Kalinga University Atal Nagar (C.G.)

SCHEME OF EXAMINATION

& SYLLABUS

of

M.Tech Electrical

Instrumentation & Control Engineering

UNDER

Faculty of Engineering and Technology

w.e.f. Session 2021-22

Kalinga University, Raipur
Master of Technology (M.Tech) Electrical Instrumentation & Control Engineering
(2 yrs Programme) w.e.f 2021-22 Session

M.Tech Electrical Instrumentation & Control Engineering					
Semester - I					
Code No.	**Paper**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
MEIC101	Industrial Transducers & Sensors	4	100	50	150
MEIC102	Bio-Medical Instrumentation	4	100	50	150
MEIC103	Digital Measurement Techniques	4	100	50	150
MEIC104	Control System Design	4	100	50	150
Refer Below Elective – I		4	100	50	150
MEIC105A	Systems Optimization				
MEIC105B	Reliability Engineering				
MEIC105C	Robotics & Computer Vision				
MEIC106-P	Industrial Transducers & Sensors Lab	1	30	20	50
MEIC107-P	Control System Design Lab	1	30	20	50
	Total	**22**	**560**	**290**	**850**
Semester - II					
Code No.	**Paper**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
MEIC201	Microcontroller & Embedded Systems	4	100	50	150
MEIC202	Optimal Control Systems	4	100	50	150
MEIC203	Process Control & Industrial Automation	4	100	50	150
MEIC204	Industrial Electronics & Power Control	4	100	50	150
Refer Below Elective – II		4	100	50	150
MEIC205A	Fuzzy - Neural Control				
MEIC205B	Computer Numerical Control & Programming				
MEIC205C	AI & ES in Industrial Systems				
MEIC206-P	Microcontroller & Embedded Systems Lab	1	30	20	50
MEIC207-P	Computer Simulation Lab	1	30	20	50
	Total	**22**	**560**	**290**	**850**

Semester - III					
Code No.	**Paper**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
MEIC301	Adaptive Control Systems	4	100	50	150
MEIC302	Communication & Research Methodology	4	100	50	150
Refer Below Elective – III		4	100	50	150
MEIC303A	Analytical Instrumentation				
MEIC303B	Real Time Systems				
MEIC303C	Programmable Logic Controllers				
MEIC304	Preliminary work on Dissertation	9	100	50	150
MEIC305	Seminar Based on Dissertation	1	100	50	150
	Total	**22**	**500**	**250**	**750**
Semester - IV					
Code No.	**Paper**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
MEIC401	Dissertation	18	300	200	500
	Total	**18**	**300**	**200**	**500**

SEMESTER -I

MEIC101

Industrial Transducers & Sensors

UNIT–I

Transducers Fundamentals: Transducer terminologies, principles, design and performance characteristics, criteria for transducer selection, static and dynamic characteristics, identification of sensor parameters. Classification of transducers.

UNIT-II

Types of Transducers: Mechanical Transducers, Passive Electrical transducers, Active Electrical Transducers, Feedback transducer systems, Resistive transducers, inductive transducers, capacitive transducers, Piezo-electric transducers, Nuclear Transducers.

UNIT-III

Mechanical Transducers: Displacement transducers, tachometers and velocity transducers, accelerometers and gyros, force and torque transducers, Angular and linear encoders. Strain gauges, Gauge Factor, Measurement of strain, Temperature compensation, Calibration, Load cells. Pressure Transducers: Terminology, Units; Manometers – Piezometer, U-Tube Double Column Manometer, Single Column Manometer, U-Tube Differential Manometer, Double Reservoir Manometer; Advantages and Limitations; Bourdan Gauge; Thermal Conductivity Gauge; Pirani Gauge; Dead Weight Piston Gauge.

UNIT-IV

Temperature Transducers: Liquid-in-glass thermometers; Bimetallic Thermometers; Thermocouples, Laws of thermocouples, Elements of thermoelectric pyrometers, General considerations in thermocouples, thermocouple instrumentation and circuits; Resistance thermometers; Thermistors; Radiation and Optical Pyrometers.

UNIT-V

Flow Sensors: Nature of flow, Classification of flow measurement techniques, Theory of variable head meters (incompressible fluids), Venturi Flow meter, Flow Nozzle, Orifice Flow meter, Electromagnetic Flow meter, Hot Wire Anemometer. Optical Sensors: Photo tubes and photo diodes: photo-voltaic and photo-conductive cells, photo emission, photo electromagnetic detectors, pressure actuators, photo electronic detectors, design and operation of optical detectors, detector characteristics, different types of optical fiber sensors.

Text Books:

1. Transducers and Instrumentation, D.V.S. Murthy; Prentice Hall
2. Measurement systems: Application and Design – E.O. Doeblin; Tata McGraw Hill

Books Reference :

1. Sensors and Transducers- D. Patranabis; Prentice Hall
2. Instrumentation Devices and Systems - C.S. Rangan, G.R. Sharma, V S V Mani
3. Telemetry Principles, Patranabis; Tata McGraw Hill
4. Electronic Instrument Handbook, Clyde F Coombs; McGraw Hill

5. Electronic Instrumentation and Measurement Techniques, William David Cooper, Albert D. Helfrick, Prentice-Hall of India.

