

NEW B-SCHEME & SYLLABI

of

Master of Technology

in

Electrical Engineering

(Instrumentation & Control)

(Effective from 2012-13)

**DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY,
MURTHAL (SONIPAT)-131039
SCHEME OF STUDIES & EXAMINATIONS FOR
M.Tech. in Electrical Engineering (Instrumentation & Control)
(Effective from 2012-13)**

SEMESTER - I

Course No.	Course Title	Teaching Schedule			Marks			Total Credits	Duration of Exam (Hours)
		L	T	P	Class-work	Exam	Total		
MIC501B	Modern Control Systems	4	-	-	25	75	100	4	3
MIC503B	Stochastic Processes in Electrical Engineering	4	-	-	25	75	100	4	3
MIC505B	Microcontrollers & Applications	4	-	-	25	75	100	4	3
MIC507B	Optimal & Robust Control Systems	4	-	-	25	75	100	4	3
MIC509B	Industrial Instrumentation & Automation	4	-	-	25	75	100	4	3
MIC511B	Microcontrollers & Instrumentation Lab.	-	-	3	20	30	50	1.5	3
Total		20	-	3	145	405	550	21.5	

NOTE:

1. The students in the examination will be allowed to use only non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
2. Electronics gadgets including cellular phones are not allowed in the examination.

SEMESTER - II

Course No.	Course Title	Teaching Schedule			Marks			Total Credits	Duration of Exam (Hours)
		L	T	P	Class-work	Exam	Total		
MIC502B	Fuzzy Logic Based Control	4	-	-	25	75	100	4	3
MIC504B	Multirate & Adaptive Signal Processing	4	-	-	25	75	100	4	3
MIC506B	Discrete Control Systems	4	-	-	25	75	100	4	3
MIC508B	Nonlinear & Adaptive Control	4	-	-	25	75	100	4	3
	Elective-I	4	-	-	25	75	100	4	3
MIC510B	Modelling & Simulation Lab	-	-	3	20	30	50	1.5	3
Total		20	-	3	145	405	550	21.5	

NOTE:

1. The students in the examination will be allowed to use only non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
2. Electronics gadgets including cellular phones are not allowed in the examination.

(Effective from 2013-14)

SEMESTER - III

Course No.	Course Title	Teaching Schedule			Marks			Total Credits	Duration of Exam (Hours)
		L	T	P	Class-work	Exam	Total		
MIC601B	Neural Networks in Instrumentation & Control	4	-	-	25	75	100	4	3
MIC603B	Process Control & Instrumentation	4	-	-	25	75	100	4	3
	Elective-II	4	-	-	25	75	100	4	3
MIC605B	Advanced Control & Instrumentation Lab	-	-	3	20	30	50	1.5	3
MIC607B	Dissertation (Phase-I)	-	-	6	100	-	100	6	-
MIC609B	Seminar	-	-	2	50	-	50	2	-
Total		12	-	11	245	255	500	21.5	

NOTE:

1. The students in the examination will be allowed to use only non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
2. Electronics gadgets including cellular phones are not allowed in the examination.

SEMESTER - IV

Course No.	Course Title	Teaching Schedule			Marks			Total Credits	Duration of Exam (Hours)
		L	T	P	Class-work	Exam	Total		
MIC602B	Dissertation	-	-	20	50	100	150	20	3
Total		-	-	20	50	100	150	20	3

Course No.	List of Electives-I	Course No.	List of Electives-II
MIC514B	Modern Industrial Drives & Control	MIC611B	Genetic Algorithms Based Optimization
MIC516B	Computational Intelligence	MIC613B	Robotics & Automation Engineering
MIC518B	Parameter Estimation & System Identification	MIC615B	SCADA & Power System Automation
MIC520B	Advanced Virtual Instrumentation	MIC617B	Bio-inspired Optimization Techniques
MPS518B	Power System Control & Dynamics	MIC619B	Biomedical Instrumentation
		MPS633B	Power System Reliability

MIC501B

MODERN CONTROL SYSTEMS
M.Tech. Electrical Engg. (I&C) Semester-I

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

LINEAR SPACES & LINEAR OPERATORS: Limitations of classical control theory; Axiomatic treatment of Field, Vector, Vector Space (linear vector space); Linear combination, Linear Independence, The notion of bases; Linear function / map / operator & its matrix representation, Scalar product of vectors; Quadratic functions & definite, semi-definite matrices, Gram determinant vector & matrix norms; Rank & Nullity of a matrix; Eigen values, Eigen vectors & Canonical form representation of linear operators; Generalized Eigen vectors.

UNIT-II

STATE VARIABLE DESCRIPTIONS: The concept of State: initial state, definition of state, state vector, trajectory, Consistency conditions, State Transition Relation or State Equation; State equations for dynamic system; Time invariance; Linearity; Non-uniqueness of State model; State diagrams for linear time-invariant continuous-time & discrete-time systems.

PHYSICAL SYSTEM & STATE ASSIGNMENT: Linear continuous time models of electrical, mechanical, electromechanical, hydraulic system (illustrative problems). State variable representation using Phase variables, Observable Phase variable form, Controllable phase variable form, State space representation using Canonical variable or Normal form.

UNIT-III

SOLUTION OF STATE EQUATIONS: Derivation of T.F. from State model; State equations for continuous time LTI system, Properties of STM (State Transition System) for LTI system; Computation of STM by Infinite series expansion, by Resolvent matrix method (Inverse Laplace Transform), by Similarity or Canonical transformation & by technique based on Cayley Hamilton Theorem; Solution of state equations for discrete-time systems; Evaluation of STM, $\phi(k)$, for Discrete Time System; System Modes.

UNIT-IV

CONTROLLABILITY, OBSERVABILITY & STABILITY: Concept of controllability, Definition of controllability; General concept of observability, Definition of observability; Controllability tests for Continuous-time system; observability tests for continuous-time systems; Kalman tests & Gilberts tests (Physical interpretation of Gilberts Tests); Liapunov's stability theory for linear dynamical systems.

Text Books:

1. M. Gopal, "Modern Control Theory", New Age International (P) Ltd. Publishers, New Delhi.

Reference Books:

1. I.J. Nagrath, & M. Gopal, "Control Systems Engineering," New Age International (P) Ltd. Publishers, New Delhi.
2. C.T. Chen, "Introduction to Linear System Theory", Rinehart & Winston, NY.
3. L.A. Zadeh and C.A. Desoer, "Linear System Theory: A State Space Approach", McGraw Hill, New York.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC503B

STOCHASTIC PROCESSES IN ELECTRICAL ENGINEERING

M.Tech. Electrical Engg. (I&C) Semester-I

L T P

4 - -

Class-work Marks: 25

Exam Marks : 75

Total Marks : 100

Duration of Exam : 3Hrs

Credits : 4

UNIT-I

Random Variables: Concept of random variable, Distribution & density functions, conditional distributions, Total probability & Baye's theorem, Mean & variance, moments, characteristic functions for one and two random variables.

Stochastic Processes: Properties, Stationary & non-stationary Processes, Systems with Stochastic Inputs, Power Spectral Density & Properties, Polyspectra & Spectral Correlation Density, Discrete Time Processes.

UNIT-II

Spectral Representation: Factorization and innovations, finite-order Systems & state variables, Fourier Series & Karhunen-Loeve Expansions, introduction to spectral representation of random processes.

Spectrum Estimation: Introduction to spectrum estimation, extrapolation, general class of extrapolating spectra.

UNIT-III

Random Walks with Applications: Random walks, poisson points & shot noise, modulation, cyclostationary processes, bandlimited processes & sampling theory, deterministic signals in noise, Bispectra.

