up and Step-Down Choppers- use of Choppers- Frequency converters and cyclo converters.

UNIT-IV

Relays, Heat and Welding : Standard Eigen value problems- properties of Eigen values and Eigen Vectors- Generalized Eigen value problems- Strum sequence- Jacobi, Givens and Householders transformations.

UNIT-V

Process Controllers : Elements of process control- Process Characteristics- ON/OFF control- Proportional and Derivative control- electronic controllers – Pneumatic controller- Temperature, flow and pressure control voltage regulations- principle of digital control.

TEXT BOOK:

1. R.Ralph Benedict and Nathan Weiner- "Industrial electronics circuits and applications" – prentice hall of India New Delhi, 1996.

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REFERENCE BOOKS:

1. P.C Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons Inc 2nd edition, 1997.
2. Harrott, P "Process Control"- Tata McGraw Hill 1991.
3. Joseph Vithayathil, "Power Electronics": Principle and Application McGraw Hill 1st edition 1995.

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Paper Code- MTM-023
Credit- 3

INTERNET OF THINGS (IOT)

COURSE OUTCOME

1. To understand the basics of IOT and its framework and architecture.
2. To understand and hardware for IOT and various associated aspects.
3. To understand the basics of network and communication aspects of IOT.
4. To understand and application on arduino.
5. To understand the challenges associated with IOT design.

UNIT I:

Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples, Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability

UNIT II:

Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.

UNIT III:

Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

UNIT IV:

Programming the Arduino: Arduino Platform Boards Anatomy, Arduino IDE, coding, using emulator, using libraries, additions in arduino, programming the arduino for IoT.

UNIT V:

Challenges in IoT Design challenges: Development Challenges, Security Challenges, Other challenges IoT Applications : Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, Communicating data with H/W units, mobiles, tablets, Designing smart street lights in smart city.

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REFERENCES:

1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", Wiley
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications, 2014
6. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India

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Paper Code- MTM-024
Credit- 3

PC BASED AUTOMATION

COURSE OUTCOME

1. Understand the basic computer architecture including serial and parallel communication techniques, develop the understanding of LAN, WAN and MAN Networks.
2. Apply quantization and sampling techniques on discrete and continuous signals for designing various ADC and DAC.
3. Analyse multi-channel analog signals and understand the concept of universal DAQ card.
4. Design flowchart and program algorithms, develop the understanding of programming and debugging techniques.
5. Assess current research issues and future directions in field of virtual instrumentation.

UNIT I:

Basic Computer Architecture, Components of a PC, Serial and Parallel Communications, Parallel port, OSI Model, RS232, USB, ISA, PCI, PXI, PCI Express, GPIB Protocols, LAN, WAN and MAN Networks, RS485, RS 422, LXI Protocols, Modbus, Field bus, Ethernet, CAN bus, SCADA and DCS.

UNIT II:

Continuous and Discrete signals, Sampling theorem, Quantization, Sampling and Hold, ADC, DAC, Resolution and Sampling Frequency, Multiplexing of input signals, Single ended and differential inputs, Sampling of Multi-channel analog signals. Concept, Timer, Counter and analog output in Universal DAQ card.

UNIT III:

Algorithm, Flowchart, Variables & Constants, Expressions, Data types, Input output operations, Conditional Statements, Looping, Sub-programs/Functions, Arrays, Structures and Classes, Inheritance, Polymorphism, Debugging.

UNIT IV:

GUI, Graphical Programming, Data Flow techniques, Processing Data in GP, Loops and Structures, Event based & Schedule based operations, Global and Local Variables, File I/O operations, parallel processing of data, Virtual Instrument and control, VISA & SCPI.

REFERENCES:

1. Morris Mano M., Computer System Architecture, Prentice Hall of India, Third Edition, 2002.
2. John P. Hayes, Computer Architecture and Organization, McGraw Hill International, Third Edition, 2003.

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Edition, 1998.

3. William Stallings, "Computer Organization and Architecture", VI Edition, Prentice Hall of India, 2003.
4. Krishna Kant, 'Computer based Industrial Control', Prentice Hall of India, 1997.
5. Gary Johnson, 'LabVIEW Graphical Programming', II Ed., McGraw Hill, 1997.
6. Sanjeev Gupta, 'Virtual Instrumentation using Labview' Tata McGraw Hill, 2004.
7. Jovitha Jeome 'Virtual Instrumentation using Lab View' PHI Learning Pvt Ltd, 2009.