Further Reading:

1. Intelligent Sensor Systems, John Brignell & Neil White
2. AIP Handbook of Modern Sensors, Jacob Fraden
3. Sensors and Signal Conditioning, Ramon Pallas-Areny and John G. Webster
4. Capacitive Sensors, Larry Baxtor
5. Electronic Distance Measurement, J.M. Rueger
6. http://www.sensorsportal.com/
7. http://www.sensorsmag.com/

MEIC102

Biomedical Instrumentation

UNIT-I

Introduction: Brief introduction to human physiology, Basic components of bio-medical instruments, bio-electric signals and recording electrodes, Biomedical Transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases

UNIT-II

Bio-Potentials and Their Measurement: EEG, ECG, EMG, EOG and their nature. Bio-electrodes and Bio-Potential Amplifiers.

UNIT-III

Cardiac Instrumentation – Measurement of blood pressure, blood flow, stroke volume, Impedance Plethysmography, Cardiac output, heart sound etc. Instrumentation for respiratory and nervous systems.

UNIT-IV

Non-invasive Diagnostic Measurements: Temperature measurements, X-ray diagnosis, Ultrasonic and Nuclear Medical Imaging Systems, Digital Radiographic Equipment, Prostheses and aids: Pacemakers, Defibrillators, Heart-Lung Machine, Lithotriptors, artificial kidney, Anesthesia Machine, Ventilators, Radiotherapy Equipment, Automated Drug Delivery System, aids for the handicapped.

UNIT-V

Advanced Topics in Medical Electronics: Safety aspects. Recent advances in Bio-Medical Instrumentation, Microprocessor based systems, Laser and optical fiber systems.

Text Books:

1. Biomedical Instrumentation & Measurement, L. Cromwell, F.J. Weibell and E.A. Pfeiffer, 2nd Ed., PHI
2. Handbook of Biomedical Instrumentation, R.S. Khandpur, Tata McGraw Hill Pub. Co.

Books Reference :

1. Electronics in Medicine and Biomedical Instrumentation, Nandini K. Jog, Prentice Hall [I]
2. Biomedical Instrumentation, Dr. A. Arumugam, Anuradha Agencies, Chennai.
3. Introduction to Biomedical Engineering, Domach, Pearson Education
4. Principles of Medical Electronics & Biomedical Instrumentation, C Raja Rao & S.K Guha, University Press.
5. Handbook of Medical Electronics, J.G. Webster
6. Principles of Medical Electronics and Biomedical Instrumentation, By C. Raja Rao, Sujoy K. Guha, Universities press (India) Limited.

Further Reading:

1. IEEE Transactions on Medical Electronics

MEIC103

Digital Measurement Techniques

UNIT – I

DIGITAL TIME MEASUREMENT: Introduction, measurement of time between two events, error in time interval, Vernier techniques, measurement of periodic time, phase measurement, capacitance measurement, quality factor measurement.

UNIT – II

DIGITAL FREQUENCY MEASUREMENT: Introduction, basics of frequency measurement, measurement of ratio of two frequency, product of two frequency measurement, high frequency measurement, low frequency measurement, low frequency measurement in a narrow band.

UNIT – III

PROGRAMMABLE LOGIC CONTROLLER: Introduction to PLC, input and output system of PLC, processor unit of PLC, memory types used in the PLC, understanding of PLC using ladder diagram, implementation of logic gates using PLC's

UNIT – IV

DISCRETE STATE PROCESS CONTROL & MEASUREMENT: Basics of discrete state process control, characteristic of the systems, relay controllers and ladder diagrams, Design of process control using PLC's

UNIT – V

DATA AQUISITION SYSTEM: Microprocessor based data acquisition system; Signal conditioning, single channel data acquisition system, multi-channel data acquisition system, and data conversion using ADC and DAC in data acquisition system.

Text Books:

1. Digital Measurement Techniques: T.S. Rathore, Narosa Publishing House
2. Process Control: Curtis Johnson, Prentice Hall

Books Reference:

1. Instruments in Systems: Coombs
2. Digital Instrumentation, Bouwnes, Tata McGraw Hill Book Pub. Co.

Further Reading:

1. Advanced Practical Process Control, Brian Roffel

MEIC104

Control System Design

UNIT-I

SISO Control Fundamentals: Feedback, Modeling, Continuous-Time Signals and Systems. SISO Control Essentials, Analysis of SISO Control Loops, Classical PID Control, Synthesis of SISO Controllers.

UNIT-II

SISO Control Design: Fundamental Limitations in SISO Control, Frequency-Domain Design Limitations, Architectural Issues in SISO Control, Dealing with Constraints. Digital Computer Control, Models for Sampled-Data Systems, Digital Control, Hybrid Control.

UNIT-III

Advanced SISO Control: SISO Controller Parameterizations, Control Design Based on Optimization, Linear State Space Models, Synthesis via State Space Methods, Introduction to Nonlinear Control.

UNIT-IV

MIMO Control Essentials: Analysis of MIMO Control Loops, Exploiting SISO Techniques in MIMO Control. MIMO Control Design, Design via Optimal Control Techniques, Model Predictive Control, Fundamental Limitations in MIMO Control.

UNIT-V

Advanced MIMO Control: MIMO Controller Parameterizations, Decoupling, Field Applications.

Text Books:

1. Control System Design, Graham C. Goodwin, Stefan F. Graebe, Mario E. Salgado; Pearson Ed.

- **Books Reference:**

1. Numerical Methods for Linear Control Systems & Analysis, Biswa Datta
2. Advanced Practical Process Control, Brian Roffel

Further Reading:

1. The Control Handbook, William S. Levine

MEIC105A

System Optimization

UNIT-I

Basics of Optimization: Need for optimization and historical development. Classification and formulation of optimization problem, classical optimization methods: Differential calculus. Lagrangian theory, Kuhn Tucker conditions.

UNIT-II

Unconstrained minimization techniques: one-dimensional minimization; Fibonnacci, Golden section and quadratic interpolation methods.