Mean Square Estimation: Prediction, filtering and prediction, Kalman filter, introduction to variants of Kalman Filters.

UNIT-IV

Markov Processes & Queueing theory: Basic concepts of entropy, maximum entropy method, higher transition probabilities, classification of states, stationary distributions & limiting probabilities, transient states & absorption probabilities, branching processes, Markov processes, introduction to Queueing theory.

Text Books:

1. Papoulis, "Probability, Random variables & Stochastic Processes," McGraw-Hill Book Co.
2. J.S. Meditch, "Stochastic optimal linear estimation and Control," McGraw-Hill.

Reference Books:

1. Y. Viniotis, "Probability & Random Processes," TMH.
2. Donald. G. Childers, "Probability & Random Processes Using MATLAB," TMH.
3. J.I. Aunon, "Probability & Random Processes," TMH.
4. H. Stark & J. W. Woods "Probability & Random Processes with Application to Signal Processing," Pearson.
5. S. Haykin, "Adaptive Filter Theory," Pearson.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC505B

MICROCONTROLLERS & APPLICATIONS

M.Tech. Electrical Engg. (I&C) Semester-I

L T P

4 - -

Class-work Marks: 25

Exam Marks : 75

Total Marks : 100

Duration of Exam: 3Hrs

Credits : 4

UNIT- I

Microcontrollers (8051): Classification of microcontrollers, Concept of embedded systems, 8051 Microcontrollers, Architecture , Pin Diagram, Timers, Addressing Modes & Power management features of 8051 microcontrollers. Serial Port operation & interrupts of 8051 microcontroller, Programming applications based on 8051 microcontrollers.

UNIT -II

Interfacing and Applications of 8051: Basic issues of interfacing, Interfacing applications of 8051 microcontrollers, interfacing of 8051with External memory, 8255, keyboards, DACs/ADCs, LCD, LED, DC Motors, Stepper motor, servomotor etc.

UNIT-III

PIC Microcontrollers: Introduction, different types, Salient features of PIC microcontroller PIC microcontroller families, The PIC16F8X family, Features of the PIC16F84, The PIC16F84 architecture, Program memory, Data memory, Ports, Electrical characteristics of the ports, Clock source options, the timer/counter module, Low power operation and the sleep, instructions, The watchdog timer, special function registers.

UNIT-IV

AVR Microcontrollers: Important features, Pins & Signals, Internal architecture, Watchdog Timer.

MCS-96 Microcontrollers: Salient features, architecture, Instruction set & addressing modes.

ARM Microcontrollers: ARM core architecture, versions of ARM, Important features, intelligent energy manager.

Text Books:

1. Mazidi, Mazidi & Mckinlay, "The 8051 Microcontroller & Embedded Systems", Pearson.
2. Subrata Ghoshal, , "The 8051 Microcontroller", Pearson.
3. Mackenzie & Phan, "The 8051 Microcontroller", Pearson.
4. Myke Predko, "Programming and Customizing the PIC Microcontroller", TMH.
5. John B. Peatman, "Design with PIC Microcontrollers", Pearson.

Reference Books:

1. Mazidi, Mckinlay & Causey, "PIC Microcontroller & Embedded systems", Pearson.
2. Dhananjay V. Gadre, "Programming and Customizing the AVR Microcontroller," TMH.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC507B

OPTIMAL & ROBUST CONTROL SYSTEMS
M.Tech. Electrical Engg. (I&C) Semester-I

L T P
4 - -

Class-work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3Hrs
Credits : 4

UNIT-I

Optimal Control and Calculus of Variations: Definition of optimal control problem, The performance Measure, Fundamental concepts of calculus of variations, Application of fundamental theorem of calculus of variations, minimization of functions and functionals, functionals involving single function and various independent functions, piecewise smooth extremals, constrained extrema.

UNIT-II

Dynamic Programming and Principle of Optimality: Basics of dynamic programming, The principle of optimality, application of the principle of optimality to decision making, dynamic programming applied to a routing problem, Recurrence relation of dynamic programming, characteristics of dynamic programming solution, Hamilton-Jacobi-Bellman equation, Pontryagin's Minimum Principle

UNIT-III

Linear Quadratic Optimal Control: Quadratic performance index, optimal state regulator, state regulator design through the Lyapunov equation, optimal state regulator through the matrix Riccati equation, optimal digital control systems; Iterative numerical techniques in optimization problems, method of steepest descent algorithm, Variation of extremals

UNIT-IV

Robust Control: Robust control systems and system sensitivity, Analysis of robustness, systems with uncertain parameters, Design of Robust Controlled Systems & Robust PID Controlled Systems, The Pseudo-Quantitative Feedback System, Robust Control Systems Using Control Design Software.

Text Books:

1. Donald E. Kirk, "Optimal Control Theory: An Introduction", Prentice Hall.
2. R.C. Dorf & R.H. Bishop, "Modern Control Systems, 11th edition," Pearson.
3. M. Gopal, "Digital Control and State Variable Methods," Tata McGraw Hill.

Reference Books:

1. D. S. Naidu, "Optimal Control Systems," CRC Press.
2. A. S. Gupta, "Calculus of Variations with Applications," PHI.
3. Stanislaw H. Zak, "Systems and Control," Oxford University Press.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC509B

INDUSTRIAL INSTRUMENTATION & AUTOMATION

M.Tech. Electrical Engg. (I&C) Semester-I

L T P

4 - -

Class-work Marks : 25

Exam Marks : 75

Total Marks : 100

Duration of Exam : 3Hrs

Credits : 4

UNIT-I

Smart Sensors: Primary sensors; Excitation; Compensation (Nonlinearity: look up table method, polygon interpolation, polynomial interpolation, cubic spline interpolation, Approximation & Regression; Noise & interference; Response time; Drift; Cross-sensitivity); information Coding/processing; Data communication; Standards for smart sensor interface.

UNIT-II

Interfacing Instruments & Computers: Basic issues of interfacing; Address decoding; data transfer control; A/D converter; D/A converter; Sample & hold circuit; other interface considerations.

Instrumentation network Design and Upgrade: Instrumentation design goals, cost optimal and sensor networks, global system architectures, advantages and limitation of open networks, HART network.

UNIT-III

Instrument Transducers: Primary quantities: input characteristics, Secondary quantities: output characteristics, Electromechanical coupling characteristics: Electromechanical analogies, unified theory of bilateral electromechanical transducers; basic two port equations, ideal transducers, real transducers, generalized performance analysis of bilateral electromechanical transducers, the transducer constants.

UNIT-IV

Programmable Logic Controllers: Introduction, area of application of PLC, basic design of PLC, PLC standards EN 61131 (IEC 61131), system configuration, CPM 1A components, CPM 2A Components, features and functions, expansion of I/O unit components, CPM 1A communication, CPM 2A communication.

Text-books:

1. D. Patranabis, "Sensors and Transducer," PHI.
2. H.K.P. Neubert, "Industrial Transducers: An Introduction to Their Performance & Design", Oxford.
3. Alan S. Morris, "Principle of Measurement and Instrumentation," PHI.