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AUDIT COURSE

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Paper Code- MTM-A01
Credit- 0

MTM-A01 RESEARCH PROCESS & METHODOLOGY

COURSE OUTCOME

1. To understand the definition of problem and basics of research.
2. To understand research design and methods of research design
3. To understand the basics data, its classification and methods of collections.
4. To understand the basics data analysis, interpretation and all other associated aspects.
5. To understand the types of research reports and all other basics associated with it.

UNIT I:

Introduction to Research and Problem Definition Meaning, Objective and importance of research, Types of research, steps involved in research, defining research problem

UNIT II:

Research design, Methods of research design, research process and steps involved, Literature Survey

Unit III:

Data Collection Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research

Unit IV:

Data Analysis and interpretation Data analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis testing, Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results

Unit V:

Technical Writing and reporting of research Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing and citation of Journals, Intellectual property, Plagiarism

Text Books:

1. C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques, New Age International publishers, Third Edition.
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005
3. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
4. Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013.

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Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

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Paper Code- MEM-151
Credit-2

SENSOR LAB

COURSE OUTCOME

1. To get familiar with the MATLAB software.
2. To get basics of LABVIEW package.
3. To get familiar with the VEE package.
4. To understand the LVDT and application of sensor.

LIST OF EXPERIMENTS:

1. Familiarization of MATLAB package.
2. Familiarization of LABVIEW package.
3. Familiarization of VEE package.
4. Temperature & Optical transducers Characterization.
5. Strain gage, Load cell characterization & applications
6. Torque transducer characterization & applications
7. LVDT, Acoustics Ranging and Hall effect sensor applications.



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Khwaja MoINUDDIN Chishti Language University, Lucknow, U.P. (India)

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Paper Code- MTM-152
Credit- 1

ADVANCED CNC LAB

RSE OUTCOME

1. To apply the basics G & M codes
2. To apply application of CNC with turning and milling process.
3. To understand the working of various non-conventional machining process.
4. To understand and get familiar to CMM.
5. To understand the basics and get familiar with the basics of NDT technique.

LIST OF EXPERIMENTS:

1. Exercises on Manual CNC Part programming using G& M codes.
2. Machining of parts on CNC Machines including preparation of part program, after simulation of tool path using suitable CAM software package.
3. Part Programming using CAM software like MASTERCAM
4. CNC programming on Turning and Milling process
5. Experiments on micro-machining
6. Study and experimentation with CMM
7. Experiments with NDT techniques
8. Experiments with non conventional machining processes such as EDM, USM, Abrasive Machining etc...
9. Use of Surface roughness meter and related experiments



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Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

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SEMESTER: II

भाषा विश्व विद्यालय



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Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

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Paper Code- MTM-201
Credit-3

COMPUTATIONAL FLUID DYNAMICS

COURSE OUTCOME

1. To be able to understand the basics equations of mass, energy and its conservation.
2. To understand the various types of equation, and its boundary conditions along with few numerical methods.
3. To understand and application finite difference methods and other finite methods.
4. Applications of various solutions of finite difference equations and its applications.
5. To understand the basics and applications of phase change problems and associated methods.

UNIT I:

Introduction, Conservation equation, Mass Momentum and Energy equations, Convective form of the equation and general description.

UNIT II:

Clarification into various types of equation, Parabolic, Elliptic, Boundary and initial conditions, Overview of numerical methods.

UNIT III:

Finite difference methods; Different means for formulating finite difference equations, Taylor series expansion, Integration over element, Local function method; Finite volume methods; Central, upwind and hybrid formulations and comparison for convection-diffusion problem, Treatment of boundary conditions; Boundary layer treatment; Variable property, Interface and free surface treatment, Accuracy of F.D. method.

UNIT IV:

Solution of finite difference equations; Iterative methods; Matrix inversion methods, ADI method, Operator splitting, Fast Fourier Transform applications.

