DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING
B. Tech. - INSTRUMENTATION AND CONTROL ENGINEERING - FULL TIME

S.N0	Code No	Course Title	L	T	P	C
		SEMESTER III				
THEORY						
1.	BMA205	Mathematics III	3	1	0	4
2.	BEE201	Circuit theory	3	1	0	4
3.	BCS231	Object oriented programming	3	0	0	3
4.	BEC201	Solid state devices	3	0	0	3
5.	BEE213	Electrical machines	3	1	0	4
6.	BME231	Thermodynamics and Fluid Mechanics	3	0	0	3
PRACTICAL						
7.	BCS243	Object oriented programming Lab	0	0	3	2
8.	BCE281	Fluid Mechanics Lab	0	0	3	2
		TOTAL CREDITS=25				
		SEMESTER IV				
1.	BMA214	Probability and Statistics	3	1	0	4
2.	BEC202	Digital electronics	3	1	0	4
3.	BCS232	Data structures and Algorithms	3	0	0	3
4.	BEI204	Principles of communication	3	0	0	3
5.	BEE202	Network analysis and synthesis	3	0	0	3
6.	BEC204	Electronic circuits	3	0	0	3
PRACTICAL						
7.	BCS242	Data Structure Laboratory	0	0	3	2
8	BEE242	Electrical machines Laboratory	0	0	3	2
9	BEI202	Electronic circuits Lab	0	0	3	2
		TOTAL CREDITS=26				

S.N0	Code No	Course Title	L	T	P	C
		SEMESTER V				
THEORY						
1.	BEI301	Control engineering	3	0	0	3
2.	BEI303	Measurements and Instruments	3	0	0	3
3.	BEI305	Linear and Digital Integrated Circuits	3	0	0	3
4.	BEI307	Transducer engineering	3	0	0	3
5.	BIC301	Analytical instruments	3	0	0	3
6.	BEI313	Microprocessors and Micro controllers	3	1	0	4
PRACTICAL						
7.	BEI315	Microprocessor and Micro controller Laboratory	0	0	3	2
8.	BEI309	Linear and Digital Integrated Circuits Lab	0	0	3	2
9	BEI311	Transducer Lab	0	0	3	2
		TOTAL CREDITS=25				

- BEI313 is Equivalent to BEI306 of previous Batches

		SEMESTER VI				
THEORY						
1.	BMG332	Management concepts and organizational behavior	3	0	0	3
2.	BEI302	Digital signal processing	3	0	0	3
3.	BEI304	Digital system control	3	0	0	3
4.	BIC304	Process Control	3	0	0	3
5.	BIC308	Control system components	3	0	0	3
6.	BPRE14	Professional Ethics and Entrepreneurship development	3	0	0	3
PRACTICAL						
7.	BIC310	Measurement & Control lab	0	0	3	2
8.	BIC306	Process Control Laboratory	0	0	3	2
		TOTAL CREDITS=22				

* BIC304 is equivalent to BIC307 of previous batches
* BIC306 is equivalent to BIC309 of previous batches
* BIC310 is equivalent to BIC305 of previous batches

S.N0	Code No	Course Title	L	T	P	C
		SEMESTER VII				
THEORY						
1.	BIC411	Industrial Instrumentation I	3	0	0	3
2.	BIC413	Industrial Chemical Process	3	0	0	3
3.	BEI405	Computer networks & Distributed control systems	3	0	0	3
4.	BIC415	Data acquisition & Communication	3	0	0	3
5.	BICEXX	Elective-I	3	0	0	3
6.	BICEXX	Elective-II	3	0	0	3
PRACTICAL						
7	BIC405	Industrial instrumentation Lab	0	0	3	2
8	BEI409	Design Project Laboratory	0	0	3	3
			TOTAL CREDITS=23			

- BIC411 is equivalent to BIC302

		SEMESTER VIII				
THEORY						
1.	BIC412	Industrial Instrumentation II	3	0	0	3
2.	BICEXX	Elective III	3	0	0	3
3.	BICEXX	Elective IV	3	0	0	3
PRACTICAL						
1.	BEI404	Comprehension	0	0	3	3
2.	BEI406	Project Work	0	0	6	6
			TOTAL CREDITS=18			

*BIC412 is equivalent to BIC401 of previous batches

Total No. of credits to be earned for the award of degree – **180** credits

LIST OF ELECTIVES :

ODD SEMESTER

S.No	Code No.	Course Title	L	T	P	C
1	BEIE01	Artificial Intelligence and Expert Systems	**3**	**0**	**0**	**3**
2	BEIE03	Neural and Fuzzy Logic Control	**3**	**0**	**0**	**3**
3	BEIE05	Systems Theory	**3**	**0**	**0**	**3**
4	BICE01	Power Plant Instrumentation	**3**	**0**	**0**	**3**
5	BICE13	System Identification and Adaptive control				
6	BICE15	Modern Control Systems	**3**	**0**	**0**	**3**
7	BICE07	PC Based Instrumentation	**3**	**0**	**0**	**3**
8	BICE09	Digital Instrumentation	**3**	**0**	**0**	**3**
9	BICE17	Optimal Control System	**3**	**0**	**0**	**3**

BICE15 is equivalent of BICE06 of previous batches.
BICE17 is equivalent of BICE12 of previous batches.

EVEN SEMESTER

1	BEIE02	Mechatronics	**3**	**0**	**0**	**3**
2	BEIE04	Robotics and Automation	**3**	**0**	**0**	**3**
3	BICE02	Instrumentation in Petrol Chemical Industry	**3**	**0**	**0**	**3**
4	BICE04	Intelligent Controllers	**3**	**0**	**0**	**3**
5	BICE14	Fibre Optics and Laser Instruments	**3**	**0**	**0**	**3**
6	BICE08	Virtual Instrumentation	**3**	**0**	**0**	**3**
7	BICE10	Control System Design	**3**	**0**	**0**	**3**
8	BICE16	Nano Technology	**3**	**0**	**0**	**3**
9	BICE18	Bio-Medical Instrumentation	**3**	**0**	**0**	**3**

BICE14 is equivalent of BICE05 of previous batches.
BICE16 is equivalent of BICE11 of previous batches.
BICE18 is equivalent of BICE03 of previous batches.

BMA205 MATHEMATICS III 3 1 0 4

Laplace Transforms
Transforms of simple functions –properties – Transforms of derivatives and integrals – Initial and Final value theorems – Inverse transforms – Convolution theorem – Periodic functions – Applications - linear ordinary differential equations – Integral Equations.

Fourier series
Dirichlet's conditions- general fourier series- half range sine & cosine series- parsevals identity- complex form of fourier series – harmonic analysis

Fourier transforms
Statement of fourier integral theorem – fourier transform pairs – fourier sine & cosine transforms – properties – transforms of simple functions – convolution theorem - parsevals identity

Analytical Functions
Cauchy Riemann equations – Properties of analytical functions –determination of harmonic conjucates- milnes thompsons method - Conformal mappings – mappings $w=z+a$, az, $1/z$, z^2– Bilinear transformation.

Complex Integration
Cauchy's integral theorem – statement & applications of Cauchy's 0 integral theorem – Taylor's and Laurent's series – singularities - Residues, Cauchy's residue theorem – Contour Integration around the circle and semi-circular.