Reference books:

1. J. Turner & M. Hill, "Instrumentation for Engineers and Scientists," Oxford University Press.
2. B. E. Noltingk, "Instrumentation Reference Book", Butterworth Heinemann, 1995
3. B.G. Liptak, "Process Software & Digital Networks," CRC Press.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC511B

MICROCONTROLLERS & INSTRUMENTATION LAB

M.Tech. Electrical Engg. (I&C) Semester-I

L T P

-- 3

Class-work Marks : 20

Exam Marks : 30

Total Marks : 50

Duration of Exam : 3Hrs

Credits : 1.5

List of Experiments:

1. Write an ALP in 8051 to generate 10 kHz frequency rectangular waveform of different duty cycles.
2. Write an ALP using 8051 to generate square waves of 10 kHz & 100 kHz frequency simultaneously using interrupts.
3. Write an ALP in 8051 & interface LCD.
4. Write an ALP using 8051 & interface LED display.
5. Write an ALP using 8051 & interface traffic light.
6. Write an ALP to interface one μ C with other using serial/parallel communication.
7. Write an ALP to switch ON alarm when μ C receives interrupt.
8. Minor project on μ C based temperature controller
9. Minor project on μ C to interface stepper motor
10. Write an ALP to generate PWM using 8096 microcontroller.
11. Write an ALP to control mouse using 68HC11
12. To write a program for Spike Filter & test it under simulation.
13. To design a Low-pass filter & test it under simulation.
14. To design a High-pass filter & test it under simulation.
15. To interface 8051 microcontroller with DC motor.
16. To interface PIC microcontroller with servomotor.

Note: At least ten experiments are to be performed in the semester from the above list. However, few experiments may be designed and included in this list depending upon the scope of the syllabus and infrastructure available in the institute.

MIC502B

FUZZY LOGIC BASED CONTROL
M.Tech. Electrical Engg. (I&C) Semester-II

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3Hrs
Credits : 4

UNIT-I

Introduction: A prologue to intelligent control; The all-pervasive uncertainty; role of heuristics; Fuzzy Knowledge Based Control (FKBC) from an industrial perspective; Benefits of fuzzy control; Early and recent major applications of fuzzy theory, Industrial and consumer products applications.

The Mathematics of Fuzzy Control: Definition of a Fuzzy set; Membership Function and their genesis; Methods to obtain mfs; Differentiating fuzzy and probability theory; Similarities and dissimilarities between classical set theory, probability theory and fuzzy set theory; Operations on fuzzy sets and their context sensitiveness.

UNIT-II

Essential Elements of Fuzzy Logic Controllers (FLCs): Structure of Mamdani Fuzzy Controller; Rationale for normalization and denormalization; Fuzzification; Singleton; N-valued logic, Fuzzy Logic; Classical inference rules; Classical and fuzzy implication; Classical and fuzzy relation; Composition of fuzzy relations; Max-min, Max-product and Max-avg. compositions; Approximate Reasoning or Fuzzy Inferencing; Fuzzy inference rules: Compositional rule of inference, Composition based inference and Individual rule-based inference; Defuzzification.

Design of FLC: Choice of input and output variables; Choice of content of rules; Choice of term sets and Universe of Discourse; Choice of scaling factors and membership functions; Choice of fuzzification; Derivation of rules; Choice of defuzzification procedure; Centre-of-area / gravity, Centre-of-sums, Centre-of-largest-area, First-of-maxima, Middle-of-maxima, and Height defuzzification.

UNIT-III

Nonlinear, PID-like and TSK FLC: Myths and facts about nonlinear fuzzy control; Linear and nonlinear rules, The two ways of introducing nonlinearity in fuzzy rules. The FLC as a non-linear transfer element (mathematical proof of each block's nonlinearity/linearity); Distinction between PID-like FLC and FLC of PID type; Structure of TSK FLC and differences from Mamdani type FLC.

UNIT-IV

Adaptive Fuzzy Control: Rationale for adaptive FLC; Extra components in adaptive FLC; Tunable parameters; Design and performance evaluation; The process monitor (Performance measures and Parameter estimators); The adaptation mechanism (altering sfs, fuzzy set definitions, rules); The main approaches to design: mf tuning using Gradient descent / Steepest Descent Algorithm (SDA); mf tuning using performance criterion; The Self Organizing Fuzzy Controller (SOFC); Performance monitor, Adaptation algorithm.

Text Books:

1. D. Driankov, H. Hellendoorn and M. Reinfrank, "An Introduction to Fuzzy Control," Narosa Publishing House, New Delhi.

Reference Books:

1. Timothy Ross, "Fuzzy Logic with Engineering Applications," Tata McGraw Hill.
2. Kandel and G. Ingholz, "Fuzzy Control Systems," Narosa Book Distributors Pvt. Ltd., New Delhi.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC504B

MULTIRATE & ADAPTIVE SIGNAL PROCESSING

M.Tech. Electrical Engg. (I&C) Semester-II

L T P

4 - -

Class-work Marks: 25

Exam Marks : 75

Total Marks : 100

Duration of Exam : 3Hrs

Credits : 4

UNIT-I

Fourier Transform: Definition and Properties, DFT, FFT Algorithms, Review of Discrete time system and digital filters.

Fundamentals of Multirate Systems: Basic multirate operations, Interconnection of building blocks, Polyphase representation, multistage implementations, some application of multirate systems, multigrid methods.

UNIT-II

Maximally decimated filter banks: Errors created in QMF Bank, power symmetric QMF banks, M-channel filter banks, Polyphase representation, perfect reconstruction systems, lossless transfer matrices, filter bank properties inducted by paraunitaries M-channel paraunitary filter banks.

Linear Phase Perfect Reconstruction QMF Banks: Lattice structure for linear phase FIR PR QMF Banks, Formal Synthesis of linear phase FIR PR QMF Lattice, Cosine Modulated filter bank.

UNIT-III

Multirate Filter Bank Theory: Type of quantization effects, review of standard techniques, noise in filter banks, filter bank output noise, limit cycles, coefficients quantization, block filters, LPTV systems and multirate filter bank,

Wavelet Transform: Background, STFT, Wavelet transform, discrete-time orthonormal wavelets, continuous-time orthonormal wavelets, Multidimensional signals, Minimum sampling density, Multirate fundamentals, Multirate filter design.

UNIT-IV

Wiener Filters: Linear Optimum Filtering: statement of problem, minimum mean square error, error performance surface, multilinear regression model, linearly constrained minimum variance filter, least mean square adaptation algorithm and application.

Adaptive DSP Applications: System Identification, Inverse System Identification, Noise cancellation Predictive Systems, Multichannel systems, Oversampling DSP systems.

Text Books:

1. S. Haykin, "Adaptive Filter Theory," Pearson.
2. P.P. Vaidyanathan, "Multirate System and Filter Banks," Pearson.
3. A. V. Oppenheim & R. W. Schaffer, "Discrete Time Signal Processing," Pearson.
4. Proakis, "Digital Signal Processing" PHI.

Reference Books:

1. S. K. Mitra, "Digital Signal Processing," (PHI).
2. Johny Johnson, "Introduction to Digital Signal Processing," PHI.
3. A. Antoniou, "Digital Signal Processing," Tata McGrawHill.
4. B. Somanathan Nair, "Digital Signal Processing,"(PHI).
5. L. Tan, "Digital Signal Processing," Elsevier
6. S.Palani, D. Kalaiyarasi, "Digital Signal Processing," Ane Books Pvt. Ltd.
7. E. Ifeachor, B.W. Jervis, "Digital Signal Processing," Pearson.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC506B

DISCRETE CONTROL SYSTEMS
M. Tech. Electrical Engg. (I&C) Semester-II

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

Introduction: Block diagram of a digital control system, importance of Sampling in control systems. Mathematical analysis of the sampling process, ideal sampler, evaluation of starred transform function and their properties, Shannon's sampling theorem.

UNIT-II

Reconstruction of Sampled Signals & Z-Transform: Data reconstruction by polynomial extrapolation, zero order hold, first order hold, fractional order hold, definition & evaluation of the z-transform, mapping of the s-plane into the z-plane, inverse z-transform, theorems of the z-transform, Pulse transfer function, limitations of the z-transform method, response of open loop sampled data systems between sampling instants, theorems of the modified z-transforms.