UNIT V:

Phase change problems, Rayleigh-Ritz, Galerkin and Least square methods; Interpolation functions, One and two dimensional elements, Applications. Phase change problems; Different approaches for moving boundary; Variable time step method, Enthalpy method.

Books:

1. Computational Methods for Fluid Dynamics Ferziger Joel H Springer-Verlog
2. Principles of Heat Transfer Kaviany M Wiley-International
3. Radiative Heat Transfer Modest Michael Academic Press
4. Middleman Stanley John Wiley.



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Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

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Paper Code- MTM-202
Credit-3

INDUSTRIAL ROBOTICS

RSE OUTCOME

1. To understand the basics of robots and its configurations.
2. To be able to understand the complete kinematics of robot motion and various methods for location and orientation of the object.
3. To understand the basics of sensors and its applications.
4. To understand the basics of programming and few of the AI related techniques.
5. To be able to understand the robotic cells layouts and applications of robots in various fields.

UNIT I

INTRODUCTION

Types of Industrial Robots, definitions – classifications based on work envelope – Generations configurations and control loops, co-ordinate system – need for robot – basic parts and functions – specifications.

UNIT II

MECHANICAL DESIGN OF ROBOT SYSTEM

Robot motion – Kinematics of Robot motion – Direct and Indirect kinematics Homogeneous transformations – linkages and joints – mechanism – method for location and orientation of objects – drive systems – end effectors – types, selection, classification and design of grippers – gripper force analysis.

UNIT III

SENSORS

Functions of Sensors – Position and proximity's sensing – tactile sensing – sensing joint forces – vision system – object recognition and image transformation – safety monitoring sensor systems – image analysis – application of image processing.

UNIT IV

ROBOT PROGRAMMING & AI TECHNIQUES

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

UNIT V

ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

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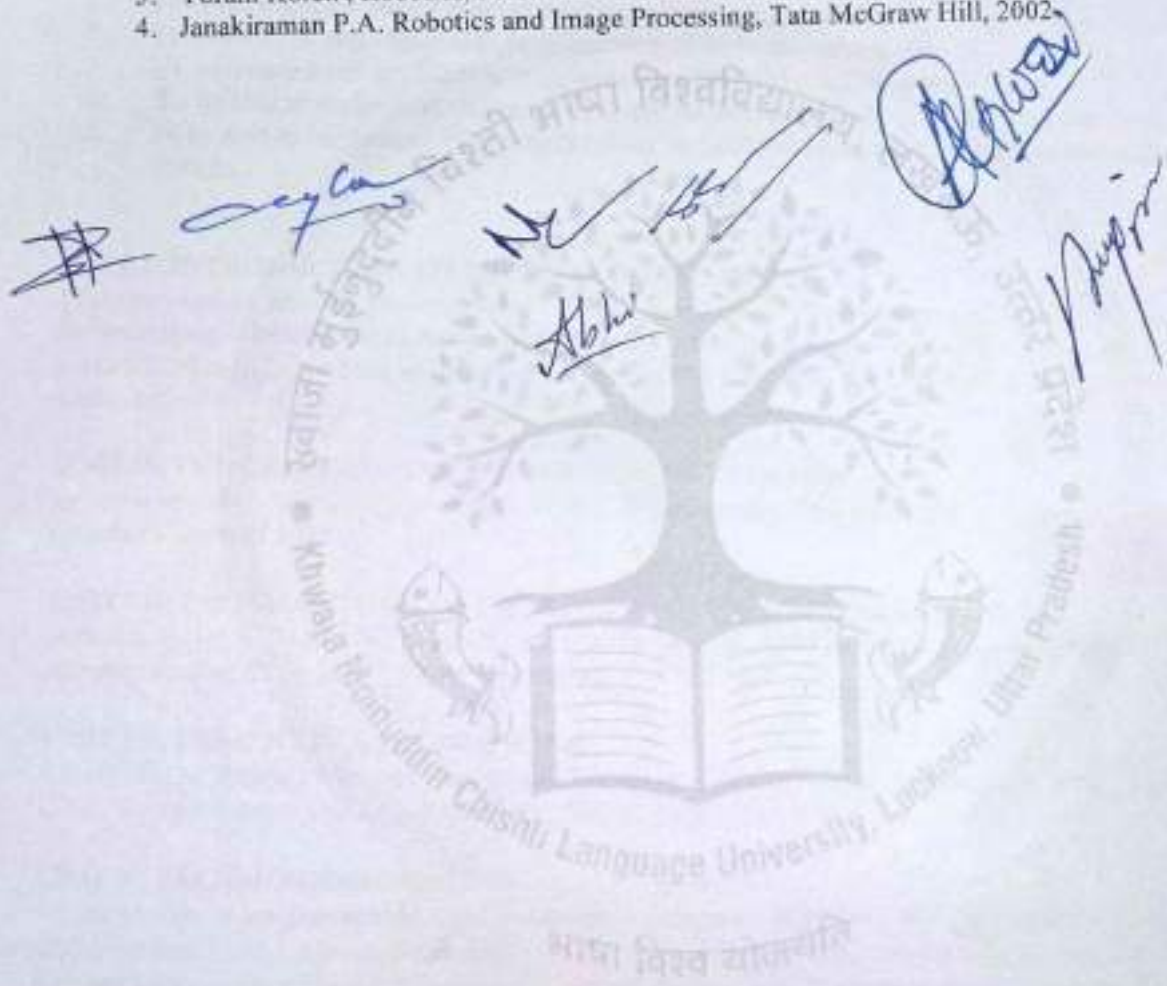
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Text Books:-