Text Books:

1. P.Kandaswamy, K.Thilakavathy and K. Gunavathy, Engineering Mathematics Vol I & II S. -Chand & Co Publishers – (1998).
2. B.S. Grewal, Higher Engineering Mathematics (35th Edn.)- Khanna Publishers Delhi (2000).
3. E. Kreyszig, Advanced Engineering Mathematics (8th Edn.),-
4. John Wiley and Sons (Asia) Pnt. Ltd., Singapore (2001).

Reference:

1. S.Narayanan, T.K. Manikavachagam Pillai, and G.Ramanaiah, Advanced Mathematics for Engineering Students – Vol I (2nd Edn.) S. Viswanathan (printers and publishers) (1992).
2. M.K.Venkatraman, Engineering Mathematics – III year- National Publishing Company, Chennai (2nd Edn.),(2000).
3. R.V.Churchill complex variables & applications MC Graw Hill Books & Co., New Delhi (2003)
4. M.R Speigel Laplace transform Schaum's outline series MC Graw Hill Books & Co., New Delhi (2003)

BEE201 CIRCUIT THEORY 3 1 0 4

BASIC CIRCUIT CONCEPTS
V-I relationships of R, L and C – independent sources – dependent sources – Kirchhoff's Laws - simple resistive circuits – network reduction – voltage division – current division – source transformation.

AC FUNDAMENTALS
AC quantity, Phasor representation – analysis of simple series and parallel circuits – power and power factor – Analysis mesh current and node voltage methods – series resonance and parallel resonance

NETWORK THEOREMS AND APPLICATIONS
Superposition theorem – Thevenin's theorem – Norton's theorem - Maximum power transfer theorem - Reciprocity theorem – Compensation theorem – Substitution theorem - Millman's theorem and Tellegen's theorem with applications.

THREE PHASE CIRCUITS
Three phase systems - phase sequence – solution of three phase balanced circuits – solution of three phase unbalanced circuits – power measurement and two Watt meter method

COUPLED CIRCUITS
Mutual inductance – coefficient of coupling – ideal transformer – analysis of multi winding couple circuits – single & double tuned circuits – critical coupling.

TEXT BOOK

1.Sudhakar, A. and Shyam Mohan S.P. "Circuits and Network Analysis and Synthesis", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 94.

REFERENCES

1. Hyatt, W.H. Jr and Kimmerly, J.E., 'Engineering Circuits Analysis', McGrawHill International Editions, 1993.
2. Edminister, J.A., 'Theory and Problems of Electric Circuits', Schaum's outline series McGraw Hill Book Company, 2nd Edition, 1983.
3. Paranjothi S.R., 'Electric Circuit Analysis', New Age International Ltd., Delhi, 2nd Edition, 2000.

BCS231 OBJECT ORIENTED PROGRAMMING 3 0 0 3

INTRODUCTION
Programming methodologies-Comparison-Object Oriented concepts-Basics of C++ environment.

CLASSES
Definition-Data members-Function members-Access specifiers-Constructors-Default constructors-Copy constructors-Destructors-Static members-This pointer-Constant members-Free store operators-Control statements

INHERITANCE AND POLYMORPHISM
Overloading operators-Functions-Friends-Class derivation-Virtual functions-Abstract base classes-Multiple inheritance. Microsoft Foundation Class Libraries

TEMPLATES
Class templates-Function templates-Exception handling-Streams.

JAVA PROGRAMMING
Java environment-Classes-Definition-Fields-Methods-Object creation-Constructors-Overloading methods-Static members-This keyword-Nested classes-Extending classes-Inheritance-member accessibility-Overriding methods-Abstract classes-Interfaces.

Text Books:
1. Stanley B.Lippman, "The C++ Primer" Pearson Education,3rd edition 2000.
2. H.M.Deitel and P.E.Deitel, "Java How to Program", Pearson Education, 5th edition 2003.

References:
1. Deitel and Deitel, "C++ How to Program" Pearson Education, 4th edition 2000.
2. N.Barkakati, "Object Oriented Programming in C++", Prentice Hall of India Pvt.Ltd, 1997.
3. Ken Arnold and James Gosling, "The Java Programming Language with updated 1.3", Pearson Education *2000.*

BEC201	**SOLID STATE DEVICES**	**3**	**0**	**0**	**3**

UNIT – 1
Drift velocity of electrons in applied electric field. – Mobility and conductivity – charge densities in a semiconductor – generation and recombination of charges – Drift and Diffusion current – continuity equation – injected minority carrier concentration - Potential variation within a Graded semiconductor

UNIT – 2
Theory of PN junction diode – VI characteristics – static and dynamic resistance – effect of temperature on diodes – space charge and diffusion capacitance - zener diode – avalanche and zener break down mechanisms – Zener diode as a voltage regulator

UNIT – 3
Principles of transistor action – current components – cut off, Active & saturation region – I/P & O/P characteristics CE, CB and CC. Small signal large signal 'β', Break down & Switching characteristics – Transistor biasing – bias stabilization – bias compensation – Thermal runaway – Design with Heat sink.

UNIT – 4
Construction feature & Working principles of JFET, MOSFET Depletion and Enhancement mode, Biasing of FET, and MOSFETS.

UNIT – 5
Small signal mode of transistor- Analysis of Amplifiers using small signal model. Common Emitter, Common Base, Common Collector, Common source, Common Drain, Common Gate, multistage amplifiers.

Text Book:
1. Boylestad, Robert. L and Nashelsky Louis – Electronic Devices and Circuit theory" Prentice Hall of India,6th Edition, 2001
2. William & Harris, Electronic Devices and Circuits Tata McGraw Hill International Editions, 2000
3. Millman Halkias, "Electron Devices", Tata McGraw Hill , 2000
4. David A.Bell, " Electron Devices and Circuits", Prentice Hall of India, 2003

BEE213	**ELECTRICAL MACHINES**	**3**	**1**	**0**	**4**

D.C. MACHINES
Constructional details-EMF and Torque-Circuit model-Methods of Excitation-Characteristics of Generators- Characteristics of motors-Starting and speed control methods-Testing and Efficiency-Losses in D.C machines-Applications

TRANSFORMER
Constructional details-Principle of operation-EMF equation-Equivalent circuit-Losses and efficiency-Voltage regulation-Auto transformers-Three phase transformers-Constructional details-Types of connections.

INDUCTION MOTORS
Constructional details-types-Principle of operation-Torque equation-Equivalent circuit-Characteristics-Performance calculations-Starting methods-Speed control methods.

SYNCHRONOUS MACHINES
Construction of synchronous machines-Classification-Induced EMF equation-Voltage regulation-EMF method-Parallel operation-Synchronous motor-Principle of operation-Methods of starting-Hunting-Effect of change of excitation of a synchronous motor.

SINGLE PHASE INDUCTION MOTORS& MACHINES
Single phase induction motors-Construction &Principle of working-Types-Universal motor-Reluctance motor-Stepper motor-Two phase servo motor-Tachogenerator-Linear induction motor (Qualitative Treatment)

Text Book:
1. S.K.Bhattacharya,"Electrical Machines", Tata McGraw Hill Publications, 2nd Edition 1998.

References:
a. I.J.Nagrath &D.P Kothari,"Electrical Machines", Tata McGraw Hill Publications, 2nd Edition 1997.
b. Nasar S.A."Electrical Machines & Power systems", TMH Publications
c. Hyghes "Electrical Technology", Revised by I. McKenzie Smith, Low price Edition, Pearson Education,7th Edition.
d. Irving L.Kosow,"Electrical Machinery and Transformers", PHI 2nd Edition, 2001.