UNIT-III

Block Diagram, Signal Flow Graph and Matrix Representation of Sampled Data systems : Block diagram analysis and transfer functions of closed loop sampled data systems, signal flow graphs of sampled data systems, transmission matrix of sampled data systems, the state-variable approach, system characteristic equation, time response, steady state accuracy, stability techniques, Bi-linear transformation, Routh-Hurwitz criterion, Jury stability test & Root locus.

UNIT-IV

Frequency Response & Digital Controller Design: Nyquist criterion, Bode diagram, interpretation of frequency response, closed loop frequency response. Introduction to controller design, need for compensation, phase lag compensator, phase lead compensator, phase lead design procedure, lag lead compensator, PID controllers, analysis and design of digital control systems using root locus and transform techniques. Simulation of sampled data systems.

Text Books:

1. M. Gopal, "Digital Control & State Variable Methods," TMH.
2. Chartles L. Philips & H. Troy Nagle, "Digital Control System Analysis and Design," PHI.

Reference Books:

1. K. Ogata, "Discrete Time Control System," PHI.
2. M. Gopal, "Control System-Principles & Design," TMH.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC508B

NONLINEAR & ADAPTIVE CONTROL
M.Tech. Electrical Engg. (I&C) Semester-II

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

Nonlinear Systems: Salient features of nonlinear systems, difficulties in modeling and control of Nonlinear control systems, concept of phase plane portrait and Phase plane analysis, Various methods for constructing phase plane trajectories, describing function analysis of nonlinear systems, describing functions of various nonlinear components, stability study based on phase plane and describing function .

UNIT-II

Lyapunov Stability Analysis: Lyapunov method for stability analysis of nonlinear systems, concept of Lyapunov function & various methods of constructing Lyapunov function, applications of Lyapunov analysis for autonomous & non-autonomous systems, Lyapunov stability analysis for discrete time systems, Popov's stability criterion for stability analysis of nonlinear systems.

UNIT-III

Adaptive Control: Basic concepts & block diagram of adaptive control applied to various systems, various techniques of adaptive control, design of adaptive controllers, adaptive control of nonlinear systems, robustness of adaptive control systems, composite adaptive control.

UNIT-IV

variable Structure Systems: Sliding mode control definition, simple sliding mode controller, sliding in multi input systems, sliding surface design, non-ideal sliding mode, state estimation of uncertain systems, sliding modes in solving optimization problems, penalty function method, dynamical gradient circuit analysis.

Text Books:

1. Slotine & Li, "Applied Nonlinear Control", Prentice Hall.
2. Stanislaw H. Zak, "Systems & Control", Pearson.
3. Nagrath & Gopal, "Control System Engineering", New Age International Publishers.

Reference Books:

1. M. Gopal, "Digital Control and State Variable Methods," TMH.
2. R.C. Sukla, "Control Systems," Dhanpat Rai & Co.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC510B

MODELLING & SIMULATION LAB
M.Tech. Electrical Engg. (I&C) Semester-II

L T P
- - 3

Class-work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3Hrs
Credits : 1.5

List of Experiments:

1. To implement PI, PD & PID controllers for temperature control of an oven on pilot plant &/or on a simulation kit.
2. To implement PI, PD & PID controllers for water level control of a single & two tank coupled systems on pilot plant &/or on a simulation kit.
3. To implement Fuzzy controller for temperature control of an oven & for water level control of a single & two tank coupled systems
4. To implement Fuzzy controller for speed control of dc motor.
5. To observe the effects of nonlinearities (such as saturation, backlash etc.) on the performance of PI, PD & PID controllers used for a first order system.
6. To observe the effects of nonlinearities (such as saturation, backlash etc.) on the performance of PI, PD & PID controllers used for a second order system.
7. To observe the effects of parametric disturbances on the performance of PI, PD, PID & Fuzzy controllers.
8. To observe the effects of load disturbances on the performance of PI, PD, PID & Fuzzy controllers.
9. To control speed of a dc motor using choppers.
10. Implementation of speed control of a stepper motor.
11. To implement fuzzy controller on a 2nd/3rd order system.
12. To control the pressure of Hydraulic System.
13. To control the pressure of Pneumatic System.
14. To study vector control of induction motor.

Note: At least ten experiments are to be performed in the semester from the above list. However, few experiments may be designed & included in this list depending upon the scope of the syllabus and infrastructure available in the institute.

MIC601B NEURAL NETWORKS IN INSTRUMENTATION & CONTROL
M. Tech. Electrical Engg. (I&C) Semester-III

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

Introduction: History of NN development, biological neural networks, performance comparison of computer and biological neural networks, introduction to models of ANN: McCulloch-Pitts model; classification models: Perceptron, Adaline, Madaline; Associative models-Hopfield net & bidirectional associative memories, self organizing models- Kohonen network, optimization models- Boltzmann machine, neural network learning

UNIT-II

Single Layer & Multilayer Perceptron Classifiers: Classification model, features & decision regions; discriminant functions; linear machine and minimum distance classification; training and classification using discrete perceptron algorithm, single layer continuous perceptron networks for linearly separable classification, multicategory single layer perceptron networks, linearly inseparable pattern classification; delta learning rule for multilayer perceptron, generalized delta learning rules; error back-propagation training, learning factors.

UNIT-III

Single Layer Feedback Networks: Basic concepts of dynamical systems; mathematical foundations of discrete time and gradient type Hopfield networks, energy analysis of Hopfield network, state transition diagram, example solutions of optimization problems such as minimization of the travelling Salesman Tour length.

UNIT-IV

Applications of ANN to Control Systems: Process identification, non-dynamic learning control architectures, inverted pendulum neuro-controller, cerebellar model articulation controller, artificial neural networks for robot kinematics: solution of the forward & inverse kinematics problems, target position learning, introduction to neuro-fuzzy controller & its benefits.

Text Books:

1. J.M. Zurada, "Artificial Neural System," Jaico Pub. House, Bombay.
2. Simon Haykin, "Neural Networks-A Comprehensive Foundation," PHI.

Reference Books:

1. Y. Yegnanarayana, "Artificial Neural Networks", PHI
2. Li-Ming Fu, "Neural Networks in Computer Intelligence," TMH.
3. Junhong Nie & Derek Linkens, "Fuzzy Neural Control," PHI.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC603B

PROCESS CONTROL & INSTRUMENTATION
M.Tech. Electrical Engg. (I&C) Semester-III

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT- I

Basics of Process Control: Elements of instruments, static and dynamic characteristics, basic concepts of response of first order type instruments, mercury in glass thermometer, bimetallic thermometer, pressure spring thermometer, static accuracy and response of thermometers. Thermo electricity: Industrial thermocouples, thermocouple wires, thermo couple wells. Composition analysis, spectroscopic analysis by absorption, emission, mass and color measurement spectrometers, gas analysis by thermal conductivity, analysis of moisture, gas chromatography, refractometer.

UNIT- II

Measurement of Parameters in Process Industries: Head, density and specific gravity, direct measurement of liquid level, pressure measurement in open vessels, level measurements in pressure vessels. Pressure vacuum and head: liquid column manometers, measuring elements for gauge pressure and vacuum, indicating elements for pressure gauges, measurement of absolute pressure, measuring pressure in corrosive liquids. Head flow meters, area flow meters, open channel meters, viscosity meters, quantity meters, viscosity measurements. Recording instruments, indicating and signaling instruments.

UNIT-III

Biosensors: Types, Transducers in biosensors- calorimetric, optical, potentiometric/amplometric, conductometric/ resistometric, piezoelectric, semi conductor, mechanical and molecular electronics based, molecular wires and switches, development of molecular arrays as memory stores, design for a biomolecular photonic computers- information processing.

