YBN UNIVERSITY, RANCHI, JHARKHAND
School of Engineering & Technology

M.Tech. Semester-I — Control System

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical/ Viva	Practical Record/ Assignment/Quiz/Presentation	
1.	YMECS101	Mathematics	3	1	-	4	70	20	10	-	-	100
2.	YMECS102	Linear Control System	3	1	-	4	70	20	10	-	-	100
3.	YMECS103	Discrete data & non-linear control	3	1	-	4	70	20	10	-	-	100
4.	YMECS104	Operations Research and Optimization	3	1	-	4	70	20	10	-	-	100
5.	YMECS105	Industrial and Process Instrumentation	3	1	-	4	70	20	10	-	-	100
6.	YMECS106	Lab-I (Inst. And Control System Engg.)	-	-	6	6	-	-	-	90	60	150
7.	YMECS107	Lab-II (Discrete data & non-linear control)	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L:Lecture- T:Tutorial- P:Practical

ADVANCED MATHEMATICS(YMECS101)

UNIT I

Solution of Partial Differential Equation (PDE) by separation of variable method, numerical solution of PDE (Laplace, Poisson's, Parabola) using finite difference methods, Elementary properties of FT, DFT, WFT, Wavelet transform, Haar transform.

UNIT II

Probability, compound probability and discrete random variable. Binomial, Normal and Poisson's distributions, Sampling distribution, elementary concept of estimation and theory of hypothesis, recurred relations.

UNIT III

Stochastic process, Markov process transition probability transition probability matrix, just and higher order Markov process, Markov chain. Queuing system, transient and steady state, traffic intensity, distribution queuing system, concepts of queuing models (M/M/1: Infinity/ Infinity/ FC FS), (M/M/1: N/ Infinity/ FC FS), (M/M/S: Infinity/ Infinity/ FC FS)

UNIT IV

Operations of fuzzy sets, fuzzy arithmetic & relations, fuzzy relation equations, fuzzy logics. MATLAB introduction, programming in MATLAB scripts, functions and their application.

UNIT V

Introduction and definition of reliability, derivation of reliability functions, Failure rate, Hazard rate, mean time t future & their relations, concepts of fault tolerant analysis, Elementary idea about decision theory and goal programming.

Reference Books:

1. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Hill.
2. Advance Engineering Mathematics by Ervin Kreszig, Wiley Easten Edd.
3. Applied Numerical Methods with MATLAB by Steven C Chapra, TMH.
4. Introductory Methods of Numerical Analysis by S.S. Shastry,
5. Introduction of Numerical Analysis by Forberg
6. Numerical Solution of Differential Equation by M. K. Jain
7. Numerical Mathematical Analysis By James B. Scarborogh
8. Fourier Transforms by J. N. Sheddon
9. Fuzzy Logic in Engineering by T. J. Ross
10. Fuzzy Sets Theory & its Applications by H. J. Zimmersoms

LINEAR CONTROL SYSTEMS(YMECS102)

Unit 1
State transition matrix and solution of state equations, continuos and discsrete systems.

Unit 2
Controllability and Observability, stability analysis, Liapunov stability, generation of Liapunov function, Liapunov Stability for discrete systems.

Unit 3
State and output formulation of state variable equations for distributed and discrete time systems,

Unit 4
Stability of distributed parameter systems.

BOOK RECOMMENDED:

1. Ogata- State Space Analysis of Control Systems: Prentice Hall
2. C.T. Chan, Linear Systems Theory
3. Schults and Melsa~ System Theory, Mc Graw Hill.
4. Zadeh and Polok, System Theory, Mc Graw Hill.

DISCRETE DATA AND NON LINEAR CONTROL(YMECS103)

Unit 1

SAMPLING PROCESSES:
Reconstruction of sampled-data system and modified transformation, frequency and time response analysis of sampled data system.

Unit 2

Design and optimization of digital controllers, multirate and sampling, design and compensation of sampled data systems.