BME231 THERMODYNAMICS AND FLUID MECHANICS 3 0 0 3

LAWS OF THERMODYNAMICS
Systems zeroth law, first law of thermodynamics – concept of internal energy and enthalpy applications to closed and open systems – second law of thermodynamics – concept of entropy – clausius inequality and principles of increase in irreversible processes.

BASIC THERMODYNAMICS APPLIED
Basic IC engine and gas turbine cycles single and multistage reciprocating compressors.

THERMODYNAMICS OF REFRIGERATORS AND PUMPS
Properties of steam – Ranking cycle – one dimensional flow through nozzles and applications to jet and rocket propulsion – basic thermodynamics of refrigerators and heat pumps.

BASIC CONCEPT OF FLUID MECHANICS
Introduction – classification – types of fluids – properties – laws of pressure – atmospheric, gauge, absolute pressure, pressure measurement – manometers – mechanical gauges.

FLOW OF FLUIDS
Introduction – types of fluid flow – velocity – rate equation of continuity – energy of a liquid in motion – head of a liquid – Bernoulli's theorem – orifice and mouthpiece.

DIMENSIONAL AND MODEL ANALYSIS
Introduction – dimensions – dimensional analyses – Rayleigh's and Buckingham's method û similitude - dimensionless numbers and their significance – similarity laws – model studies.

PUMPS AND TURBINES
Introduction – types of pumps – reciprocating pump – construction details – co-efficient of discharge – slip – power required – centrifugal pump – classification – working principle – specific speed – turbine – classification – working principle.

REFERENCES

1. Shames, I.H., 'Mechanics of fluids', Kogakusha, Tokyo, 1998.
2. Kumar, K.L., 'Fluid Mechanics', Eurasia publishers, 1990
3. Radhakrishnan, E., 'Introduction to fluid Mechanics', Prentice Hall, India 1999.
4. Rajput R.K., 'Fluid Mechanics and Hydraulic Machines', S.Chand and Co., India 1998.
5. Nag, P.K., Engineering Thermodynamics, Tata McGraw Hill Co. Ltd., 1993.
6. Reynolds, Thermodynamics, Int. Student Edition, McGraw Hill Co. Ltd., 1990.

BCS243 OBJECT ORIENTED PROGRAMMING LAB 0 0 3 2

1. Simple C++ programs using control structures.
2. Functions.
3. Class and objects : constructors and destructors
4. Unary operator overloading
5. Arithmetic operator overloading
6. Comparison operator overloading
7. Function overloading
8. Inheritance
9. Virtual function
10. Friend function
11. Templates
12. Exception handling

BCE281 FLUID MECHANICS LAB 0 0 3 2

1. Measurement of flow using orificemeter.
2. Measurement of flow using Venturimeter.
3. Measurement of flow using flow through pipes.
4. Measurement of flow using Flow meter.
5. Performance test on Reciprocating pump.
6. Performance test on Centrifugal pump.
7. Performance test on Gear pump.
8. Performance test on Pelton wheel.
9. Performance test on Francis turbine.
10. Study of Meta Centric Height.
11. Discharge Through Notch.
12. Discharge through Weir.

IV SEMESTER

BMA214 PROBABILITY AND STATISTICS 3 1 0 4

UNIT-1.
Measures of dispersion – the range - quartile deviation standard deviation – relative measures of dispersion – coefficient of variation- quartile coefficient of variation – moments – measures of skewness & kurtosis- correlation & regression

UNIT II
Probability concepts – baye's theorem – random variables- moments – moment generating functions – chebyshev's inequality - functions of random variables – marginal and conditional distributions

UNIT III
Binomial, poisson, geometric, nagative binomial, exponential, gamma, weibull – normal distributions – central limit theorem

UNIT IV
Tests of significance – large sample tests- mean – proportions – small sample tests – t, F, Chi – square tests – independence of attributes – goodness of fit

UNIT V
Analysis of variance – one way, two way classifications – design of experiments – completely randomized block design - randomized block design – latin square design

Text Books
1. Gupta.S.C & kapoor V.K "Fundamentals of Mathematical statistics" All India, All Courses , Sultan Chand & Co., New Delhi (2003)
2. Gupta.S.C & kapoor V.K "Fundamentals of applied statistics" All India, All Courses , Sultan Chand & Co., New Delhi (2003)

Reference books
1. Kapoor, J.N. Saxena, II.C "mathematical statistics", Sultan Chand & Co., New Delhi (2003)
2. Probability & statistics (2003) , schaum series

BEC202 DIGITAL ELECTRONICS 3 1 0 4

NUMBER SYSTEMS: -
Review of binary, octal and hexadecimal number systems – conversions; Binary Arithmetic – signed magnitude form – 1's, 2's complement representation. Codes: - BCD, Excess-3, Greycodes, ASCII Codes, Error detecting codes (Hamming code)

BOOLEAN ALGEBRA
Boolean algebra – De Morgan's law - Simplifications of Boolean expression – Sum of products and product of sums – Karnaugh Map – Quince McClusky method of simplification (Including Don't care conditions)

COMBINATIONAL LOGIC:
Logic gates – AND, OR, NOT, NOR, NAND and EX-OR – combinational logic- Arithmetic circuits – Half adder – Full adder, Half Subtractor - Decimal Adder – Excess 3 adder – Code converters – Multiplexer – Demultiplexer- Encoder – decoder – Design of any general combinational logic circuit.

SEQUENTIAL LOGIC DESIGN
Building blocks of sequential logic-RS, JK, Master-Slave, D and T flip-flop, Asynchronous and synchronous counters - Binary and BCD counters - Shift registers – Design and implementation of synchronous sequential circuits

LOGIC FAMILIES
Characteristics of RTL, DTL, TTL, families – Schottky, clamped TTL, ECL, IIL – Mos Inverters – complementary Mos inverters

Text Books:
1. ALBERT PAUL, MALVINO AND DONALD P LEACH: Digital principles and Applications. Mc Graw Hill publications.
2. FLOYD: Digital Fundamentals, Universal Book Stall, New Delhi.1993
3. Moris Mano, ' Digital Electronics and Design', Prentice Hall of India, 2000

BCS232 DATA STRUCTURES AND ALGORITHMS 3 0 0 3

LINEAR DATA STRUCTURES
Stacks, Queues & Lists Implementation and Applications. Singly linked list-Doubly linked lists.

NONLINEAR DATA STRUCTURES
Trees – Binary Trees – Binary Search Tree – Tree Traversals – AVL Trees

ALGORITHM ANALYSIS
Sorting and searching –space complexity-time complexity-Big Oh-Binary Searching-analysis-Quick sort-Heap sort-Merge sort-Analysis

GRAPH ALGORITHMS
Graph operations-DFS-BFS-Minimum cost spanning tree-Krushkal's algorithm-Prim's Algorithm

ALGORITHM DESIGN METHODS
Greedy method – Shortest path – Divide and Conquer –Matrix multiplication-Dynamic programming-Back tracking –Traveling Sales person problem.

TEXT BOOK:
1. E.Horowitz,S.Sahani & S.Rajasekharan, "Computer Algorithms", Galgotia 1999

REFERENCES:
1. Weiss Mark Allen , "Data Structures and Algorithm Analysis in C", Pearson Education, 2/e 1997
2. E. Horowitz, S. Sahani & Mehta," Fundamentals of Data Structures in C++", Galgotia 1999
3. SaraBaase & Allen Van Gelder, "Computer Algorithms" Galgotia 2000 Bhagat singh ,Thomas L. Naps, " Introduction to Data structures" BPB Publications

BEI204 PRINCIPLES OF COMMUNICATION 3 0 0 3

Radio Communication Systems:
Frequency Spectrum – Principle of AM and FM – AM and FM transmitters and receivers – introduction to microwave communication systems – Principles of Satellite communication.