1. Groover, M.P. Industrial Robotics, technology, programming and application Mc-Graw Hill book and co. 2012
2. Fu, K.S., Gonzalez R.C., Lee C.S.G, Robotics Control, sensing, vision and intelligence, Mc-Graw Hill book co 2011.
3. Yoram Koren, Robotics, McGraw Hill 2006
4. Janakiraman P.A. Robotics and Image Processing, Tata McGraw Hill, 2002.





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Paper Code- MTM203

Credit- 3

MICROCONTROLLER & PLC

COURSE OUTCOME

1. To understand the basics microcontroller and its various aspects
2. To understand and implement programming of 8051 microcontroller
3. To understand and application programming of PIC18FXXX microcontroller
4. To be able to understand the various peripheral interfacing related with microcontroller.
5. To be able to implement PLC programming by understanding the basics and architecture of PLC.

UNIT I: INTRODUCTION TO MICRO CONTROLLER

Microprocessors and Microcontrollers – CISC and RISC – Fundamentals of Assembly language Programming – Instruction to Assembler – C Programming for Microcontrollers – Compiler and IDE – Introduction to Embedded systems – Architecture 8051 family – PIC 18FXXX – family – Memory organization

UNIT II: PROGRAMMING OF 8051 MICROCONTROLLER

Instruction set – Addressing modes – I/O Programming-Timer/Counter – Interrupts – Serial communication of 8051.

UNIT III: PROGRAMMING OF PIC18FXXX MICROCONTROLLER

Instruction set – Addressing modes – I/O Programming-Timer/Counter – Interrupts – Serial communication, CCP, ECCP PWM programming of PIC18FXXX.

UNIT IV: PERIPHERAL INTERFACING

Interfacing of Relays, Memory, key board, Displays – Alphanumeric and Graphic, RTC, ADC and DAC, Stepper motors and DC Motors, I2C, SPI with 8051 and PIC family

UNIT V: PLC PROGRAMMING

Fundamentals of programmable logic controller – Functions of PLCs – PLC operations – Evaluation of the modern PLC – Memory– Selection of PLC – Features of PLC – Architecture – Basics of PLC programming – Developing Fundamental wiring diagrams – Problem solving using logic ladder diagrams – communication in PLCs – Programming Timers – Programming counters – Data Handling.