UNIT-III

Multi-dimensional minimization: Univariate, conjugate direction, gradient and variable metric methods. Constrained minimization techniques.

UNIT-IV

Methods of Optimisation: Penalty function methods, feasible direction and gradient projection method. Introduction to geometric programming. Linear programming and simplex method.

UNIT-V

Applications of Optimisation methods: Examples and applications of the above methods in the recent engineering design literature.

Text Books:

1. Optimization - Theory and Applications, S.S.Rao, Wiley Eastern Ltd., 1978.
2. Optimization Methods for Engineering Design, R.L. Box, Addison Wesley,

Books Reference:

1. Encyclopedia of Optimization, C.A. Floudas, Panos M. Pardalos; Kluwer Academic Pub
2. Instrument Engineers' Handbook, Fourth Edition, Volume Two: Process Control and Optimization, Béla G. Lipták

Further Reading:

1. Parallel Processing of Discrete Optimization Problems: Dimacs Workshop April 28-29, 1994, Panos M. Pardalos, Mauricio G. C. Resende, K.G. Ramakrishnan
2. Optimization and Industry: New Frontiers, Panos M. Pardalos; Kluwer Academic Pub

MEIC105B

Reliability Engineering

UNIT-I

Basics of reliability: Mathematics of Reliability, Reliability function, Models of failure. Failure data Analysis, System reliability.

UNIT-II

Reliability models and systems: Basic Reliability Models, Covariate Models, Hazard Rate Functions including Exponential, Weibull, Normal and Lognormal, System Reliability including redundant, standby and load sharing systems,

UNIT-III

Reliability and failure: Failure mode, effect and criticality analysis, fault tree analysis, reliability and maintainability design methods based on availability and life cycle costs, Preventive maintenance

UNIT-IV

Failure preparedness: Spares Provisioning Models, Renewal and Minimal Repair Models, treatment of censored data, reliability growth testing, Probability Tests and curve fitting, Maintaining likelihood estimation and goodness of fitness tests, Series configuration. Parallel configuration r-out-of-n structure.

UNIT-V

Improvement and checks: Reliability improvement. Redundancy. Reliability allocation. Reliability testing.

Text Books:

1. An Introduction to Reliability and Maintainability Engineering - Ebeling; Tata McGraw Hill
2. Probabilistic Reliability - An Engineering Approach, M.L. Shooman, McGraw-Hill Publ

Books Reference:

1. Fault-Diagnosis Systems: An Introduction from Fault Detection to Fault Tolerance, Rolf Isermann
2. Engineering Design Reliability Handbook, Boca Raton; CRC Press

Further Reading:

1. Encyclopedia and Handbook of Process Capability Indices: A Comprehensive Exposition of Quality Control Measures, W. L. Pearn

MEIC105C

Robotics & Computer Vision

UNIT-I
Basic concepts: Robotics concepts and problems, Robot Kinematics: Position Analysis, The Arm Equation

UNIT-II
Robo-Kinematics: Direct Kinematics, Inverse Kinematics, Forces, Moments, Euler's Laws, Workspace Analysis.

UNIT-III
Robo-Dynamics: Differential Motion and Velocities, Manipulator Dynamics, Dynamic Analysis and forces, Trajectory Planning and control.

UNIT-IV
Robo-Automation: Sensors and instrumentation in robotics, Actuators and power transmission, Sensors.
UNIT-V Vision and Intelligence: Image Processing and Analysis with Vision Systems, Fuzzy Logic Control.

Text Books:

1. Introduction to Robotics, Saeed B. Niku; Prentice Hall
2. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling; PHI

Books Reference:

1. Analytical Robotics and Mechatronics, Wolfram Stadler; McGraw Hill
2. Computer Vision, David A. Forsyth, Jean Ponce; Prentice Hall
3. Robotics - Control, Sensing, Vision & Intelligence, K.S. Fu, C.S.G. Lee, Ralph Gonzales; McGraw Hill
4. Understanding Electromechanical Engineering: An Introduction to Mechatronics, Lawrence J. Kamm; Prentice Hall

Further Reading:

1. http://www.cs.indiana.edu/robotics/world.html
2. Robotics : A Bibliography with Indexes, Peter J. Benne
3. Sensors for Mobile Robots, H.R. Everett
4. Intelligent Sensor Systems, John Brignell & Neil White

MEIC106-P

Industrial Transducers & Sensors Lab

Experiments to be performed:

1. Measurement of linear displacement using linear variable differential transformer (LVDT)
2. Measurement of displacement using light dependent resistor (LDR)
3. Measurement of speed of motor shaft with the help of non contact type of pickup
4. Variable reluctance tachometer
5. Photo electric pickup and also plot the graphs and percentage error from
6. To study the characteristics of filament lamp
7. To study the characteristics of photovoltaic cell
8. To study the characteristics of photoconductive cell
9. To study the characteristics of photo-transistor
10. To study the characteristics of optically controlled switching system
11. To study the characteristics of IC temperature sensor (LM 335)
12. To study the characteristics of NTC bridge circuit
13. To study that the thermistor is one of the feedback resistance in a non inverting op-amp circuit
14. 14. To demonstrate how a standard diode can be used as a thermoresistive or thermoelectric device.
15. To demonstrate the use of a general-purpose transistor as a temperature sensor.
16. To study the LVDT characteristics.
17. To study LDR as part of a voltage divider.