Pulse Communication Systems:
PAM, PPM, PDM, PCM – Delta Modulation – Differential PCM – Merit and demerits – comparison of pulse modulation schemes

Data Transmission
Base Band Signal Receiver – error probability – optimum and matched filter techniques. Coherent Reception – Digital modulations systems – FSK, PSK – comparison of Data Transmission Systems.

Transmission Medium
Characteristics of cables – optical fibers – Effects of EM Radiation – Bandwidth and Noise Restrictions – Statistical measurements of Random Noise – Concept of Multiplexing FDM and TDM.

Television
Scanning methods - B/W and colour systems – camera and picture tubes – synchronization – Transmitters and Receivers.

Text Books:

1. Kennedy, Electronic Communication systems 1987 Mc Graw Hill.
2. Simon Haykins, Communication Systems 1995 Wiley
3. Roddy and Coolen, Electronic Communication 1999, PHI

BEE202 NETWORK ANALYSIS AND SYNTHESIS 3 0 0 3

TRANSIENT ANALYSIS
Forced and free response of RL, RC and RLC circuits with D.C. and sinusoidal excitations.

TWO PORT NETWORKS
Characterization of two port networks in terms of Z, Y, H and T parameters – networks equivalents – relations between network parameters – Analysis of T, Ladder, Bridged–T and lattice networks – transfer function of terminated two port networks.

NETWORK TOPOLOGY
Network graphs, tree and cut – sets – tie set and cut – set schedules – primitive impedance and admittance matrices – Application to network solutions.

S-DOMAIN ANALYSIS & NETWORK SYNTHESIS
S - domain network – driving point and transfer impedances and their properties – transform network analysis – poles and zeros of network functions – time domain response of pole-zero plot. Realizability of one port network – Hurwitz polynomials and properties – Positive Real functions and properties – synthesis of RL, RC and LC one port networks.

FILTERS & ATTENUATORS
Classification of Filters - filter networks - design of constant K, m–derived and composite filters. Analysis of T, π, lattice, bridged-T, and L type attenuators.

TEXT BOOK:

1. Kuo F.F., "Network Analysis and Synthesis", Wiley International Edition, Second Edition, 1966.

REFERENCES:

1. Van Valkenburg, M.E., 'Network Analysis', Prentice – Hall of India Private Ltd., New Delhi, Third Edition ,1974.
2. Sudhakar. A., and Shyammohan, "Circuits and Networks Analysis and Synthesis" Tata McGraw Hill Publishing Co.Ltd. New Delhi, 1994
3. Roy Choudhury, "Networks and Systems", New Age International Ltd.

BEC204 ELECTRONIC CIRCUITS 3 0 0 3

RECTIFIER & POWER SUPPLY
Half & Full wave rectifies – filters – shunt, inductor, LC section & Ripple factor, π Calculation for C, L and LC filters – Voltage regulators – Zener – Series voltage regulator - SMPS

AMPLIFIERS
Amplifiers – Frequency response of RC coupled amplifiers – Frequency Response of Emitter follower, gain band width product – FET - amplifier at low and high frequency cascaded amplifiers

FEED BACK AMPLIFIER & OSCILLATORS
Four basic type of Feedback – effect of feed back on amplifier performance – condition for oscillation Barkhunsen criteria – LC oscillators – Hart ley & Colpitts – RC oscillators – Wein bridge, RC phase shift Crystal Oscillator.

MULTIIVIBRATORS
Collector coupled & Emitter coupled Astable multivibrator, – mono stable, Bistable multivibrator - triggering methods – storage delay and Calculation of switching time - Schmitt trigger circuits, Speed up Capacitor in switching

POWER AMPLIFIER
Classification – Class A, B, C & AB, Class B-push pull – Class B Complimentary, - Symmetry, Class S, Power sections classifications, Efficiency, distortion in amplifiers

TEXT BOOK;

1. David. A. Bell Solid state Pulse Circuits Prentice Hall India,4th Edition, 2000.
2. Millman Taub H Pulse Digital & Switching waveform - Tata McGraw Hill International, 2001
3. Integrated Electronics – Jacob Millman, Cristas C. Halkias – Tata McGraw Hill., Edition 1991.

BEE242	**ELECTRICAL MACHINES LABORATORY**	**0**	**0**	**3**	**2**

1. Verification of network theorems.
1. Determination of coupling coefficient.
2. Series and parallel resonance.
3. Power measurement in single phase and three phase circuits.
4. Open circuit characteristics of DC generators.
5. Load characteristic of DC motors.
6. Speed control of DC motors
7. Brake test of DC motors.
8. Regulation of three-phase alternator.
9. Open circuit and short circuits of transformer.
10. Brake test of induction motors.
11. V-curve of synchronous motor.

BCS242	**DATA STRUCTURE LABORATORY**	**0**	**0**	**3**	**2**

1. Implementation Of Arrays (Single and Multi dimensional)
2. Implementation Of Stack, Queue, Circular Queue (Using Arrays And Pointers)
3. Single Linked List
4. Circular Linked List
5. Doubly Linked List
6. General Lists
7. Evaluation Of Expressions
8. Binary Tree Implementations And Traversals
9. Binary Search Trees
10. Inorder Threaded Binary Trees
11. Quick Sort And Heap Sort
12. AVL Tree – Insertion

BEI202	**ELECTRONIC CIRCUITS LAB**	**0**	**0**	**3**	**2**

1. Rectifier – FWR.
2. Frequency Response of CE amplifier with self-bias.
3. Class B Push Pull Amplifier - Efficiency Determination.
4. Hartley and Colpitt Oscillators
5. R- C Phase Shift Oscillator.
6. Monostable and Astable Multivibrators.
7. FET Amplifier.
8. Schmitt Trigger.
9. Feedback Amplifier.
10. Voltage Regulator.

SEMESTER V

BEI301	**CONTROL ENGINEERING**	**3**	**0**	**0**	**3**

1. SYSTEMS AND THEIR REPRESENTATION

Basic elements in control systems-open and closed loop systems – electrical analogy of physical systems – transfer function – AC and DC servomotors – block diagram reduction techniques – signal flow graph.

2. TIME RESPONSE

Time response – time domain specifications – types of test inputs – I and II order system response – error coefficients – generalised error series – steady state error – PID controller response with and without I order system.

3. FREQUENCY RESPONSE

Frequency response – definition – Bode plot – polar plot – constant M and N circles – Nichols chart – determinate of closed loop response from open loop response.

4. STABILITY OF CONTROL SYSTEM

Characteristic equation – location of roots in s-plane for stability – Routh Hurwitz criterion – root locus techniques – construction – gain margin and phase margin – Nyquist stability criterion.

5. CONTROL SYSTEM DESIGN

Performance criteria – selection of controller modes – lag, lead, and lag-lead networks – compensator design for desired response.

TEXT BOOKS

1. Ogata K., Modern Control Engineering, Prentice Hall of India Ltd., New Delhi, 1995.
2. I.Gopal, and M.Nagrath, Control Systems, Wiley Eastern, Ltd., New Delhi, 1985

REFERENCES

1. Kuo B.C., Automatic Control Systems, Prentice Hall of India Ltd., New Delhi, 1995.
2. M.Gopal, Control Systems, Principles and Design, Tata McGraw-Hill Publishing Co., New Delhi, 1997.