Unit 3

CLASSIFICATION OF NONLINEAR PHENOMENA:
Linearization harmonic, piecewise, point transformation method, Describing function analysis, phase plane method, singular points, Poi care and Bendixsou' s theorem.

Unit 4

Various methods of stability, Second method of Liapunov Canonical forins of Lure, Zubov method, popovs stability criterion.

BOOKS RECOMMENDED:

1. B C Kuo, "Discrete Data Control Systems, Prentice Hall
2. HJ.E. Gibson, Non Linear Automatic Control" Mc Graw Hill
3. Hayashi, "Non linear oscillations, Mc Graw Hill
4. Leendes (Ed) "Modem Control Theory Mc Graw Hill
5. Lasalle and Lafachets, "Stability by Lyapunovs Direct Method Ac.ademic Press.
6. Hahn Theory and Application of Liapunovs direct method Prentice IlaJI

OPERATIONS RESEARCH AND OPTIMIZATION(YMECS104)

Unit 1

LINEAR PROGRAMMING

Inequality constraints, general definition of linear programming, graphical solution of two variable linear programming, simplex method, revised simplex method duality and degeneracy, application of the linear programming formulations to the problems like transportations, assignments and production planning. Non existing a feasible solution in the simplex tableau.

Unit 2

DISCSRETE DYNAMIC PROGRAMMING

Optimality principle, concept of multistage decision process, general approach to recursive optimization, forward and backward computations, problem of dimensionality.

Unit 3

NON -LINEAR PROGRAMMING

Optimization with a nonlinear objective function, method of steepest descrent, direct linearization, maximizing convex objective function, large step approaches, simplex method optimization with nonlinear constraints, method of feasible direction, Kuhn- Tucker conditions.

Unit 4

QUADRATIC PROGRAMMING:

Simplex algorithm decomposition of linear programing

Unit 5

INTEGER PROGRAMM1NG:

Integer programming formulations, integer linear programming, branch and bound algorithm.

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BOOKS RECOMMENDED:

1. T.Au and T.E. Stelson, Introduction to Systems Engineering, Deterministic models Addison Wesley Publication.
2. H.M. Salkin "Integer Programming, Addison Wesley Publication.
3. H.M. Wagner, Principles of Operations, Research with Applications to Managerial Decisions Prentice Hall of India
4. S.S. Rao, Optimization Theory, and Applications Wiley Eastern Ltd.

INDUSTRIAL & PROCESS INSTRUMENTATION (YMECS105)

Unit 1

TRANSDUCER FUNDAMENTALS**.** Review of transducers for non-electrical quantities their characteristics and classification.

Unit 2

TRANSDUCERS FOR INDUSTRIAL MEASUREMENT

Working principle and characteristics of transducers used for measuring weight, density, vibration, distance, thickness, opacity etc. Working principle of pneumatics, electrical optical magnetic and nucleonic transducers used for measuring pressure, level, temperature, flow, moisture, humidity and pH value.

Unit 3

PROCESS CONTROLLERS

Introduction to different control concepts like feedback, feed forward cascade etc. steady state analysis dynamic response of linear and nonlinear elements, transient and frequency response analysis of processes with controllers PID controller design (pneumatic and electrical) comparative study of pneumatic and electric controllers.

Unit 4

FINAL CONTROL ELEMENTS

Selection of instruments for a given process and their placement in the loop instrumentation diagram with standard symbols.

Unit 5

Case studies of Design of Instrumentation schemes used in Thermal and Nuclear Power Plants, Pulp and paper plants, Distillation Plants.

BOOKS:

1. Electrical Meaurement & Instrumentation By A.K.Sawney
2. Indusrial Instrumentation By M.S.Berde
3. Control System By Nagrath, Gopal 4.