List of Equipments/Machine Required:

1. Transducers, Circuit Components, CRO, Power supply, Function generator

Books Reference:

1. Transducers and Instrumentation, D.V.S. Murthy; Prentice Hall
2. Measurement systems: Application and Design – E.O. Doeblin; Tata McGraw Hill

MEIC107-P

Control System Design Lab

Experiments to be performed:

1. Synthesize a typical SISO control loop.
2. Design a practical loop for Classical PID control.
3. Design a practical loop for Digital Computer Control.
4. Design a practical Sampled-Data System.
5. Design a practical loop for Digital Control.
6. Design a practical loop for Hybrid Control.
7. Design a practical loop for Advanced SISO Control
8. Design a practical loop for control using Optimization Based Design.
9. Design a practical loop for Nonlinear Control.
10. Design a practical loop for MIMO Control.
11. Design a practical loop for SISO Techniques in MIMO Control.
12. Design a practical loop for MIMO Control Design via Optimal Control Techniques.
13. Design a practical loop for Model Predictive Control.
14. Design a practical loop for Advanced MIMO Control.
15. Design a practical loop for decoupling in Advanced MIMO Control.

List of Equipments/Machine Required:

1. Control kits, Power Supply, signal generator, CRO, Spectrum Analyzer

Books Reference:

1. Control System Design, Graham C. Goodwin, Stefan F. Graebe, Mario E. Salgado; Pearson Ed

SEMESTER –II

MEIC201

Microcontroller & Embedded Systems

UNIT – I

Microcontroller Architecture: 8 bit and 16 bit micro-controllers, Architecture, support devices, Signal Levels Timing and State Analysis, Programming Model.

UNIT-II

Programming and Modes: Instruction Sets, Addressing Models, Programmed I/O Interrupt System, Operation under Synchronous And Asynchronous Modes.

UNIT-III

Development and Applications: Microcomputer Based System-Programming Techniques, Microcontroller Development System. Advance Microcontrollers, some applications of Microcontroller Based Systems, Case Studies.

UNIT-IV

Embedded Systems: Introduction to the Embedded Systems, Processor Structure, registers and memories, the Parallel and Serial communication ports, the timers, the Interrupts, Programming an Embedded System.

UNIT-V

OS for Embedded Technology: Operating Systems and Real Time Operating Systems, Programming Tools for the Embedded Devices and Handheld Embedded Devices, Recent advances in Embedded Systems Technology, Development and design of Embedded Software.

Text Books:

1. Microcontroller, Mazidi; Prentice Hall
2. Programming and Customizing the 8051 Microcontroller, Predko; Tata McGraw Hill

Books Reference:

1. Embedded Systems, Raj Kamal; Tata McGraw Hill 2. Handbook of Microcontrollers, Myke Predko; McGraw Hill

Further Reading:

1. EDN's 2005 Microprocessor/Microcontroller Directory

MEIC202

Optimal Control Systems

UNIT-I

Basics of Optimal Control: Introduction. Statement of the optimal control problem. Dynamic programming. Bellman equations.

UNIT-II

Variational calculus: Introduction, Dynamic optimization without constraints. Euler Lagrange equation and transversality conditions. The problems. The problems of Bolza, Mayer and their solution.

UNIT-III

Computational methods in optimal control: Pontryagin's maximum principle. Rayleigh-Ritz method. Parametric expansion method. State increment dynamic programming. Gradient method. Method of steepest descent. Quasi-linearization and invariant embedding.

UNIT-IV

Optimal Regulators: Basic theory of the optimal regulator, standard regulator problem, tracking systems, properties and application of the optimal regulator, properties of optimal regulator systems with a classical control interpretation.

UNIT-V

Estimation Techniques: Asymptotic properties and Quadratic weight selection, state estimator design, systems design using state estimators, frequency shaping, controller reduction.

Text Books:

1. Modern Control System, M. Gopal; Prentice Hall
2. Optimal Control: Linear Quadratic Methods, Brian D.O. Anderson, John B. Moore; Prentice Hall

Books Reference :

1. Introduction To Optimal Control, George Leitmann; Mcgraw Hill Publishing Company
2. Optimal Control: Theory, Algorithms, and Applications (Illustrated), Panos M. Pardalos, William W. Hager; Kluwer Academic Pub

Further Reading:

1. The Control Handbook, William S. Levine
2. Handbook of Intelligent Control Neural, Fuzzy, and Adaptive Approaches, White D.A., Sofge D.A., eds., Van Nostrand

MEIC203

Process Control & Industrial Automation

UNIT-I

Introduction to Process Control: elements of process loop, controller principles, pneumatic indicators, receivers, transmitters, indicating controllers. Analog Controller, Digital Controller, Microprocessor and personal, Smith predictor.

UNIT-II

Actuators: Hydraulic, pneumatic, electric and electronic actuators and controllers, final control system. Control modes. Tuning procedures. Special feedback techniques.

UNIT-III

Digital control: Principles, Microprocessor controllers. Industrial telemetering techniques, soft computing techniques,

UNIT-IV

Advanced Control: Direct Synthesis and Adaptive Control. Multiple feedback controllers. Decoupling and feed-forward methods.

UNIT-V

Dynamic Control: Fault tolerance and optimizing processes. Process control computers. Dynamic Analysis of industrial processing systems, control schemes, synthesis of multivariable control configurations for single units and complete process plants.