BEI303 MEASUREMENTS AND INSTRUMENTS 3 0 0 3

DIFFERENT TYPES OF AMMETERS AND VOLTMETERS

Galvanometers – principle of operation, construction and sources of errors and compensation in PMMC & moving iron instruments – dynamometer and rectifier type ammeter and voltmeters.

WATTMETERS AND ENERGY METERS

Electrodynamic type wattmeter – theory and its errors – methods of correction – LPF wattmeter – phantom loading – induction type Kwh meter – theory and adjustments – calibration of wattmeters and energy meters.

ANALOG INSTRUMENTS

Cathode ray oscilloscope – general purpose and advanced types – sampling and storage scopes – A.C. millivoltmeters of different types – wave analysers – signal and function generators – noise generator – frequency synthesizer – distortion factor meter – Q meter – lock-in amplifier – Instrumentation amplifier – Programmable gain amplifier.

DIGITAL INSTRUMENTS

Digital voltmeters and multimeters – successive approximation and dual slope types of ADC – digital frequency counters – digital waveform generator – μp based DMM's with auto ranging and self diagnostic features – digital storage oscilloscopes – digital Q meter – digital IC tester – digital LCR meter.

DIGITAL DISPLAY AND RECORDING DEVICES

Bar graph display – seven segment and dot matrix displays – signal recorders – X-Y recorders – magnetic tape recorders – digital recording and data loggers

TEXT BOOKS

1. Cooper W.D., Electronic Instrumentation and measurement techniques, Prentice Hall of India, New Delhi, 1981.
2. Bouwens A.J., Digital Instrumentation, McGraw Hill Ltd., USA, 1992.
3. Sawhney A.K., A Course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai and Sons, New Delhi, 1995.

REFERENCES

1. Rangan, C.S., Sarma G.R. and Mani V.S.V., instrumentation devices and systems, Tata McGraw Hill, New Delhi.
2. Byers T.J., Electronic test Equipment: Principle and applications, McGraw Hill, USA 1987.
3. Oliver B.H., and Cage J.M., Electronics Measurements and Instrumentation, McGraw Hill, 1992.
4. Stout M.B. Basic Electrical measurements, Prentice Hall of India, New Delhi, 1990.
5. Golding E.W. and Widdis F.E., Electrical measurements and measuring instruments, Sir Issac Pitman and Sons Pvt., Ltd., 1985.

BEI305 LINEAR AND DIGITAL INTEGRATED CIRCUITS 3 0 0 3

FABRICATION OF INTEGRATED CIRCUITS

Crystal – growth – water preparation – epitoxy – vapour – phase, molecular – beam oxidation – oxide properties – induced defects – lithography – optical, reactive plasma etching and feature size control – models of diffusion in solids, in SiO_2 - diffusion enhancements and retardation – ion implementation – metallisation – packing – realisation of passive and active devices like, R, C, diodes, transistors in IC's.

LINEAR INTEGRATED CIRCUITS

Introduction to Linear IC – operational amplifiers – characteristics – application of op amp – arithmetic circuits, amplifier, rectifiers, op amp circuits using diodes – I, II order filters, waveform generators, using op amps – square, triangular and sine wave generation. Basic functional internal block diagram, characteristics and applications of following ICs: 555, 565, 566 LM 723 voltage regulator and current regulators.

DIGITAL INTEGRATED CIRCUITS

Designing combinational logic gates in CMOS – very high performance – Design of sequential logic circuits – arithmetic building blocks – design of memory and array structures

VLSI INTEGRATED CIRCUITS

Fundamental consideration – NMOS, CMOS, Bipolar IC technology – IC fabrication - assembly technique and packaging of VLSI devices – reliability requirements for VLSI – failure mechanisms and rates – future trends.

SPECIAL APPLICATION IC's

Functional Block diagram of ADC and DAC – Integrating ADC – Sigma Delta ADC – Study of successive approximation ADC MC0809 – Study of Integrating ADC ICL 7107 – Study of Sigma Delta ADC Ad7714 – Study of 8 bit DAC0800 – Waveform Generation, V/F Conversion and FSK Generation using IC XR2206 – Serial port Driver Max 232 – Temperature Transducer AD590

TEXT BOOKS

1. Ramakant A, Gayakwad, OP-Amps and Linear Integrated Circuits 'Prentice Hall of India, New Delhi, 3rd Edition, 1997.
2. Roy Choudhury and Shail Jain, 'Linear Integrated Circuits', 1995.

REFERENCES

1. S.M.Sze, 'VLSI Technology', 2nd Edition, Tata McGraw-Hill Publishing Co., New Delhi, 1996.
2. Sergio Franco, 'Design with Operational Amplifiers and Analog and Integrated Circuits', 2nd Edition Tata McGraw Hill Publishing Co., New Delhi, 1997.
3. R.A.Gay Kwad, 'Opamplifiers and Linear Integrated Circuits', Prentice Hall of India, New Delhi, 1995.
4. National Semiconductor/Texas – TTL/MOS/VLSI Data Manuals.
5. Franco, S.'Design with operational and analog Integrated Circuits', Tata McGraw Hill Publishing Co., New Delhi, 1998
6. ADC0809 DATASHEET - www.learn-c.com/adc0809.pdf
7. DAC0800 DATASHEET - www.hallbeng.jlab.org/datasheets/DAC0800.pdf
8. ICL7107 DATASHEET - www.fe.up.pt/~victorm/IC_Diversos.htm
9. AD7714 DATASHEET - www.analog.com/products Selection/pdf/AD7714_c.pdf
10. SIGMADELTA ADC - http://www.hitequest.com/Kiss/DeltaSigma.htm; http://www.astro-med.com/knowledge/adc.html http://www.ee.duke.edu/~ha/HimanshuArthur.pdf
11. XR2206 DATASHEETS - http://www.exar.com/products/XR2206.html; http://www.exar.com/products/XR2206v103.pdf
12. MAX232 DRIVER DATASHEETS - http://www.maxim-ic.com/quick_view2.cfm/qv_pk/1798; http://www.pulsdetektor.de/datenblatt/max232.pdf
13. AD590 TRANSDUCER DATASHEET - http://www.omega.com/Temperature/pdf/AD590.pdf ; http://www.iweil.com/devices/converters/ad590.pdf

BEI307 TRANSDUCER ENGINEERING 3 0 0 3

SCIENCE OF MEASUREMENT

Units and standards – calibration methods – static calibration – classification of errors – error analysis – statistical methods – odds and uncertainty.

CHARACTERISTICS OF TRANSDUCERS

Static characteristics – accuracy, precision, sensitivity, linearity etc. – mathematical model of transducers – zero, first-order and second-order transducers – response to impulse, step, ramp and sinusoidal inputs.

VARIABLE RESISTANCE TRANSDUCERS

Principle of operation, construction details, characteristics and applications of resistance potentiometers, strain gauges, resistance thermometers, thermistors, hot-wire anemometer, piezoresistive sensors and humidity sensors.

VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS

Induction potentiometer – variable reluctance transducers – EI pick up – LVDT – capacitive transducers – variable air gap type – variable area type – variable permittivity type – capacitor microphone.

OTHER TRANSDUCERS

Piezoelectric transducer – magnetostrictive transducer – IC sensor – digital transducers – smart sensor – fiber optic transducers.

REFERENCES

1. Neubert, H.K.P. Instrument Transducers, Clarenden Press, Oxford, 1988.
2. Doebelin, E.O., Measurement Systems, McGraw-Hill Book Co., 1998.
3. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997.
4. Murthy, D.V.s., Transducers and Instrumentation, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
5. Renganathan, S., Transducer Engineering, Allied Publishers, Chennai, 1999.