Control System By B.S.Manake

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M.Tech. Semester-II — Control System

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical /Viva	Practical Record/ assignment /Quiz /presentation	
1.	YMECS201	Fuzzy Maths and Applications to Controllers	3	1	-	4	70	20	10	-	-	100
2.	YMECS202	Optimal & Adaptive control	3	1	-	4	70	20	10	-	-	100
3.	YMECS203	State Estimation and System Identification	3	1	-	4	70	20	10	-	-	100
4.	YMECS204	Pattern Recognition	3	1	-	4	70	20	10	-	-	100
5.	YMECS205	Advanced Controlled Systems	3	1	-	4	70	20	10	-	-	100
6.	YMECS206	Lab-IIIControl Sys.)	-	-	6	6	-	-	-	90	60	150
7.	YMECS207	Lab-IV (Application of Fuzzy to Controllers)	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L:Lecture- T:Tutorial- P:Practical

Fuzzy Maths and Applications to Controllers(YMECS201)

UNIT-I

THE MATHEMATICS OF FUZZY CONTROL:

Fuzzy Set vagueness, fuzzy set theory versus probability theory, classical set theory, fuzzy set, properties of fuzzy sets, operations on fuzzy sets, fuzzy relations, operations on fuzzy relations. The Extensions principle, Approximate reasoning, linguistic variable fuzzy propositions, fuzzy. If then statements, inference rules, the compositional rule of inference.

Unit-II

KNOWLEDGE BASE CONTROLLER:

The structure of a F K B C fuzzification module, knowledge base, inference engine, defuzzification module, rule base, choice of variables and content of rules, choice of term set, derivation of rules, date base choice of membership functions, choice of scaling factors. Inference engine, choice of fuzzification procedure choice of defuzzification procedure, center of area gravity, center of , sums, Height, center of largest area, first of maxima middle of maxima.

Unit-III

NON LINEAR FUZZY CONTROL:

F K B C as a non linear transfer element F K B C computational structure, the Non linearity of the controller, Rule based representation of conventional T E types of F K B C, P I D like F K B C sliding mode F K B C sugeno F K B C.

Unit-IV

NEURAL NETWORK:

Basic of Neural Network different of neural architecture, single input neuron, transfer functions multiple input neuron Network architectures, a layer of neurons, multiple layer of neurons.

Unit-V

Perceptions linear network, back propagation Radial basis network. Association learning rules, self organizing networks, learning vector quanitization recurrent networks.

BOOKS RECOMEDED :

1. An introduction to fuzzy control "Bruce Graham and Anifal Ollero"
2. Neural Network Tool box "MATLAB' ,

Optimal & Adaptive control(YMECS202)

UNIT-1

Basic mathematical preliminaries-set theory, convexity,

Unit 2
Development of feedback control laws through state space technique modal control, pole placement problem.

Unit 3 OPTIMAL CONTROL
Condition for optimality, variational calculus approach, optimal feedback control of linear deterministic systems, matrix Riccati equation, linear regulator problem, Pontrygin maximum principle, Hamilton-Jacobi Bellman Theory, structure and properties of optimal systems, various types of constraints, singular solution, minimum time and minimum fuel problems, sensitivity of optimal systems, second variations and neighboring extremes, penalty function method.

Unit 4 ADAPTIVE CONTROL
Adaptive control schemes and introduction to adaptive optimal problems, Models reference adaptive control, Design of adaptive system, Learning model approach, input signal adaptive systems adaptive auto-pilot, some practical illustrations.

BOOK RECOMMENDED:

1. A.P. Sage-Optima] System Control, Prentice Hall
2. Athens and Fa]b-Optimal control, Mc Graw Hill
3. D.E. Kirk-Optima] control theory Prentice Hall
4. Polak-Computation methods in optimization, Academic press.

YMECS 203 State Estimation and system Identification

Unit 1
ESTIMATION: Optimum State estimation in linear stationary systems, Wiener filters, optimal filtering of non stationary continuous systems, Kalman Bucy filters.

Unit 2
Full and reduced order observers, least square curve fitting, state estimation and discrete linear systems, nonlinear estimation.

Unit 3
IDENTIFICATION: Classical and modem techniques of system identification, impulse response identification, correlation techniques, matched filter identification.