REFERENCES

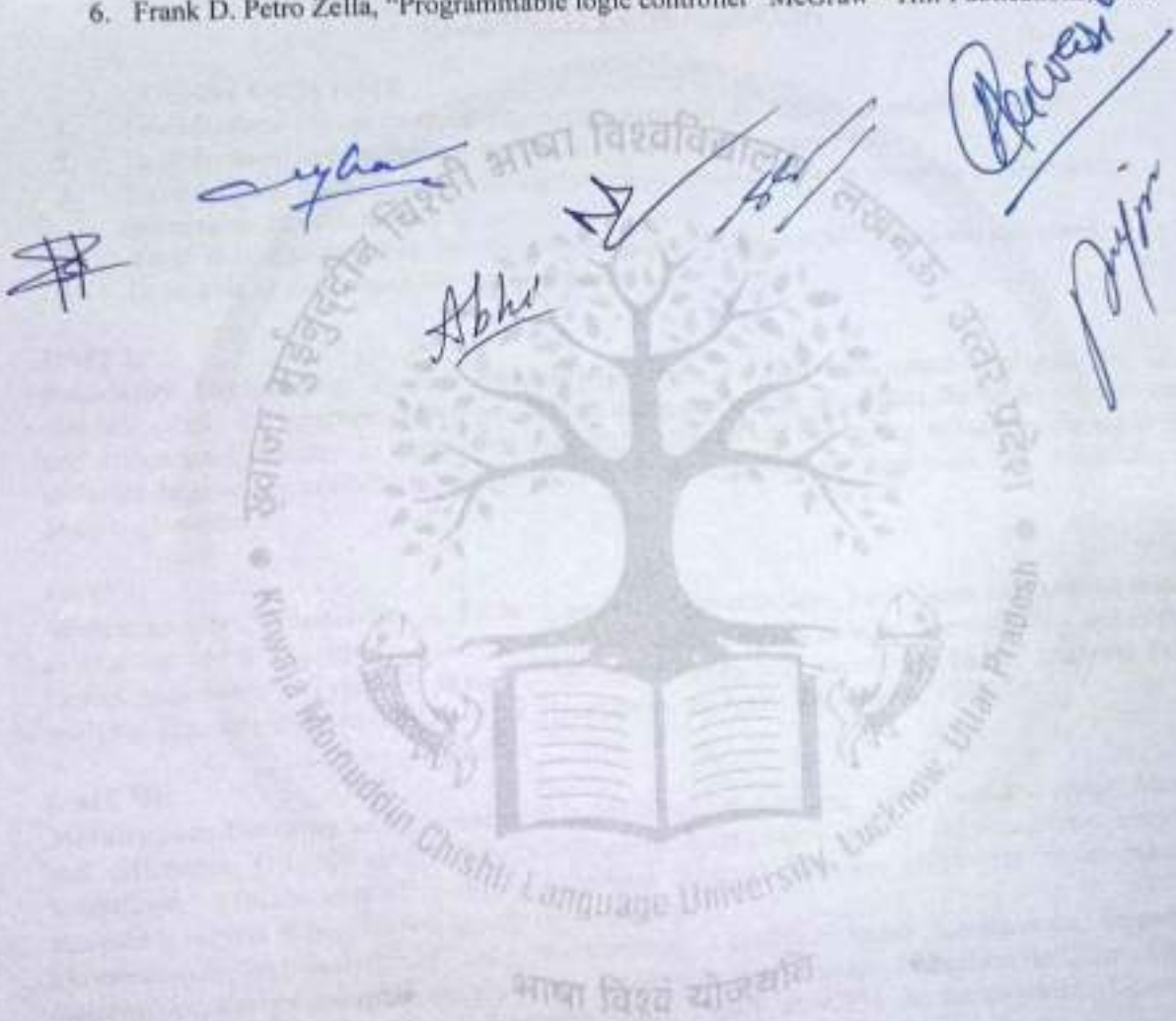
1. Muhammad Ali Mazidi and Janice GillispieMazdi, "The 8051 Microcontroller and Embedded Systems" Pearson Education, Inc 2006.
2. John B. Peatman, PIC programing, McGraw Hill International, USA, 2005.



ख्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
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3. John B. Peatman, Design with Micro controllers, McGraw Hill International, USA, 2005.
4. Kenneth J. Aylala, "The 8051 Micro controller, the Architecture and Programming applications":2003..
5. James W. Stewart, "The 8051 Micro controller hardware, software and interfacing, regents Prentice Hall, 2003.
6. Frank D. Petro Zella, "Programmable logic controller" McGraw – Hill Publications, 1998





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Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
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Paper Code- MTM-032
Credit- 3

SIMULATION, MODELING OF MANUFACTURING SYSTEM

COURSE OUTCOME

1. To understand the basics of systems and models and their simulations.
2. To understand the various steps involved in the simulation process.
3. To understand the mathematical aspects of simulations.
4. To be able to understand the various analysis methods used for analysing the output..
5. To understand the various field of applications associated with the simulation.