BIC301 ANALYTICAL INSTRUMENTS 3 0 0 3

pH CONDUCTIVITY & DISSOLVED COMPONENT ANALYSER

Sampling systems – ion selective electrodes – conductivity meters – pH meters – dissolved oxygen analyser – sodium analyser – silica analyser – moisture measurement.

GAS ANALYSER

Oxygen analyser – CO monitor – NO_2 analyser –H_2S analyser – dust and smoke measurement – thermal conductivity type – thermal analyser – industrial analysers.

CHROMATOGRAPHY

Gas chromatography – Liquid chromatography – Principles, types and applications – high pressure liquid chromatography – detectors

SPECTRO PHOTOMETERS

Spectral methods of analysis – Beer's Law û UV – Visible spectrophotometers – single beam and double beam instruments – sources and detectors – IR spectrophotometers – sources and detectors – FTIR spectrometers – atomic absorption spectrophotometers – flame emission spectrophotometers – sources of flame photometry – applications.

NUCLEAR MAGNETIC RESONANCE AND RADIATION TECHNIQUES

NMR – basic principle – NMR spectrometers – applications – introduction to mass spectrophotometers – nuclear radiation detectors – GM counter – proportional counter – solid state detectors – introduction to x- ray spectroscopy

TEXT BOOKS

1. Willard, H.H., Merrit L.L., Dean J.A Seattle F.L., 'Instrumental Methods of Analysis', CBS Publishing and Distribution, 1995
2. Robert D.Braun, Introduction to Instrumental Analysis, McGraw–Hill, Singapore, 1987.

REFERENCES

1. Skoog, D.A. and West D.M., Principles of Instrumental Analysis, Holt Sounder Publication, Philadelphia, 1985
2. Ewing G.W., Instrumental Methods of Analysis', McGraw-Hill, 1992
3. Mann C.K. Vickers, T.J. and Guillick W.H Instrumental Analysis, Harper and Row Publishers, New York, 1974.
4. Liptak, B.G, Process Measurement and Analysis, Chilton Book Company, 1995
5. Frank A.Settle, Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, New Jersey, 1997

BEI313 MICROPROCESSORS AND MICRO CONTROLLERS 3 1 0 4

ARCHITECTURE

General 8-bit microprocessor and its architecture – 8085 functional block diagram – architecture functions of different sections – architecture of 8086 CPU.

INSTRUCTION SETS

Instruction format-addressing addressing modes – instruction set of 8085 CPU – instruction cycle – timing diagrams – different machine cycles – fetch and execute operations – estimation of execution time.

ASSEMBLY LANGUAGE PROGRAMMING

Assembly format of 8085 – assembly directions – multiple precision arithmetic operations – binary to BCD and BCD to binary code conversion – ALU programming using look up table – stack and subroutines

DATA TRANSFER AND INTERFACING

Data transfer schemes – program I/O û interrupt structure of 8085 – interrupt driven I/O – DMA serial I/O – input/output ports – latches and buffers – peripheral interface IC's – 8212, 8255, 8251, 8279, 8259 – interfacing of A/D and D/A converters – RAM and ROM – memory devices – display devices – applications.

MICROCONTROLLERS

Architecture of 8-bit micro controller (8051) – bus configuration – reset circuitry – power down considerations – instruction sets - programming exercises and micro controllers software design - development and troubleshooting tools – applications.

TEXT BOOKS

1. Gaonkar R.S., Microprocessor architecture Programming and application, Wiley Eastern Ltd., New Delhi, 1995.
2. Kenneth Hint, and Daniel Tabak, Microcontrollers, Architecture, Implementation and Programming, McGraw Hill International, USA, 1992.

REFERENCES

1. Mathur A.P., Introduction of Microprocessors, Tata McGraw-Hill Publishing Co.Ltd., New Delhi, 1989.
2. John B.Peatman, Design with Microcontrollers, McGraw Hill International, USA, 1988.
3. Kenneth J.Aylal, The 8051 Microcontroller, Architecture and Programming applications.

BEI309 LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB 0 0 3 2

1. Study of TTL IC's pin details
2. Study of R-S, J-K flip flops, IC 555, IC 741
3. Minimization of Boolean functions, Truth functions, Truth table realisations
4. Code converters
5. Shift registers and counters.
6. Encoders, Decoders, Multiplexers and Demultiplexers
7. Memory Devices (Read and Write)
8. A/D and D/A converters in analog and digital
9. Application Circuits of OP-Amp.
10. Application circuits of Ne 555.
11. Study of PLL
12. Arithmetic Logic Unit.

BEI315 MICROPROCESSOR AND MICRO CONTROLLER LABORATORY 0 0 3 2

1. Familiarisation of 8085 microprocessor kit
2. Familiarisation of 8051 microcontroller kit
3. 8085 and 8051 assembly language programming exercises
4. Interfacing of switches and display devices
5. Interfacing of D/A and A/D converters
6. Interface of key board and display using programmable controllers
7. Interface of programmable timer
8. Stepper motor control using microprocessor
9. Simple 8086 assembly language programming exercises
10. Study of MASM and DEBUG utilities

BEI311 TRANSDUCER LAB 0 0 3 2

1. Displacement versus output voltage characteristics of a potentiometric transducer.
2. Strain gauge characteristics.
3. Load cell characteristics.
4. Photoelectric tachometer.
5. Hall effect transducer.
6. Characteristics of LVDT.
7. Characteristic of LDR, thermistor and thermocouple.
8. Ramp response characteristic of filled in system thermometer.

9. Step response characteristic of RTD and thermocouple.
10. Flapper nozzle system.
11. P/I and I/P converters.
12. Study of smart transducers.

SEMESTER VI

BMG332 MANAGEMENT CONCEPTS AND ORGANIZATIONAL BEHAVIOR 3 0 0 3

Objectives

This course is aimed at addressing the contemporary issues, which fall under the broad title of management, and its functions. In addition, there will also be an attempt to analyze the behavior of individuals within an organization and the issues of working with other groups or teams.

Contents:

1. Management – definition, evolution, MBO
2. Management functions- Planning, Organizing, Leading, Motivating, Control and Operations / Marketing / Finance / HR
3. Organizing and managing HR and communicating
4. Motivating and leading
5. Behavior of an individual in an organization – attitude, value, job satisfaction, personality, perception, concepts of learning, motivation - theories and application
6. Group behavior – structure process, decision making, work team – different from group - leadership, communication – theories
7. Power and politics, organizational culture
8. Organization work culture, and work design
9. HR policies and practices
10. Managing the future - new worker/new manager/new organization etc.

Text Books:

1. Stephen P. Robbins, Organisational Behaviour, PHI, IX Edition, 2001
2. Koontz O' Dannel, Principles of Management – Mc Graw Hill Publishing Co. Ltd
3. Petert Drucker, The Practice of Management – Allied Publications
4. L.M. Prasad, Management Principles, Sultan Chand & Sons

Reference Books:

1. Stephen P. Robbins and David A. Decenzo, Fundamentals of Management, Pearson Education, III Edition, 2001
2. Koontz, Essentials of Management, Tata McGraw Hill, V Edition, 2001
3. Gupta .C.B, Management Theory and Practice, Sultan Chand &Sons
4. Steward Black & Lyman W. Porter, Management –Meeting new challenges, Prentice- Hall, 2001

BEI302 DIGITAL SIGNAL PROCESSING 3 0 0 3

DISCRETE TIME SIGNALS AND SYSTEMS

Periodic and pulse signals – examples of sequences – pulse step, impulse, ramp, sine and exponential – differential equations – linear time invariant – stability, causality – DT systems – time domain analysis.