Text Books:

1. Process Control Instrumentation Technology- C. Johnson; Prentice Hall, 7th Ed.
2. Process Control Systems, F.G. Shinskey, McGraw Hill,

Books Reference:

1. Chemical Process Control : An Intro. to Theory and Practice, G. Stephanopoulos; Prentice Hall
2. Design for Manufacturability Handbook, James G. Bralla

Further Reading:

1. Advanced Practical Process Control, Brian Roffel
2. Handbook of Intelligent Control Neural, Fuzzy, and Adaptive Approaches, White D.A., Sofge D.A., eds., Van Nostrand

MEIC204

Industrial Electronics & Power Control

UNIT-I

Basics of Industrial Electronics: Industrial Safety, Understanding Industrial Electrical Diagrams, Four Layer Devices, Power Transistor, characteristics, triggering techniques, commutation circuits,

UNIT- II

Converters and Transformers: Thyristor controlled power rectifiers, converters, Transformers and Power Distribution Systems, Industrial Control Devices,

UNIT-III

Inverters, Choppers and Motor Control: Inverters, chopper circuits, Industrial Motors and generators, Relays, Contactors and Motor Starters, Speed control of AC/DC motors, Motor Control Circuits, Types of control, Control of electronic motors,

UNIT-IV

Computer Control of Motors: Computer Controlled Machines and Processes, PAM, PWM, PPM techniques, soft starting techniques,

UNIT-V

Power Supplies and Heat Sinks: Single phase and three-phase uninterrupted power supplies, Regulated Power Supplies, Heat sink design.

Text Books:

1. Power Electronics, Khanchandani; Prentice Hall
2. Industrial Power Control, Rashid; Prentice Hall

Books Reference:

1. Electronic Power Control, Gottlieb; Prentice Hall
2. Industrial Electronics, Frank D. Petruzella, Tata McGraw Hill
3. Handbook of Electric Motor Control Systems, Eswar; Tata McGraw Hill

Further Reading:

1. Analog Signal Processing, Ramon Pallas-Areny & John G. Webster
2. The Art of Electronics, Paul Horowitz & Winifield Hill
3. Active Filter Cookbook, Don Lancaster

MEIC205A

Fuzzy - Neural Control

UNIT-I

Basics of Neuroscience and Artificial Neuron Models: Graphs, Algorithms, Deed Forward Networks, Perceptions and LMS Algorithm, Multilayer Networks, Complexity of Learning using Feed Forward Networks, Adaptive Structure Networks, Recurrent Networks, Competitive Learning and Self- Organizing Networks.

UNIT-II

Fuzzy Logic: Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy Relations, Membership Functions, Fuzzy-to-Crisp conversions, Fuzzy Arithmetic, Numbers, Vectors, Extension Theorem, Classical Logic and Fuzzy Logic.

UNIT-III

Fuzzy Systems: Fuzzy Rule-Based Systems, Fuzzy Non-linear Simulation, Fuzzy Decision Making, Fuzzy Classification, Fuzzy Pattern Recognition, Fuzzy Control Systems, Fuzzy Measures - Belief, Plausibility, Evidence, Probability and Possibility.

UNIT-IV

Approximate Reasoning and Learning: A unified Approximate reasoning Approach, Multivariable Blood Pressure Control: an application of approximate reasoning, Constructing rule-bases by self- learning: system structure and learning algorithm, Rule-base formation and application, Neural Network based approximate reasoning, principles and implementation.

UNIT-V

Fuzzy Controllers: BNN Network based Fuzzy controller with Self Learning Teacher, A Hybrid Neural Network based Self-organizing Fuzzy Controller, CPN Network based Fuzzy controller: explicit representation and self construction of rule bases, Fuzzified CMAC and RBF network based self- learning controllers .

Text Books:

1. Neural Network Fundamentals with Graphs, Algorithms and Applications, Bose, Tata Mcgraw Hill

Books Reference :

1. Neural Networks: A Comprehensive Foundation, Simon Haykin, Prentice Hall, 2nd Ed.
2. Fuzzy-Neural Control: Principles, Algorithms and Applications, Junhong Nie, Derek Linkes; Prentice Hall
3. Fuzzy Logic with Engineering Applications, Timothy Ross; Pearson Education

Further Reading:

1. Intelligent Sensor Systems, John Brignell & Neil White
2. Handbook of Fuzzy Computing, W. Pedrycz, E. Ruspini and P. Bonnisone; Oxford University Press
3. Handbook of Neural Computation, K. J. Cios, W. Pedrycz, Neuro-fuzzy systems, IOP Publishing and Oxford University Press
4. Handbook of Intelligent Control Neural, Fuzzy, and Adaptive Approaches, White D.A., Sofge D.A., eds., Van Nostrand

MEIC205B

Computer Numerical Control & Programming

UNIT-I

Introduction: NC/CNC, CNC machines, Industrial applications of CNC, economic benefits of CNC.

UNIT-II

CNC Machine Tools: Classification of machine tools, CNC machines tool design, control systems.

UNIT-III

Control and Input: Position control velocity control and machine tool control, Interpolation and electronics. Data Input: Punched tape, manual data input, tape punch, reader error checking.

UNIT-IV

CNC tooling: Qualified and pre-set tooling, tooling systems, tool setting, automatic tool changers, work holding and setting.

UNIT-V

Programming: Part programming language, programming procedures, proving part programmes, computer aided part programming. Advances: Advances in CNC programming, integration with CAD, material handling in CNC machines, manufacturing systems.