Unit 4
Transfer function evaluation, cost function for system identification, gradient technique, stochastic approximation, quasi-linearization, invariant impending.

BOOK RECOMMENDED:

1. Sage-Optimum System control, Prentice Hall
2. Sage ann MeJsa -Sy~t.em Identificatior1, Academic Press New York.
3. Sage and Melsa- Estimation theory with applications to Communication and Control, Mc Graw Hill.

Pattern Recognition(YMECS204)

Unit 1

MASK MATCHING Optical mask matching, electronic mask matching using analogue grey scale, digital grey scale, score maximization, peephole masks, negative weights.

Unit 2

PREPROCESSING FOR CHARACTER RECOGNITION Conversion from visual detection and to electrical patterns, binarisation, alignment, smoothing e
thining.

Unit 3

LINEAR TECHNIQUES Recognition class, minimum error baycsian classifier, statistical independence, Gaussian distribution cross correlation with normalized average masks, linear discriminant functions, fixed increment procedure pattern error, Dischotemisation schemes, Karhuncn-Leave expansion.

Unit 4

PIECE WISE TECHNIQUES Piece-wise linear discriminant functions, intuitively determined subclasses, nearest neighbour method, firschein and fischlers method, piecewise linear fixed increment procedure, the method of potentials, stochastic approximation in pattern recognition.

Unit 5

POLYNOMIAL DISCRIMINANTS A N TUPLE MEHODS Least square approximation maximum likelihood n-topple method, Bledsoe and Browning method ,polynomial discriminate functions, Automatic selection means of information criterion, shifted peephole mask systems.

Unit 6

BOOLEAN AND SEQUENTIAL DECISION MAKING Boolean Functions, recognition systems using Boolean functions, incompletely specified Boolean functions implementation of Boolean functions using numerical functions non- numerical sequential recognition, decision making strategies. Introduction to zoned features, graph representation techniques-, sequentially detected features, discussion of features. Crossing counting techniques.

Unit 7

CONTEXTUAL LINGUISTIC AND ARRAY TECHNIQUES Context, scene analysis, picture syntax, analysis by synthesis, iterative array techniques, Higher moments, slit scanning techniques, Fourier Transformation, pattern recognition by Fourier optics, autocorrelation, speech recognition

Unit 8

LEARNING Unsupervised learning, automatic determination of features, transference of learning, associative memory, scientific basis of automatic pattern recognition.

BOOKS RECOMMENDED:

1. H C Andrews, Introduction to Mathematical Techniques in Recognitions Wiley
2. M Nongard, Pattern recognition Spartan Books 1970
3. J R Villrnann , Pattern Recognition Techniques, Butterworths 1973

Advanced Controlled Systems(YMECS2058)

UNIT-I

through differential equations and Rewiew of Linear Control System: M difference equation, state space method of description and its solution, discretization of continuous-time state space model, Laplace and z-domain analyses of control systems, Controllability, operability & Stability, Dode & Nyquist analysis, Root Loci, Effect of load disturbance upon control actions.

UNIT-II

Development of feedback control laws through state space technique modal control, pole placement problem.

UNIT-III

Variable Structure control and its applications. Examples on variable structure control.

UNIT-IV

Control of nonlinear dynamics: Lyapunov based control function, Phase plane technique, Liapunov stability analysis.

UNIT –V

Optimal control: Calculus of variation, Euler-Lagrange equations, Boundary conditions, Transversal condition Bolza problem, Pontyazin's maximum principle.