Z- TRANSFORM

Z-transform and its properties – convolution – inverse Z-transform – discrete Fourier series – properties – sampling the Z-transform – discrete Fourier transform – properties for frequency domain analysis – linear convolution using discrete Fourier transform – overlap add method, over lap save method.

FAST FOURIER TRANSFORM (FFT)

Introduction to Radix 2 FFT's – decimation in time FFT algorithm – decimation in frequency FFT algorithm – computing inverse DFT using FFT – mixed radix FFT algorithm – periodogram technique.

IIR AND FIR FILTER DESIGN

Classification – reliability constrains – IIR design – bilinear transform method – impulse invariant method – step – invariance method – FIR design – Fourier series method – window function method.

PROGRAMMABLE DSP CHIPS

Architecture and features of TMS 320C50 and ADSP 2181signal processing chips

TEXT BOOKS

1. Openheim A.V., and Schafer R.W., Discrete Time Signal Processing, Prentice Hall of India, New Delhi, 1992
2. Proakis J.G. and Manolakis, D.G., Digital Signal Processing Principles, Algorithms and Applications, Prentice Hall of India, New Delhi, 1997.

REFERENCES

1. Antonian A., Digital Filters analysis and Design, Tata McGraw-Hill Publishing Co., New Delhi, 1988.
2. Stanley W.D., Digital Signal Processing, Restion Publishing House, 1989.
3. ADSP2181 DATASHEET - http://www.analog.com/UploadedFiles/Datasheets/505104853ADSP2181_d.pdf
4. TMS320C50 DATASHEET - http://www.ti.com/sc/ds/smq320c50.pdf

BEI304 DIGITAL SYSTEM CONTROL 3 0 0 3

INTRODUCTION

Digitisation – Effect of sampling – Linear difference equation - Review of - Z transforms – solution of difference equation – convergence.

DISCRETE SYSTEM ANALYSIS

The transfer function – State Variable description – Relation of transfer function to pulse response – external stability state space form – solution of state equation – Numerical consideration – dynamic response – controllability and observability effect of sampling.

SAMPLED DATA SYSTEMS
Sample and hold – spectrum of a sampled signal – extrapolation – response between samples – Hold equivalents.

DESIGN OF DIGITAL CONTROLLER
Pole placement – estimation design – regulation design – Integral control and disturbance estimation – design by emulation – root locus design – direct design method – frequency response methods.

PLC
Evolution of PLC's – Sequential and programmable controllers – Architecture- Programming of PLC – Relay logic – Ladder logic – Functional blocks.

TEXT BOOKS
1. Franklin G.F, J.David Powell, Michael Worleman, " Digital Control of dynamic Systems"3rd Edition, Addison Wesley, 2000
2. Petrezeulla, Programmable Controllers, McGraw-Hill, 1989.

REFERENCES
1. M.Gopal, 'State variables and Digital control methods', Tata McGraw-Hill, 1997.
2. Ogatta.K. 'Modern Control Engineering', Prentice hall of India, II edition, 1997.
3. Kuo, "Digital control systems", Second Edition, Oxford University press, 1992.

BIC304 PROCESS CONTROL 3 0 0 3

INTRODUCTION
Need for process control – mathematical model of first – order level, pressure and thermal processes – higher order process – interacting and non-interacting systems – continuous and batch process – self-regulation – servo and regulator operation.

CONTROL ACTIONS AND CONTROLLERS
Basic control actions – characteristics of on-off, proportional, single-speed floating, integral and derivative control modes – P+I, P+D and P+I+D control modes – pneumatic and electronic controllers to realize various control actions.

OPTIMUM CONTROLLER SETTINGS
Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio – determination of optimum settings for mathematically described processes using time response and frequency response – tuning – process reaction curve method – Ziegler Nichols method – damped oscillation method.

MULTILOOP CONTROL
Feed forward control – ratio control- cascade control – inferential control – split range control – introduction to multivariable control – examples from distillation column and boiler systems.

FINAL CONTROL ELEMENT
I/P converter – pneumatic and electric actuators – valve positioner – control values – characteristics of control valves – inherent and installed characteristics – valve body – commercial valve bodies – control valve sizing – cavitation and flashing – selection criteria.

TEXT BOOKS
1. Stephanopoulis, G, Chemical Process Control, Prentice Hall of India, New Delhi, 1990.
2. Eckman. D.P., Automatic Process Control, Wiley Eastern Ltd., New Delhi, 1993.

REFERENCES
1. Pollard A.Process Control, Heinemann educational books, London, 1971.
2. Harriott. P., Process Control, Tata McGraw-Hill Publishing Co., New Delhi, 1991.

BIC308 CONTROL SYSTEM COMPONENTS 3 0 0 3

INTRODUCTION
Linear approximation of Non-linear systems - electrical systems – stepper motor - hydraulic systems - pneumatic systems – gyroscopes - classification of control systems, choice of system hardware.

TRANSDUCERS AND DATA TRANSMISSION
Principle of transducers and data transmission choice of transducers, Transducers for-displacement, load and tension transducers for- temperature, pressure, flow, level density, pH, humidity, moisture, thickness.Analog and digital data transmission. Pneumatic data transmission, transmitter.**Noise:** common sources of electrical noise, mechanism causing noise introduction, techniques for minimising noise introduced into a circuit.

MECHANICALCOMPONENTS
Load and welding beam, differential gear, gear trains brakes, clamps, clutches.

ELECTRICAL AND ELECTRO MECHANICALCOMPONENTS
Potentiometers, synchros, synchro control transformer, servo motor-2phase A.C. servo motor, D.C. servo motor advantages and limitation, permanent magnet step motor, variable reluctance step motor application, modulators, demodulators, gear trains, application, Tacho generator-d.c and a.c. type.

DEVELOPMENT OF COMPLETE SYSTEMS
Electric amplifiers and find control elements introduction, preamplifiers transistor power amplifier, use of negative feedback loops, need for combining datas, electrical methods for combining analog signals, mechanical methods for combining signals, electronic methods for combining digital data, controller for speed control systems, sequence controllers general purpose controllers, on-off temperature controllers, position control systems, example of electro-hydraulic drives and process control systems.

TEXT BOOKS

1. Basic Control System Technology by C.J.Chermond, Viva book, 1988.
2. Gibson T.E. and Tetuer F.B. Control system components, McGraw-Hill, New York . 1993.

REFERENCES

1. Control System Engineering, A.Nagoor Kani.
2. Greenwood, Mechanical details for product design, McGraw-Hill, New York, 1990.

BPRE14 PROFESSIONAL ETHICS AND ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3

ENGINEERING ETHICS

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy -Kohlberg's theory -Gilligan's theory - consensus and controversy - professions and professionalism – professional ideals and virtues - theories about right action - self-interest-customs and religion - uses of ethical theories

ENGINEER'S RESPONSIBILITY & SAFETY

Engineering as experimentation - engineers as responsible experimenters - codes of ethics-a balanced outlook on law
Safety and risk - assessment of safety and risk - risk benefit analysis-reducing risk – Case Study

INTRODUCTION, PROJECT SELECTION & REPORT

Introduction - Entrepreneurship concept - principles and forms - self employment - need and mode - Project Selection/Formulation - Identification of opportunities - Project identification - Product/Service selection - Determining optimum project size - Selection of appropriate technology - Estimate of project cost - Time scheduling - Foreign collaboration - Patents – Licenses.
Detailed Project Report with Project Viabilities (Appraisal) – Case Studies.