UNIT I:

System – ways to analyze the system – Model - types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages. Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1 & 2 errors – Framing – strong law of large numbers.

UNIT II:

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model. Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

UNIT III:

Generation of random variates – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – weibull – normal Bernoulli – Binomial – uniform – poisson. Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.

UNIT IV:

Output data analysis – Types of Simulation w.r.t output data analysis – warmup period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

UNIT V :

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

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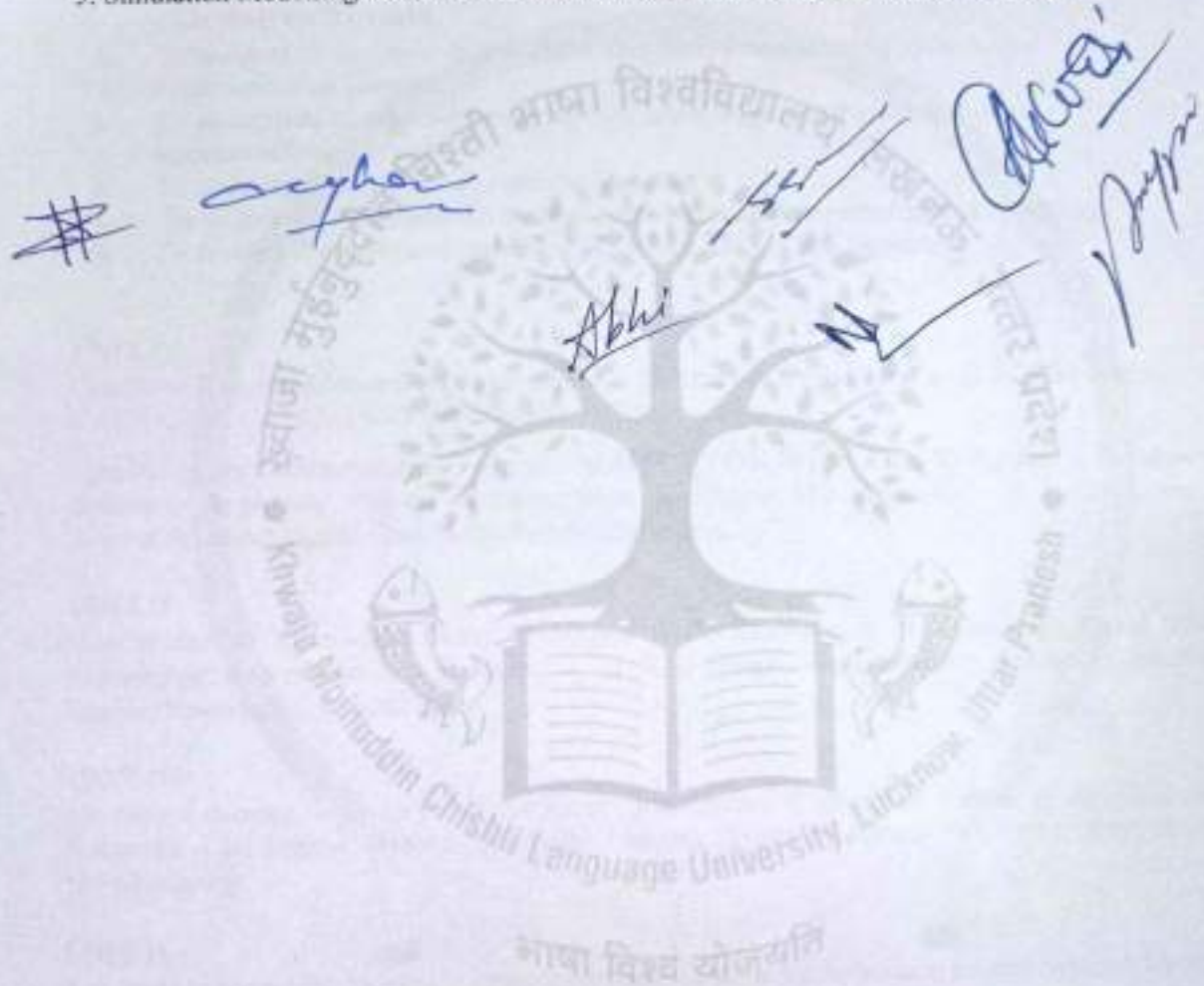