Books

1. Automatic Control System – B.C. Kuo, Prentice Hall, New York, 1975
2. Modern Control Engineering K. Ogata, Prentice Hall of India Ltd. New Delhi,1992
3. Digital control system B.C. Kuo Oxford Pub.
4. Discrete Time Control Systems – K. Ogata. Prentice Hall of India Ltd. New Delhi.
5. Optimum System Control Andrew P. Sage, Prentice Hall New York, 1970
6. Advanced Control System- B.S.Manake,Khanna Publication

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M.Tech. Semester-III — Control System

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical/Viva	Practical Record/ Assignment/Quiz /Presentation	
1.	YMECS301	Elective I	3	1	-	4	70	20	10	-	-	100
2.	YMECS302	Elective II	3	1	-	4	70	20	10	-	-	100
3.	YMECS303	Seminar	-	-	4	4	-	-	-	-	100	100
4.	YMECS304	Dissertation Part- I (Literature Review/Problem Formulation/ Synopsis)	-	-	8	8	-	-	-	120	80	200
		Total	6	2	12	20	140	40	20	120	180	500

L:Lecture- T:Tutorial- P:Practical

Elective –I(YMECS301)

(A)AdvancedMicroprocessor

Elective-II (YMECS302)

A) Robotics

YMECS301 (A) Advanced Microprocessor

Unit 1
INTRODUCTION: MP overview, Data representation, addresses, operation.

Unit 2
8086 ARCHITECTURE: CPU, operation, ihstruction, formats and execution timing, addressing modes,. 8086. ALP Instructions arithmetic, branch, loop, NOP and HL T logic, shift and rotate, Directives and operations Assembly process.

Unit 3
MODULAR PROGRAMMING Linking and relocation, stacks, Procedures, Interrupts, Macros, program design, I/O PROGRAMMING Programmed I/O, Interrupt I/O, Block transfer and DMA. MULTI PROGRAMMING Process management, common procedure sharing, Memory management, virtual 0= memory and 80286.

Unit 4
I/O INTERFACE: Series and parallel communication interface, programmable timers and counters, DMA controllers

Unit 5
MULTIPROCESSOR CONFIGURATION 8086/8088 based multiprocessing systems, 8087 numeric data processor, 8089 I/O processor 80286/80287- TASKS Single level, multilevel, Multiple, Interrupt system, Interfacing

Unit 6
SINGLE CHIP MICROCOMPUTERS
Architecture of 8084/8078 pin out ALP, UPI (5)

BOOK RECOMMENDED:

1. Micro computer systems: The 8086/8088 family, second edition by Y C Liu and G A Gibson, PHI, 1986.
2. Digital Systems by S K Bose, Wiley Eastern, 1986.

YMECS302 (A) Robotics

Unit 1

Basic concepts in robotics, classification and structure of robotic systems, the manipulators. Drives and control systems, Kinetic analysis and coordinate transformation. The inverse kinematics problem, work space analysis and trajectory planning. Differential motion and statics, joint space singularities, the manipulator jacobian, Induced joint torques and forces.

Unit 2

MANIPULATOR DYNAMICS: Lagranges equation, kinetic and potential energy, Generalized force, Largrange-Euler dynamic model. Dynamic model of a two axis and three axis robot, Direct and inverse dynamics, Recursive Newton-Euler formulation, Dynamic model of a one axis Robot (Inverted Pendulum)

Unit 3

ROBOT CONTROL The control problem, state equations, constant solutions, Linear feedback systems, single axis PID control PD-gravity control, computed torque control, variable-structure control, Impedance control.

Unit 4

ROBOT VISION Image representation Template matching, Polyhedral objects shape analysis, segmentation, Iterative processing, perspective transformation structured Illumination.

Unit 5

TASK PLANNING Task-level programming, Uncertainty configuration space, Gross motion planning, Grasp planning Fine motion planning, simulation of planar motion, A Task-planning problem.

BOOK RECOMMENDED:

1. Fundamentals of Robotic Analysis and Control by: Robert J Schilling (Prentice-Hall of India, Pvt Ltd,) 1997 Edition
2. Robotics for Engineers by: Yoram-Koran, Mc Graw-Hill book company.

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M.Tech. Semester-IV — Control System

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical/ Viva	Practical Record/ Assignment/Quiz /Presentation	
1.	YMECS401	Dissertation Part- II	-	-	20	20	-	-	-	300	200	500
		Total	-	-	20	20	-	-	-	300	200	500

L:Lecture- T:Tutorial- P:Practical