Time-Response: Transfer function, transient response to step, impulse, sinusoidal forcing function, physical examples of first order systems, liquid level, mixing process, concept of time constant, response of second order system to step, impulse and sinusoidal forcing function, transportation lag control systems, servo and regulatory control problems.

UNIT- IV

Controller: Development of block diagram, controllers and final control elements, ideal transfer functions of operational, PI, PD and PID controllers. Reduction of physical control system to block diagram. Closed loop transfer functions for servo regulator problems. overall Transfer function for multi loop control system. Stability and control system by Routh's Criterion.

Frequency Response: Bode diagram, first order, first order system in series, second order system and for controllers and transportation lag. Bode stability criterion. gain margin and phase margin.

Text Books:

1. Donald P. Eckman, "Industrial Instrumentation," Wiley eastern, 1950.
2. Donald R. Coughanowr, "Process Systems Analysis and Control", McGraw-Hill, 1991
3. S. K Singh, "Process Control : Concepts , Dynamics and Application," PHI

Reference Books:

1. D. Patranabis, "Principles of Industrial Instrumentation," TMH.
2. G. Stephanopoulos, "Chemical Process Control," Prentice Hall, New Delhi.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC605B

**ADVANCED CONTROL & INSTRUMENTATION LAB.
M.Tech. Electrical Engg. (I&C) Semester-III**

L T P
- - 3

Class-work Marks : 20
Exam Marks : 30
Total Marks : 50
Duration of Exam : 3Hrs
Credits : 1.5

List of Experiments:

1. To study the first order and second order systems responses and their stability with simulative approach with disturbance and without disturbance.
2. To design and simulate the root-locus, frequency response, polar and Bode plots of both continuous and discrete systems.
3. To study the controllability and observability of control systems in LabView environment.
4. Design of state feedback controller for various systems.
5. To study control of DC motor using fuzzy rules.
6. Simulation of Mass-Spring-Dashpot System in LabVIEW.
7. Study of Robust control algorithm.
8. Study of fuzzy Control algorithms & PID Controls.
9. Analysis of ECG and EEG signals IN LabVIEW.
10. Simulation of Biosignals .
11. Wavelet analysis for signal compression in MATLAB.
12. Processing and analysis of speech signals in LabVIEW
13. Design of Oscilloscope and Function Genertor using NI Compact DAQ and NI LabVIEW .
14. Design of Temperature data acquisition and control system in LabVIEW environment.
15. Design of a RTD Data Acquisition System to write data onto an MS Excel File using LabVIEW.
16. To implement a simple Neural Network based control system.

Note: At least ten experiments are to be performed in the semester from the above list. However, few experiments may be designed and included in this list depending upon the scope of the syllabus and infrastructure available in the institute.

MIC607B

DISSERTATION (PHASE-I)
M.Tech. Electrical Engg. (I&C) Semester-III

L T P
-- 6

Class-work Marks: 100
Exam Marks : ----
Total Marks : 100
Duration of Exam. : ----
Credits : 6

The primary objective of this course is to develop in students the capacity for analysis and judgment and the ability to carry out independent investigation in design/development through a dissertation work involving creativity, innovation and ingenuity. The work must start with comprehensive literature search and critical appreciation thereof so as to select research problem the student wishes to work on. The topic of dissertation work shall be finalized after comprehensive literature survey on the contemporary developments in diverse research areas.

Each student will carry out independent dissertation under the supervision of teacher(s) who will be called Supervisor(s). In no case more than two supervisors can be associated with one dissertation work.

The dissertation (phase-I) involving design/fabrication/ testing/computer simulation/case studies etc. which commences in the 3rd semester will be completed as dissertation in 4th semester. Every student will be required to present three seminar talks, first at the beginning of the Dissertation (Phase-I) to present the scope of the work and to finalize the topic, second in the middle of the semester involving literature survey and fine-tuning of work and third towards the end of the semester, presenting the progress report containing the partial results if any of the work carried out by him/her in the semester. The evaluation of the dissertation (Phase-I) besides approval of the dissertation topic of the students will be done by a committee constituted as under.

Chairperson of the Department:	Chairperson
M.Tech. (I&C) Coordinator/Senior Faculty:	Member Secretary
Respective Dissertation Supervisor(s):	Member(s)

The students will be required to submit Two copies of dissertation (Phase-I) report to the M.Tech. coordinator for record and processing with one copy each for the department and respective supervisor(s).

MIC609B

SEMINAR
M.Tech. Electrical Engg. (I&C) Semester-III

L T P
-- 2

Class-work Marks: 50
Exam Marks : --
Total Marks : 50
Duration of Exam. : --
Credits : 2

SCOPE:

Part 1. : Students are expected to prepare seminar under the guidance of assigned faculty. Seminar should encourage students to know the research methodology and are required to select topic of seminar based on latest research papers from reputed journals, decode and present the technical understanding. The activities should be focused on understanding the research process, problem identification, survey of relevant research papers, and basic form of research paper writing, referencing etc.

Part 2: Further students should also be exposed to teaching methodology, where students will prepare one or two lectures and present in front of junior students/ classmates under the guidance of Faculty and feedback from audience will be the basis for the improvement; upon incorporating suggestions students must present another lecture in similar manner. In the process, the concerned faculty should expose students about Lecture preparation, planning, class room presentations, usage of Board, time management, importance of voice modulation etc.

MIC602B

DISSERTATION
M.Tech. Electrical Engg. (I&C) Semester-IV

L T P
- - 20

Class-work Marks: 50
Exam Marks : 100
Total Marks : 150
Duration of Exam : 3Hrs
Credits : 20

The dissertation shall be the extension of dissertation (Phase-I) carried out in the 3rd semester. Every student will be required to present three seminar talks, first at the beginning of the Dissertation to present the progress made during the winter break, second in the middle of the semester involving results obtained and comparative analysis and third towards the end of the semester, presenting the dissertation report of the work carried out by him/her. The committee constituted by the Chairman of the Department will screen all the presentations so as to award the sessional marks.

Internal Assessment:

The internal assessment (Class work evaluation) will be effected as per the ordinance of the University through interim report, presentation and discussion thereon by the following committee of three persons:

Chairperson of the Department:	Chairperson
M.Tech. (I&C) Coordinator/Senior Faculty:	Member Secretary
Respective Dissertation Supervisor(s):	Member(s)

External Assessment:

The Dissertation will be evaluated by the committee consisting of following three persons:

Chairperson of the Department:	Chairperson
Respective Dissertation Supervisor(s):	Member(s)
External Expert :	To be appointed by the University

Note: The external expert must be from the respective area of the specialization. The chairperson and M.Tech. (I&C) coordinator with mutual consultation will divide the submitted dissertation into groups depending upon area of specialization and recommend the list of experts for each group separately to the Vice-Chancellor for selecting the examiners with the note that an external expert should be assigned a maximum of five dissertations for the evaluation. The students will be required to submit three copies of dissertation report to the M.Tech. (I&C) Coordinator for record and processing.

List of Electives-I

MIC514B

MODERN INDUSTRIAL DRIVES & CONTROL

M.Tech. Electrical Engg. (I&C) Semester-II

L T P

4 - -

Class-work Marks: 25

Exam Marks : 75

Total Marks : 100

Duration of Exam: 3Hrs

Credits : 4

UNIT-I

Electrical Drives: Introduction, advantages, choice of electrical drives, Dynamics of Electrical Drives: Fundamental torque equations, multi-quadrant operation, equivalent values of drive parameters, load torque components, types of loads, steady state stability, load equalization. Modes of operation, closed loop control of drives, Selection of motor power rating: Heating and cooling, determination of motor rating, continuous, short time and intermittent duties, load equalization and determination of moment of inertia of the flywheel.