ख्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
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TEXT BOOKS:

1. Simulation Modelling and Analysis / Law, A.M. & Kelton / McGraw Hill, 2nd Edition, New York, 1991.
2. Discrete Event System Simulation / Banks J. & Carson J.S., PH / Englewood Cliffs, NJ, 1984.
3. Simulation of Manufacturing Systems / Carrie A. / Wiley, NY, 1990.
4. A Course in Simulation / Ross, S.M., McMillan, NY, 1990.
5. Simulation Modelling and SIMNET / Taha H.A. / PH, Englewood Cliffs, NJ, 1987.





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Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

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Paper Code- MTM-044
Credit- 3

MACHINE LEARNING

COURSE OUTCOME

1. To understand the basics of machine learning and applications of ML.
2. To understand the various models, boundary conditions associated with a hypothesis.
3. To understand the basics of Decision tree and associated various applications.
4. To be able to understand unsupervised learning techniques and associated algorithms.
5. To understand the basics of reinforcement learning algorithms.

UNIT I:

Basic Concepts, Introduction to Machine Learning, Applications of ML, Design Perspective and Issues in ML, Supervised, Unsupervised, Semi-supervised learning with applications and issues, A Formal Learning Model, The Runtime of Learning.

UNIT II:

Model (or hypothesis) representation, decision boundary, cost function, gradient descent, regularization, Diagnostic: debugging a learning algorithm, evaluating a hypothesis (Model selection), training/validating/testing procedures, diagnosing bias versus variance and vice versa, regularization and bias/variance, learning curves, Accuracy and Error measures: classifier accuracy measures, predictor error measure, evaluating the accuracy of a classifier or predictor, Confusion metric, precision, recall, tradeoff between both, accuracy.

UNIT III:

Decision Tree : representation, hypothesis, issues in Decision Tree Learning, Pruning, Rule extraction from Tree, Learning rules from Data, Probabilistic classifier: Bayes rule, Maximum Likelihood Estimation, case study, Support Vector Machine, Nearest Neighbor.

UNIT IV:

Clustering: Unsupervised learning technique, Similarity and Distance Measures, k-means and k-medoids algorithm, optimization objective, random initialization, choosing value of k, EM algorithm Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, Graphical Models, Combining Multiple Learners.

UNIT V:

Reinforcement Learning: Elements of Reinforcement Learning, Model-Based Learning, Temporal Difference Learning, Generalization, Design and Analysis of Machine Learning Experiments.