Text Books:

1. CNC Technology and Programming, Krar, S., and Gill, A., McGraw Hill
2. Introduction to Computer Numerical Control, Barry Leatham - Jones, Pitmans, London

Books Reference:

1. Numerical control and Computer Aided Manufacturing, T.K. Kundra, P.N. Rao and N.K. Tewari, Tata McGraw Hill
2. Computer Numerical Control, Concepts and Programming, W.S. Seames, Delmar Publ. Inc
3. Essentials of Numerical Control, R.G. Rapello, Prentice Hall,
4. Numerical Control Programming, G.C. Stanton, John Wiley and Sons, New York

Further Reading:

1. Assembly Automation: A management handbook, Frank Riley
2. Machining and CNC Technology, Activities Manual; McGraw-Hill

MEIC205C

AI & ES in Industrial Systems

UNIT-I

Introduction to Artificial Intelligence: Overview of AI, LISP and other AI programming Languages

UNIT-II

Knowledge Representation: Formalized Symbolic Logics, Dealing with Inconsistencies and Uncertainties, Probabilistic Reasoning, Structured Knowledge, Graphs, Frames and related structures, Object Oriented Representations

UNIT-III

Knowledge organization and manipulation: search and control strategies, Parallel and Distributed AI, Matching Techniques, Knowledge Organization and Management, Perception

UNIT-IV

Communication and Expert Systems: Natural Language Processing, Pattern Recognition, Visual Image Understanding, Expert Systems Architectures; Problems, problem spaces and search, Heuristic search techniques, Using Predicate Logic, Representing knowledge using rules, symbolic reasoning under uncertainty, statistical reassigning, weak slot-and-filter structures, strong slot-and-filter structures, game playing, understanding

UNIT-V

Knowledge Acquisition: Machine Learning, connectionist models, common sense, perception and action, Learning by Induction, Analogical and Explanation-based Learning.

Text Books:

1. Introduction to Artificial Intelligence and Expert Systems, Dan W. Patterson; Prentice Hall
2. Artificial Intelligence, Rich; Tata Mcgraw Hill

Books Reference:

1. AI - A Modern Approach, Stuart Russell, Peter Norvig; Pearson Ed.
2. Artificial Intelligence, George F. Luger; Pearson Ed.
3. An Introduction to Expert Systems, James P. Ignizio; Mcgraw Hill

Further Reading:

1. Encyclopedia of Artificial Intelligence, Hapiro, Stuart C., John Wiley & Sons, New York,
2. The Handbook of Artificial Intelligence, Avron Barr and Edward A. Feigenbaum, Volumes 1-4, Addison-Wesley

MEIC206-P

Microcontroller & Embedded Systems Lab

Experiments to be performed:

1. Write a microcontroller 8051 program to transfer the bytes into RAM locations starting at 50H, assuming that ROM space starting at 240H contains CHHATTISGARH by using – a) a Counter, b) null char for end of string .
2. Write a microcontroller 8051 program to get hex data on the range of 00-FFh from port 0 and convert it to decimal. Save the digits in R7, R6 and R5, where the least significant digit is in R7.
3. Write a microcontroller 8051 program to add two 16 Bit unsigned numbers. Operands are two RAM variables. Results to be in R1-R0 pair.
4. Write a microcontroller 8051 program to subtract an unsigned 16 Bit number from another. Operands are two RAM variables. Results to be in R1-R0 pair.
5. Write a microcontroller 8051 program to add two unsigned 32-bit numbers. Operands are two RAM variables. Results to be in R1-R0 pair.
6. Write a microcontroller 8051 program to add two 16 Bit signed numbers.
7. Write a microcontroller 8051 program to convert a binary number to equivalent BCD
8. Write a microcontroller 8051 program to convert a packed BCD number to two ASCII numbers and place them in R5 and R6.
9. Write a microcontroller 8051 program to calculate the square root of an 8-bit number using iterative method.
10. Write a microcontroller 8051 program to add two floating-point numbers.
11. Write a microcontroller 8051 program to multiply two floating-point numbers.
12. Write a microcontroller 8051 program that generates 2kHz square wave on pin P1.0, 2.5 kHz on pin P1.2 and 25 Hz on pin P1.3.
13. Write a microcontroller 8051 program for counter 1 in mode 2 to count the pulses and display the state o the TL1 count on P2. Assume that the clock pulses are fed to pin T1.
14. Write a microcontroller 8051 program to transfer letter "N" serially at 9600 baud, continuously. Assume crystal frequency to be 11.0592 MHz.
15. Write a microcontroller 8051 program to transfer word "CSVTU" serially at 4800 baud and one stop bit, continuously. Assume crystal frequency to be 11.0592 MHz.
16. Write a microcontroller 8051 program to receive bytes of data serially, and put them in P1. Set the baud rate at 2400 baud, 8-bit data, and 1 stop bit. Assume crystal frequency to be 11.0592 MHz.
    PIC Microcontroller or ARM Microcontroller based practices with emphasis of different applications etc (Software/ Hardware based).

List of Equipments/Machine Required:

1. Microcontroller kit, Interfacing kit, Keyboard, Monitor, SMPS for Microcontroller

Books Recommended:

1. 8051 Programming, Interfacing and Applications, K.J. Ayala; Penram Publ.

MEIC207-P

Computer Simulation Lab

Experiments to be performed:

1. Write a computer simulation program to generate, analyze and display various waveforms.
2. Write a computer simulation program to generate multiple waveforms and waveform properties on the same waveform graph.
3. Write a computer simulation program to simulating alarm conditions and generating an alarm.
4. Write a computer simulation program to write instrumentation data to a file.
5. Write a computer simulation program for controlling the saving of data to a data file.
6. Write a computer simulation program to generate a signal, reduce the number of samples in the signal, and display the resulting data in a table in the front panel.
7. Write a computer simulation program to prepare a virtual instrument for use as a sub- virtual instrument. Let the virtual instrument convert measured temperature in °C to °F.
8. Write a computer simulation program that generates random numbers until the number generated matches a number we specify. The number of iterations should be counted and displayed.
9. Write a computer simulation program to run a virtual instrument loop a specified number of times. 10. Write a computer simulation program to add a shift register to a virtual instrument loop for averaging data points.
10. Write a computer simulation program to use a shift register in a virtual instrument loop for accessing values from previous iterations in a loop.
11. Write a computer simulation program to build a virtual instrument that displays two plots, a random plot and a running average of the last four points, on a wave display in sweep update mode.
12. Write a computer simulation program for creating array controls, indicators and constants.
13. Write a computer simulation program to generate a random linear signal.
14. Write a computer simulation program to set up annunciation using a random linear signal.