UNIT-II

DC Motor Drives: Speed-torque characteristics of different types of dc motors, starting, types of braking, transient analysis, speed control methods, static control of dc motors. Converter fed dc drive & chopper fed dc drive.

UNIT-III

Induction Motor Drives: characteristics, analysis and performance, starting methods, braking methods, transient analysis, methods of speed control, vector control. Static control techniques- stator frequency control, stator voltage control, rotor resistance control. Static Scherbius system & static Kramer system, Synchronous motor & brushless DC motor drives.

UNIT-IV

Traction Drives: Stepper Motor & switched reluctance motor drives, Traction Drives: Nature of traction load, important features of traction drives, static control of traction drives; comparison between ac and dc tractions, Energy conservation in electrical drives

Text Books:

1. G.K. Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House

Reference Books:

1. G.K. Dubey, "Power Semiconductor controlled drives", Prentice Hall.
2. V. Subrahmaniyam, "Electric Drives", TMH
3. Leonard, "Electric Drives", Narosa Pub.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC516B

COMPUTATIONAL INTELLIGENCE
M.Tech. Electrical Engg. (I&C) Semester-II

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

Introduction: Computational Intelligence and Knowledge, a representation and reasoning system: Definition of computational intelligence. Agents in the world, Representation and reasoning. Representation and Reasoning System, simplifying assumptions of the initial RRS, Datalog, semantics. Case studies using definite knowledge.

UNIT-II

Searching: Purpose of search, Graph searching, a genetic searching algorithm, blind search strategies, heuristic search, refinements to search strategies, constraint satisfaction problems.

Representing Knowledge: defining a solution, choosing a representation language, mapping from problem to representation, choosing an inference procedure, introduction to knowledge engineering, knowledge based system architecture, complete knowledge assumption.

UNIT-III

Actions & Planning: Introduction, Representations of Actions and change, reasoning with world representations, an assumption-based reasoning framework, default reasoning, abduction, evidential and causal reasoning, algorithms for assumption-based reasoning. Uncertain knowledge

UNIT-IV

Building Situated Robots: Introduction, robotic system, agent function, designing robots, uses of agent models, robot architectures, implementing a controller, robots modelling the world reasoning in situated robots.

Text-book:

1. David Poole, Alan Mackworth, Randy Goebel, "Computational intelligence: A logical approach," Oxford University Press

Reference Books:

1. N.P Padhy, "Artificial Intelligence and Intelligent Systems" Oxford University Press.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC518B

PARAMETER ESTIMATION & SYSTEM IDENTIFICATION

M. Tech. Electrical Engg. (I&C) Semester-II

L T P

4 - -

Class-work Marks: 25

Exam Marks : 75

Total Marks : 100

Duration of Exam: 3Hrs

Credits : 4

UNIT-I

Classical Methods of Identification: Models and model classification, the identification problem, some fields of applications. Time response and frequency response methods of transfer function evaluation, impulse response identification using cross-correlation test and orthogonal series expansion, methods of convolution, model learning technique, linear least square estimates, its properties, non-recursive least square identification of dynamic system, extensions such as generalized least square, repeated least square and instrumental variable method.

UNIT-II

Recursive Methods of Identification: Recursive least square identification, minimum variance algorithms, stochastic gradient approximation method, maximum likelihood method & their applications.

UNIT-III

Identification of State Variable Models: State estimator using Kalman and extended Kalman filter, Simultaneous state and parameter estimation of linear systems, two stage identification methods.

UNIT-IV

Nonlinear Identification: Identification of a volterra series models, identification of nonlinear state models using extended Kalman filter, quasilinearization method, gradient method, numerical identification through model following approach.

Text Books:

1. Lennart Ljung & Torsten Soderstrom, "Theory & Practice of Recursive Identification," MIT Press.
2. J.M.Mendel, "Discrete Techniques of Parameter Estimation," Marcel Dekker, 1973.

Reference Books:

1. F. Eykhoff, "System Identification, Parameter and State Estimation, John Willey, 1974.
2. A.P. Sage & J.L. Melsa " System Identification", Academic Press, 1971.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC520B

ADVANCED VIRTUAL INSTRUMENTATION
M.Tech. Electrical Engg. (I&C) Semester-II

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

Introduction to LabVIEW: Software environment, front panel, block diagram, palettes, loops, structures and tunnels, arrays, clusters, plotting data.

Modular Programming: Modular programming in LabVIEW, creating an icon, building a connector pane, displaying sub VIs and express VIs as icons or expandable nodes, creating sub VIs from sections of VIs, opening and editing sub VIs, placing sub VIs on block diagrams, creating stand alone applications.

UNIT-II

Strings and File I/O: Creating string controls and indicators, string functions, editing, formatting & parsing strings, configuring string controls and indicators, basics of file input/output, file I/O VIs.

Instrument Control: GPIB communication, hardware and software architecture and specifications, instrument I/O assistant, VISA, Instrument Drivers, Serial Port communications.

UNIT-III

Data Acquisition: Transducers, signal conditioning, DAQ hardware configuration, DAQ hardware, Analogy I/O, counters, digital I/O, DAQ assistant, selecting & configuring a data acquisition device.

Cluster of instruments in vi system Interfacing of external instruments to a PC - RS232, RS 422, RS 485 and USB standards - IEEE 488 standard - ISO-OSI model for serial bus - Introduction to bus protocols of MOD bus and CAN bus.

UNIT-IV

Graphical Programming Environment in VI : Concepts of graphical programming - Lab-view software - Concept of VIs and sub VI - Display types - Digital - Analog - Chart - Oscilloscopic types - Loops - Case and sequence structures - Types of data - Arrays - Formulae nodes -Local and global variables - String and file I/O.

Analysis Tools and Simple Applications in VI: Fourier transform - Power spectrum - Correlation - Windowing and filtering tools-Simple temperature indicator - ON/OFF controller- P-I-D controller - CRO emulation - Simulation of a simple second order system.

Text Books:

1. S. Gupta and J.P Gupta, 'PC Interfacing for Data Acquisition and Process Control', Instrument Society of America, 1994
2. Jovitha Jerome, Virtual Instrumentation using LabVIEW", PHI.
3. Gary Johnson, "Labview Graphical Programming," McGraw Hill.
4. J. Essick, "Hands-on Introduction to LabVIEW for Scientists and Engineers," Oxford.

Reference Books:

1. Kevin James, 'PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control', Newness, 2000.
2. Gary W. Johnson, Richard Jennings, 'Lab-view Graphical Programming', McGraw Hill Professional Publishing, 2001.
3. Peter W. Gofton, 'Understanding Serial Communications', Sybex International.
4. Robert H. Bishop, 'Learning with Lab-view', Prentice Hall, 2003.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MPS518B

POWER SYSTEM CONTROL & DYNAMICS

M. Tech. Electrical Engg. (I&C) Semester-II

L T P

4 - -

Class-work Marks: 25

Exam Marks : 75

Total Marks : 100

Duration of Exam: 3Hrs

Credits : 4

UNIT-I

Introduction: Dynamic models of synchronous machine, mechanical system, power flow through transmission lines, power transmission capability of line, shunt and series compensation, low frequency oscillation, SSR, torsional oscillation, induction generator effect, counter measure.

UNIT-II

Power Frequency Control: Single area load frequency control, load frequency Vs economic control, two area load frequency control, speed governor, dead band, digital load flow control, decentralized control, application to MATLAB.

UNIT-III

Excitation Control: Exciters, boost buck excitation system, static excitation system, brushless excitation system, and development of excitation system and transfer function, application of optimal control theory to excitation systems. Application of MATLAB to various excitation system, first bench mark model, second bench mark model, corpals bench mark model, multi machine system.