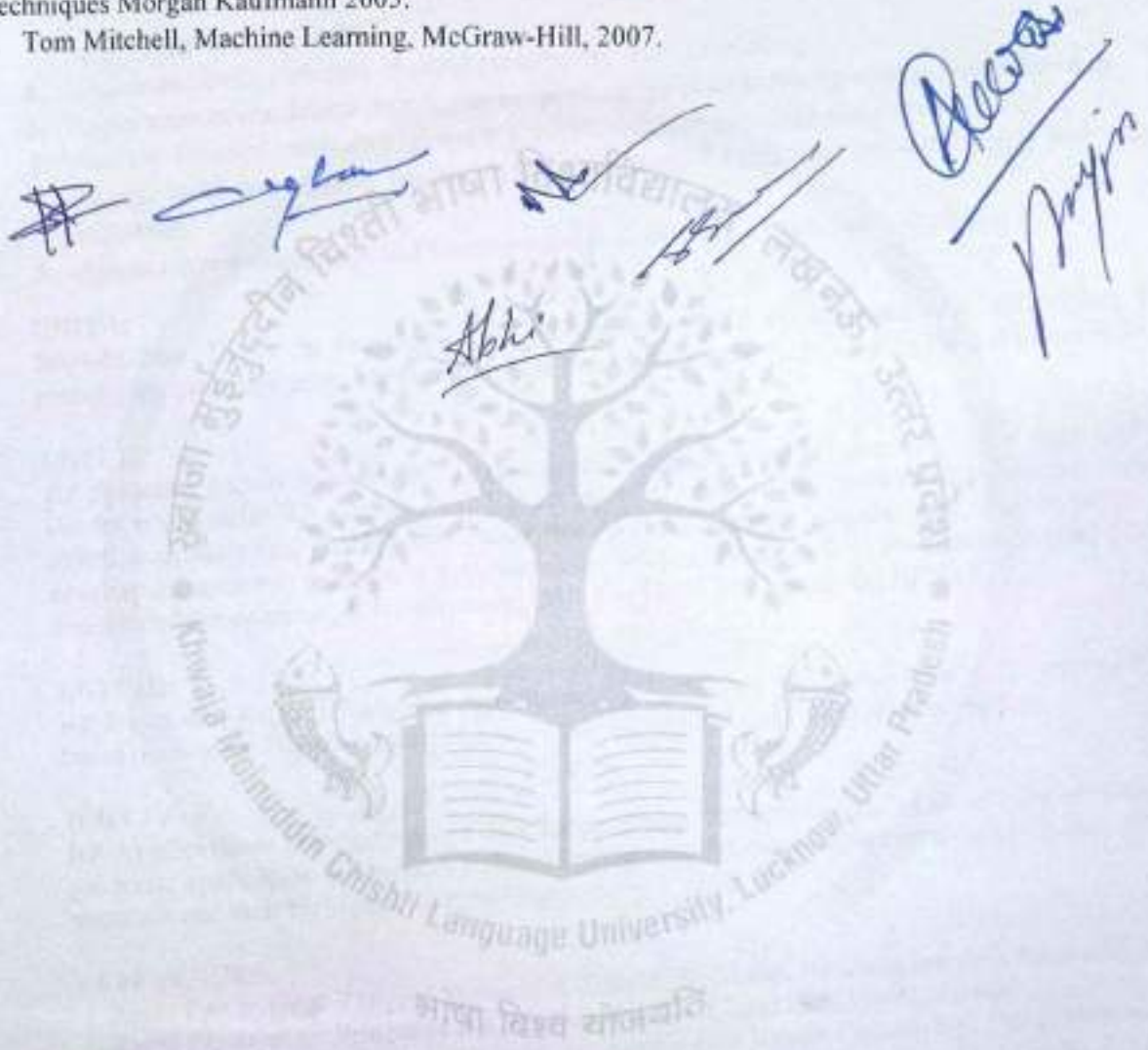


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Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
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2. H. Witten and E. Frank, Data Mining: Practical Machine Learning Tools and Techniques Morgan Kaufmann 2005.
3. Tom Mitchell, Machine Learning, McGraw-Hill, 2007.





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Paper Code- MTM-251
Credit- 2

APPLIED MECHATRONICS LAB

COURSE OUTCOME

1. To work on CNC lathe operations and understand the basics of it.
2. To work on CNC milling operations and understand the basics of it.
3. To work on CNC trainer and CNC milling machines by applying various part programs.
4. To program a robot and understand various aspects of it.
5. To design and execute logics on PLC

LIST OF EXPERIMENTS:

1. Study and operation of CNC lathe.
2. Study and CNC milling machine.
3. Preparation of testing of typical part programs on CNC Trainer.
4. Preparation of testing of typical part programs on CNC milling machine.
5. Exercises using CAM software.
6. Training on Desktop Tutors.
7. Part program generation through G and M codes for Turning, Boring, Drilling, Reaming and Milling.
8. Development of tool path simulation by setting tool offsets for multi-operations (Combinations of above operations).
9. Study of various cutting tools used in above CNC Machines such as twist drill, End Mill cutter, and other Standard tooling.
10. Machining of various Components by generation of CNC code by (CAM Packages).
11. Interfacing the CNC Codes to the CNC Lathe and mill through RS232.
12. ROBOT Programming.
13. Designing of ladder logic for various practical applications.
14. Execution of ladder logic using PLC's.

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