List of Equipments/Machine Required:

1. PC, Virtual Instrumentation Simulation Software

Books Recommended:

1. Manuals of the Simulation software used

SEMESTER -III

MEIC301

Adaptive Control System

UNIT – I

Introduction: Basic concepts and classification, Real-Time Parameter Estimation, Identification techniques; impulse response identification, parameter estimation, learning model approach

UNIT-II

Adaptive control design: Nodal reference adaptive control, input signal adaptive control. Practical application, adaptive autopilot, Auto-Tuning, Gain Scheduling, Self-tuning regulators

UNIT-III

Adaptive Regulators and Systems: Deterministic Self-Tuning Regulators, Stochastic Adaptive Control, Stochastic and Predictive Self-Tuning Regulators, Model-Reference Adaptive Systems, Properties of Adaptive Systems

UNIT-IV

Robust and Self-Oscillating Systems: Practical Issues and Implementation, Commercial Products and Applications, Perspectives on Adaptive Control

UNIT-V

Computer Aided Adaptive Control: Adaptive controller adjustment – Indirect adaptive control, Direct Adaptive control, Adaptive control schemes – Model Reference Adaptive Controllers (MRAC), Self Tuning Adaptive Controllers (STAC), Adaptive control techniques.

Text Books:

1. Adaptive Control, Chatterjee & Permar; Oxford University Press
2. Adaptive Control, Karl J. Aström, Björn Wittenmark; Pearson Ed.
3. Computer Aided Process Control, S.K Singh, Prentice Hall of India

Books Reference:

1. Adaptive Control, Chang C. Hang, Weng K. Ho, Tong Heng Lee; Instrument Society of America
2. Adaptive Control Systems(Illustrated), Rogelio Lozano, Gang Feng, Rogelio Lozano; Newnes

Further Reading:

1. Cerebellum and Adaptive Control (Illustrated), John S. Barlow; Cambridge Univ Pr
2. Adaptive Dual Control: Theory And Applications, Heinz Unbehauen, Nikolai Michailovich Filatov; Springer Verlag
3. Neural and Adaptive Systems: Fundamentals Through Simulations (Illustrated), Jose C. Principe, Neil R. Euliano, W.Curt Lefebvre; John Wiley & Sons Inc

MEIC302

Communication and Research Methodology

Unit 1

Concepts of Communications: Definition, Forms of Communication, Objectives of Communication, Characteristics of Communication, Process of Communication, Communication, Roadblocks, Role of Verbal and Non-verbal Symbols in Communication, Barriers to Effective Communication, Overcoming Communication Barriers.

Nonverbal communication: Body Language, Gestures, Postures, Facial Expressions, Dress codes; the Cross Cultural Dimensions of Business Communication; Listening and Speaking, techniques of electing response, probing questions, Observation. Business and social etiquettes;

Listening Skills: Definition, Anatomy of poor Listening, Features of a good Listener, Role Play, Group Discussion and Interviews, Meetings: Ways and Means of conducting meetings effectively, Mock Meetings and Interviews

Unit 2

Reading and language skills: The reading process, purpose, different kinds of texts, reference material, scientific and technical texts, active and passive reading, strategies - vocabulary skills, eye reading and visual perception, prediction techniques, scanning skills, distinguishing facts and opinions, drawing inferences and conclusions, comprehension of technical material - scientific and technical texts, instructions and technical manuals, graphic information.

Forms of Communication in Written mode: Basics Body language of Business Letters and Memos, Tone of writing,

Enquiries, orders and replying to them, sales letters, Job applications and resume, E-mail: How to make smart e-mail, Writing Business Reports and Proposals, Practice for Writing.

Unit 3

Referencing and Writing skills: Business letters: Enquiries, Circulars, Quotations, Orders, Acknowledgments, Executions, Complaints, Claims and adjustments, Collection letter, Banking correspondence, Agency correspondence, Bad news and persuading letters, Sales letters, Job application letters - Biodata, Covering Letter, Interview Letters, Letter of Reference, Memos, minutes, Circulars & notices.

Types of Business Reports - Format, Choice of vocabulary, coherence and cohesion, paragraph writing, organization reports by individual, Report by committee.

Unit 4

Introduction to Research and Research Design: Nature and scope of research, information based decision making and source of knowledge. The research process; basic approaches and terminologies used in research. Defining research question and framing of hypotheses, preparing a research plan, qualitative and quantitative research designs, Experimentation, Observational studies, Exploring secondary data.

Measurement and Scaling, Data Source and Data Collection Field research: primary data collection from observations, surveys and experimentation. Measurement and scaling; commonly used scales in reliability and validity of scales. Designing instrument for data collection; testing the instrument, data collection process, Sampling methods and procedures and sample size decisions.

Unit 5

Data Analysis and Presentation Editing and coding of data, tabulation, graphic presentation of data, cross tabulation, Testing of hypotheses; type I and II errors, one tailed and two tailed tests of significance, Parametric and nonparametric tests for Univariate and Bivariate data. Tests of association; simple linear regression and other non parametric tests.

Technical Writing: Technical Proposal writing: Definition, Purpose, types, characteristics, Elements of structure, style and appearance, evaluation, exercises, Research report writing, Proposal writing, referencing, forms of reports, bibliography, etc. Research paper, Dissertation, and Thesis, Instruction Manuals, Type of instructions, Writing Instructions, Technical Descriptions, Process descriptions, Guidelines for Writing Good Descriptions.