UNIT-IV

Stability Study: Definitions: angular stability- steady state stability, dynamic stability, transient stability, mechanics of angular momentum, swing equation, synchronizing power coefficient, effect of excitation on stability, steady state stability of an unregulated system, effect of dampers and governor action, steady state stability with automatic voltage regulator, reduction of power system to one machine system, equal area criteria, critical clearing angle, solution of swing equation, stability study in multi-machine system, application of MATLAB, pole place technique, eigen value analysis, energy function approach for stability evolution technique of improving transient stability, Voltage stability, voltage collapse, voltage instability in transmission system, voltage stability angle, V-P and V-Q curves.

Text Books:

1. Power Systems Engineering by S. K. Gupta, Umesh Publication
2. Power system analysis by O I Elgerd: TMH Publication New Delhi
3. Modern Power System by Nagrath Kothari: TMH Publication New Delhi
4. Power system analysis and Stability by S. S. Vadhra: Khanna Publication New Delhi
5. Power system analysis by Hadi Sadat: TMH Publication, New Delhi

Reference Books:

1. Advanced Power System Analysis & Dynamics by L P Singh: Wiley Eastern LTD New Delhi
2. Elements of Power System Analysis by W. D. Stevenson: MGH Publication New Delhi
3. Power System Dynamics by M A Pai: Prentice Hall New Delhi
4. Switch Gear Protection by S S Rao Khanna Publication, New Delhi
5. Control & Instrumentation Technology in HVAC by Michail Horddeski: Fairmont Press
6. Electric Power Systems by S L Uppal: Khanna
7. Power System Optimization By Nagrath & Kothari : TMH publication New Delhi
8. Dynamic control of Large Electric Power Systems by ILIC: Tbi pub

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

List of Electives-II

MIC611B

GENETIC ALGORITHMS BASED OPTIMIZATION

M. Tech. Electrical Engg. (I&C) Semester-III

L T P

4 - -

Class-work Marks: 25

Exam Marks : 75

Total Marks : 100

Duration of Exam: 3Hrs

Credits : 4

UNIT-I

Introduction: Early developments in Genetic Algorithms (GAs); Pragmatic appeal of GAs; Scenarios of evolutionary computation; Distinction of GAs from Evolution Programs; Definition of GAs; Distinction of GAs from traditional computer programs; Distinction between GAs and traditional optimization / search methods (i.e., calculus-based, steepest-ascent hill climbing, Next-ascent hill climbing, Random-mutation hill climbing), Enumerative search, Random search; Uni-modality v/s multimodality; comparison of GAs terms with those of natural biology.

UNIT-II

Elements of Canonical GAs and Schema Theorem: Random initialization of population: Selection; Crossover; Mutation; Algorithms for three operators: Roulette Wheel selection, Algorithm for single point crossover, Algorithm for mutation; Genesis of GA's processing power: implicit parallelism; Similarity templates (schemata); Schema order and Defining length; The fundamental theorem of GAs (Schema Theorem): Individual effects selection, crossover and mutation on schemata and their combined effect, derivation of schema growth equation, Building blocks hypothesis.

UNIT-III

Further Operators / Variants and Implementation Issues: Problems / limitations of Roulette wheel selection and ways to overcome limitations: Stochastic universal sampling, Sigma scaling, Boltzmann selection, Rank selection, Steady state selection; Problems with single point crossover: Positional bias, Spurious correlation, End point effects; Two point crossover; Parametrized Uniform crossover; Evolving crossover hotspots; Inversion; Hitch in combining inversion with single-point crossover and solution thereof.

UNIT-IV

Applications of GAs: Evolving computer programs, Evolving Lisp programs, Koza's algorithm; Data analysis and prediction: Predicting dynamical systems (Norman Packard's form of GAs), Meyer and Packard's form of GAs for predicting chaotic time series; Evolving neural networks: Primer on ANNs, Evolvable aspects of NNs, Evolving weights in a fixed network.

Text Books:

1. Melanie Mitchell, "An Introduction to Genetic Algorithms," PHI.
2. D.E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning," Addison-Wesley Pub. Co.

Reference Books:

1. L. Davis, "Handbook of Genetic Algorithms". New York: Van Nostrand, Reinhold, 1991.
2. Z. Michalewicz, "Genetic Algorithms + Data Structures = Evolution Programs". Berlin: Springer-Verlag, 1992.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC613B

ROBOTICS & AUTOMATION ENGINEERING
M. Tech. Electrical Engg. (I&C) Semester-III

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

Introduction to Automation & Automated Inspection: Reasons for automation, Automation strategies, automated inspection: Principles & methods, Sensor technologies for automated inspection, Coordinate measuring machine, other contact inspection methods, machine vision, optical inspection methods, non-contact inspection methods.

UNIT-II

Basic Concepts of Robotics & Power Sources: Definition and origin of robotics, different types of robots, various generations of robots, Asimov's laws of robotics, Dynamic stabilization of robots. Hydraulic, pneumatic and electric drives, Determination of HP of motor and gearing ratio, variable speed arrangements, path determination.

UNIT-III

Sensors, Manipulators, Actuators & Grippers: Micro machines in robotics, machine vision, ranging, Laser, acoustic, magnetic, fibre optic and tactile sensors. Construction of manipulators - manipulator dynamics and force control, electronic & pneumatic manipulator control circuits, end effectors, various types of grippers, Design considerations.

UNIT-IV

Kinematics & Path Planning: Solution of inverse kinematics problem, multiple solution, Jacobian work envelop, hill climbing techniques, robot programming languages, robots in manufacturing & non-manufacturing applications, selection of robot.

Text Books:

1. P.Mikell, G.M. Weiss, R.N. Nagel, N.G. Odrajb, "Industrial Robotics", McGraw-Hill, Singapore, 1996
2. G.M. Mair, , 'Industrial Robotics', Prentice Hall, NY, 1988.
3. R.D. Khafter, T.A. Chimelewski & M. Negin, , "Robot Engineering-An Integrated Approach," PHI.
4. M. Braddley et al., "Robot Motion: Planning and Control," MIT Press, Cambridge, Mass, 1982.
5. John J. Craig, "Introduction to Robotics, Mechanics and Control", Pearson.

Reference Books:

1. R.P. Paul, "Robot Manipulators: Mathematics, Programming and Control," MIT Press, Cambridge, Mass, 1981.
2. Mittal and Nagrath, "Robotics and Control," TMH.
3. M. Sponge, and M. Vidyasagar, "Robot Dynamics and Control," John Wiley New York 1989.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC615B

SCADA & POWER SYSTEM AUTOMATION
M.Tech. Electrical Engg.(I&C) Semester-III

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

SCADA: Need of SCADA system, Distributed control systems, General definition and SCADA components. Hardware Architecture, Software architecture, Protocol detail, Discrete control and Analog control, application & benefits, PLCs Vs RTUs, RTU Block diagram, , MTU communication interface, Future trends, Internet based SCADA display system, Components of control systems in SCADA.

PLC Programming Language Standards: ladder logic, functional block, structural text, instruction, ladder diagrams, trouble shooting, features,

UNIT-II

SCADA in Power Systems: Main task in power systems- Planning, operation, accounting, tasks of national control centre, regional control centre, Generating station control room, AGC-SCADA, SCADA in generation, SCADA in Power Distribution, SCADA in Power Grid.

Data Communication: Communication interfacing, Communication path, Communication protocol, Serial Data Transfer, Communication medium, Power-line carrier communication, man-machine communication, terrestrial & satellite radio link, amplitude, frequency phase and pulse modulation, digital transmission techniques, PLC communication, Bluetooth, RF communication, LAN.