Text Books:

1. Lesikar, R. V. & Flatley, Basic Business Communication Skills for Empowering the Internet Generation. TMH.
2. Meenakshi Raman, Sangeeta Sharma, Technical Communications, Oxford Latest Edition.

3. D. K. Bhattacharyya, Research Methodology, Excel Books 2nd Edition.

Reference Books:

1. Bowman, J.P. &Branchaw, P.P. Business Communications, Process to Product Dryden Press, Chicago.
2. M Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill.
3. E. H. McGrath, Basic Managerial Skills, Prentice hall India
4. Sajitha, Technical Writing, Himalaya Latest Edition

MEIC303A

Analytical Instrumentation

UNIT-I

Absorption spectrometry: (UV, Visible, IR), mass spectrometry, Möss Bauer spectroscopy, Principles, design aspects and application

UNIT-II

NMR spectroscopy: principles, generation, equipment, Principles, design aspects and applications, limitations

UNIT-III

ESR Spectroscopy: principles, design aspects, generation, equipment, applications, limitations

UNIT-IV

NDP spectroscopy: principles, design aspects, generation, equipment, applications, limitations

UNIT-V

X-Rays and Other Techniques: X-rays absorption, fluorescence and diffractometric techniques, electron microscope and microprobe, EXAFS, ESCA, and Auger techniques. Chromatography and colorimetry. Instrumentation of thermo physical and transport properties of matter, DTA, DSC.

Text Books:

1. Instrumental Methods of Analysis (VI edition). Willard H.W., Merritt L.L., Dean J.A., Settle F.A.,
2. Handbook of Analytical Instruments, R.S. Khandpur; Tata Mcgraw Hill

Books Reference:

1. Instrumentation, Measurement and Analysis, B.C. Nakra, K.K. Chaudhry; Tata Mcgraw Hill
2. Instrument Engineers Handbook – B.G. Liptak.

Further Reading:

1. The Art of Electronics, Paul Horowitz & Winifield Hill

MEIC303B

Real Time Systems

UNIT-I

Real Time Systems - Basics and Applications: Typical Real-Time Applications, Hard Versus Soft Real- Time Systems, A Reference Model of Real-Time Systems

UNIT-II

Real-time Scheduling: Commonly Used Approaches to Real-Time Scheduling, Clock Driven Scheduling, Priority-Driven Scheduling of Periodic Tasks

UNIT-III

Scheduling and Resources: Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems, Resources and Resource Access Control

UNIT-IV

Multiprocessor Scheduling: Resources Access Control, and Synchronization, Scheduling Flexible Computations and Tasks with Temporal Distance Constraints

UNIT-V

Communication and OS: Real-Time Communication, Operating Systems

Text Books:

1. Real Time Systems, Saeed B. Niku; Prentice Hall
2. Real Time Systems, C.M. Krishna, K.G. Shin; Mcgraw Hill

Books Reference:

1. Real-Time Systems, Jane W. S. Liu 2. Real-Time Systems : Scheduling, Analysis, and Verification, Albert M. K. Cheng

Further Reading:

1. Real-Time Concepts for Embedded Systems, Qing Li, Caroline Yao; CMP Books

MEIC303C

Programmable Logic Controllers

UNIT-I

PLC Basics: An Overall look at programmable Logic Controllers, General PLC Programming Procedure, Devices to which PLC Input and Output Modules are connected.

UNIT-II

Basic PLC Programming: Programming On/Off Inputs to Produce On-Off Outputs, Relation of Digital Gate Logic to Contact/Coil Logic, Creating Ladder Diagrams from Process Control Descriptions. Basic PLC Functions, Register Basics, PLC Time Functions, PLC Counter Functions. Intermediate Functions, PLC Arithmetic Functions, PLC Number Comparison Functions, Numbering Systems and PLC Number Conversion Functions.

UNIT-III

Data Handling Functions: The PLC SKIP and MASTER CONTROL RELAY Functions, Jump Functions, PLC Data Move Systems, Other PLC Data Handling Functions. PLC Functions -Working with Bits, PLC Digital Bit Functions and Applications, PLC Sequencer Functions, Controlling a Robot with a PLC, PLC Matrix Functions.

UNIT-IV

Advanced PLC Functions: Analog PLC Operation, PID Control of Continuous Process, Networking PLCs.

UNIT-V

PLC Deployment: Alternative Programming Language, PLC Auxiliary Commands and Functions, PLC installation, Troubleshooting and Maintenance, Selecting a PLC, Operation Simulation and Monitoring, Commonly Used Circuit Symbols.

Text Books:

1. Programmable Logic Controllers, John W. Webb, Ronald A. Reis; Prentice Hall - 5th Ed
2. Computer Based Industrial Control, Krishna Kant; Prentice Hall

Reference Books:

1. Programmable Logic Controllers: Principles & Applications, Webb & Reis, Prentice Hall of India.
2. Programmable Logic Control: Principles & Applications, NIIT, Prentice Hall of India.

Further Reading:

1. Advanced Practical Process Control, Brian Roffel

MEIC304

Preliminary work on Dissertation

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports.

MEIC305

Seminar Based on Dissertation

The student will deliver a seminar on the topic chosen by him and approved by Departmental committee for evaluation at the end of semester.

Semester – IV

MEIC401

Dissertation

The student will submit a detailed Project Report on the topic approved by Departmental committee in a specified format and will also deliver a Presentation on the topic chosen at the end of semester.