UNIT-III

Supervisory Power Management: Energy Management System, power system operation states, security analysis, computer programmes-generating planning, transmission planning, system studies, energy audit, state estimation, load forecasting. Utility distribution system design, regulation, distribution automation, DMS, design, layout and construction and commissioning of substations, Substation Automation and Equipment condition monitoring.

UNIT-IV

Automation of Power Plant: Automatic mapping and facility management, Distribution system design, Facility mapping, tracking, facility inventory, system and equipment maintenance, trouble call management, Customer level intelligent automation system, computer level monitoring and control of distribution transformers, Substation and feeder level automation.

Text Books:

1. Stuart A. Boyer, "SCADA: Supervisory Control and Data Acquisition," ISA.
2. S.S. Rao, "Switch Gear & Protection," Khanna Publication.
3. Torsten Cegrell, "Power System Control Technology", Prentice Hall.

Reference Books:

1. Parikh, Reddy & Benerjee, "Planning for Demand Side Management in the Electric Sector" TMH
2. Elliot L. Gruenberg, "Handbook of Telemetry of Remote Control," MGH.
3. Roddy & Coolen, "Electronics Communication," Prentice Hall Career and Technology.
4. Gower, "Optical Fiber Communication," Eastern Publication.
5. S.L. Uppal, "Electrical Power," Khanna Publishers.
6. S K Gupta, "Power System Engineering," Umesh Publication.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC617B

BIO-INSPIRED OPTIMIZATION TECHNIQUES
M.Tech. Electrical Engg. (I&C) Semester-III

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

Introduction: Challenges of control and automation (appropriate for non-controls person), scientific foundations of biomimicry. Elements of Decision-Making: Neural network substrates for control instincts, rule-based control, planning systems, attentional systems (including stability analysis). Learning: Learning and control (off/on-line approximation perspective, heuristic adaptive control), linear least squares methods (batch and recursive least squares), gradient methods (e.g. Levenberg-Marquardt), adaptive control (optimization perspective, introduction to stable adaptive control).

UNIT- II

Evolution: Genetic algorithm, stochastic and nongradient optimization for design (e.g., pattern search methods, response surface methodology), evolution and learning: synergistic effects.

Foraging: Cooperative foraging and search (optimization models, swarm stability), competitive and intelligent foraging (game-theoretic formulations, outlook on future of area).

UNIT- III

Ant Colony Optimization: Ants' Foraging Behavior and Optimization, Toward artificial Ants, Artificial Ants and Minimum Cost Paths, Combinatorial Optimization, ACO Metaheuristic, Ant Colony Optimization Algorithms for the Traveling Salesman, Parallel Implementations, ACO Plus Local Search, Implementing ACO Algorithms, Theoretical Considerations on ACO, The Problem and the Algorithm, Convergence Proofs, ACO and Model-Based Search.

UNIT- IV

Other Optimization Algorithms: Biogeography based optimization, Particle swarm optimization, and their hybrid optimization techniques with GA.

Text Books:

1. Kevin M. Passino, "Biomimicry for Optimization, Control, and Automation", Springer 2005.
2. Marco Dorigo and Thomas Stützle, "Ant Colony Optimization", MIT Press, 2004.

Reference Books:

1. Dan Simon, "Biogeography-Based Optimization", IEEE Transactions On Evolutionary Computation, vol. 12, no. 6, pp. 702-713, 2008.
2. A. Lazinica, "Particle Swarm Optimization", In-Tech, 2009.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MIC619B

BIOMEDICAL INSTRUMENTATION
M.Tech. Electrical Engg. (I&C) Semester-III

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

Introduction to Biomedical Instrumentation: Overview, role of technology in modern healthcare, role of biomedical engineer, man-instrument system, origin of Biosignals, classification of biomedical instruments, performance parameters of -instruments, physiological systems.

UNIT-II

Biomedical Instruments & Equipments Technology: Bio-potential electrodes, amplifiers and measurements Systems, Bio-Potential electrodes-Electrode-Electrode interface, Half-cells and their potentials, Silver-Silver chloride electrodes, biomedical Recording electrodes, circuit model of electrode. Bioelectric amplifiers-carrier amplifiers, chopper amplifiers, phase sensitive or lock-in amplifiers, isolation amplifiers, instrumentation amplifiers.

UNIT-III

Monitoring Systems: Sensory and behavioral measurements & patient monitoring systems. audiometer, galvanic skin Response (GSR), biofeedback instrumentation. Computer-assisted patient monitoring system: Bedside monitors, central monitors ., measurement of heart rate, measurement of blood pressure, measurement of respiratory rate, impedance pnuemography, apnea detectors, Intelligent patient monitoring: Intelligent monitoring system architecture.

UNIT-IV

Telemetry in Medical Applications: Telemedicine & Medical Informatics. Telemedicine and its applications: Teleradiology, telecardiology, telepsychiatry, teledermatology, telesurgery, advantages and disadvantages of telemedicine. Hospital Information systems, Computer Networks in healthcare.

Text Book:

1. R.S. Khandpur, "Handbook of Biomedical Instrumentaion," TMH.
2. Mandeep Singh, "Introduction to Biomedical Instrumentation," PHI.

Reference Book:

1. Rangayyan , "Biomedical Signal Analysis: A case-study Approach," Wiley.
2. Webster, "Bioinstrumentation," Wiley.
3. Webster, "Medical Instrumentation: Application and Design," Wiley.
4. Carr, "Introduction to biomedical equipment technology," Pearson.

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.

MPS633B

POWER SYSTEM RELIABILITY
M.Tech. Electrical Engg. (I&C) Semester-III

L T P
4 - -

Class-work Marks: 25
Exam Marks : 75
Total Marks : 100
Duration of Exam: 3Hrs
Credits : 4

UNIT-I

Introduction: Definition of reliability, types of failures, definition and factors influencing system effectiveness, various parameters of system effectiveness, laws of probability, conditional probability, Bay's theorem; various distributions; data collection, recovery of data, data analysis Procedures, empirical reliability calculations.

UNIT-II

Reliability Mathematics: Types of system- series, parallel, series parallel, stand by and complex; development of logic diagram, methods of reliability evaluation; cut set and tie-set methods, matrix methods event trees and fault trees methods, reliability evaluation using probability distributions, Markov method, frequency and duration method.

UNIT-III

Reliability of Generation and transmission System: Generating system model, Loss of Load, Loss of Energy, Scheduled outage, Load forecast uncertainty, Transmission system model, Network configurations, state selection, System and load point indices, Numerical evaluation, Application to practical interconnected transmission system.

UNIT-IV

Reliability of Distribution System: Reliability evaluation of distribution system, various interruption indices: customer-oriented indices, Load and energy oriented indices, system performance, system prediction, Application to radial distribution system, Effects of disconnects, Effect of protection failures, Effects of transferring loads.

Text Books:

1. R. Billinton & R.N. Allan, "Reliability Evaluation of Engineering and Systems", Plenum Press.
2. S.K. Sinha & B.K. Kale, "Life Testing and Reliability Estimation", Wiley Eastern Ltd.

Reference Books:

- 1 K.C. Kapoor & L.R. Lamberson, "Reliability in Engineering and Design", John Wiley and Sons.
- 2 M.L. Shooman, "Probabilistic Reliability, An Engineering Approach", McGraw Hill.
- 3 L.S. Srinath, Reliability Engineering, Affiliated East-West Press, New Delhi.
- 4 A.K.Govil, Reliability Engineering, Tata Mc-Graw Hill, New Delhi

Note: The examiner will set eight questions from the syllabus with two questions from each unit. The students are required to attempt five questions in all with at least one question from each unit. All questions carry equal marks.