INCENTIVES, INSTITUTIONS & SSI

Environmental scanning - Competition - SWOT analysis - Supportive institutions and their role - Government assistance and incentives - Sources of information - Procedures for setting up SSI - ancillary units and tiny units – Consciousness towards Environment

FINANCIAL ANALYSIS AND INDUSTRIAL SICKNESS

Financial Analysis: Concept of risk capital - Assessment of working capital requirements - Means of finance - Analysis of financial statements - Break Even Point and sensitivity analysis Industrial Sickness: Meaning of industrial sickness - symptoms - approaches and rehabilitation of sick units - Institutional support - Importance of entrepreneur education and training

Text Book

1. Mike Martin and Roland Schinzinger, "" ETHICS IN ENGINEERING", McGraw Hill, New York, 1996.
2. S.S. Khanna, ENTREPRENEURIAL DEVELOPMENT, S. Chand & Co., New Delhi, 1999
3. C.B. Gupta, N. P. Srinivasan, ENTREPRENEURIAL DEVELOPMENT, Sultan Chand & sons, New Delhi, 2001.

Reference

1. Charles D.Fleddermann, "ENGINEERING ETHICS", Prentice Hall, New Mexico, 1999.
2. Laura Schlesinger, "HOW COULD YOU DO THAT: THE ABDICATION OF CHARACTER, COURAGE, AND CONSCIENCE", Harper Collins, New York, 1996.
3. Stephen Carter, "INTEGRITY", Basic Books, New York, 1996.
4. Tom Rusk, "THE POWER OF ETHICAL PERSUASION: FROM CONFLICT TO PARTERSHIP AT WORK AND IN PRIVATE LIFE", Viking, New York, 1993
5. J. S. Saini ENTREPRENEURSHIP DEVELOPMENT PROGRAMS & PRACTICES, CBA
6. M. U. Deshpande ENTREPRENUERSHIP OF SMALL SCALE INDUSTRIES CBA ENTREPRENEURSHIP, A book by TTTI.
7. EDI I – Faculty & External Experts – A HANDBOOK FOR NEW ENTREPRENEURS, Published by Entrepreneurship Development Institute of India, Ahmedabad, 1986.
8. P. Saravanavel, ENTREPRENEURSHIP DEVELOPMENT, Ess Pee Kay Publications House, Madras, 1997.

BIC310 MEASUREMENTS&CONTROL LAB 0 0 3 2

1. Compensating Networks.
2. Study of Synchros.
3. DC Stepper Motor.
4. DC Position Control System.
5. AC Position Control System.
6. Digital Control (P and PI) of first order plant.
7. Digital Control (State variable feedback) of second order liquid level system.
8. Study of transducers.
9. Use of Wheat Stone bridge as resistance to voltage converter and to determine its sensitivity for various ratios
10. Kelvin double bridge
11. Tests on a single-phase energy meter
12. Calibration of wattmeter at different power factors
13. Calibration of ammeter, voltmeter and wattmeter using student type potentiometer

BIC306 PROCESS CONTROL LABORATORY 0 0 3 2

1. Operation of interacting and non-interacting systems
2. Responses of different order processes with and without transportation lag
3. Response of on-off controller
4. Response of P+I+D controller
5. Characteristics of control valve with and without positioner
6. Operation of on-off controlled thermal process
7. Closed loop response of flow control loop
8. Closed loop response of level control loop
9. Closed loop response of temperature control loop
10. Closed loop response of pressure control loop
11. Tuning of controllers
12. Study of complex control system (ratio / cascade / feed forward)

SEMESTER VII

BIC411 INDUSTRIAL INSTRUMENTATION-I 3 0 0 3

MEASUREMENT OF FORCE, TORQUE VELOCITY

Electric balance – different types of load cells – magnets – elastics load cell – strain gauge load cell – different methods of torque measurement Strain gauge, relative regular twist- speed measurement – revaluation counter – capacitive tacho – drag up type tacho – D.C and A.C. tacho generators – stroboscope.

MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY

Accelerometers – LVDT, piezo-electric, strain gauge and variable reluctance type accelerometers – mechanical type vibration instruments seismic instruments as an accelerometer and vibrometer – calibration of vibration pick ups – units of density, specific gravity and viscosity used in industries – Baume scale API scale – pressure head type densitometer – float type densitometer – ultrasonic densitometer Bridge type gas densitometer.

PRESSURE MEASUREMENT

Units of pressure –manometers – different types – elastic type pressure gauges – Bourde tube bellows – diaphragms – Electrical methods – elastic elements with LVDT and strain gauges – capacitive type pressure gauge – piezo resistive pressure sensor – resonator pressure sensor – measurement of vacuum – McLeod gauge – thermal conductivity gauges – Ionization gauge cold cathode and hot cathode types – testing and calibration of pressure gauges – dead weight tester.

TEMPERATURE MEASUREMENT

Definitions and standards – primary and secondary fixed points – calibration of thermometers different types of filled in system thermometer – sources of errors in filled in systems and their compensation – Bimetallic thermometers – electrical methods of temperature measurement – signal conditioning of industrial RTDs and their characteristics –3 lead and 4 lead RTDs.

THERMOCOUPLES AND PYROMETERS

Thermocouples – law of thermocouple – fabrication of industrial thermocouples – signal conditioning of thermocouple output – thermal block references functions – commercial circuits for cold junction compensation – response of thermocouple – special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement – radiation fundamentals – total radiation and selective radiation pyrometers – optical pyrometers – two colour radiation pyrometer.

TEXT BOOKS

1. Ernest O.Doebelin, Measurement systems Application and Design, International Student Edition, IV Edition, McGraw-Hill Book Company, 1998.
2. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.

REFERENCES

1. D.Patranabis, Principles of Industrial Instrumentation, Tata McGraw-Hill Publishing Ltd., New Delhi, 1999.
2. A.K.Sawhney, A course in Electrical and Electronic Measurement and Instrumentation – Dhanpat Raj and Sons, New Delhi, 1999.
3. P.Holman, Experimental Methods for Engineers International Student Edition, McGraw-Hill Book Company, 1971.
4. B.C.Nakra and K.K.Chaudary, Instrumentation Measurement and Analysis, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1985.

BIC413 INDUSTRIAL CHEMICAL PROCESS 3 0 0 3

UNIT I

Overview of a chemical process Industry – Manufacture of H_2SO_4, NaoH, NH_3, Edible oil, pulp and paper, pertolecem, refining plastics (P.E; PVC), polyester fibre(*) These process industries cover: Inorganic (H_2SO_4, NaoH, NH_3) organic (Edible, pulp & paper), petroleum, polymer (PE, PVC) & fibre

UNIT II

UNIT Opns: Momentum – flow of fluids through pipes – types of flow – pressure drop – pumps – (centrifugal, reciprocating only) flow measurement – heat transfer – mechanism – heat exchangers – evaporators.

UNIT III

Mass transfer – mechanism – Distillation Absorption, extraction, leaching, adsorption, drying, and crystallization.

UNIT IV

Chemical reactors, mixing, size reduction, filtration, other separations membrane seperation

UNIT V

Concept of material, energy momentum balance, case study of process variables and control in typical unit operation as distillation, absorption, reactors, heat exchangers.

(*) Description of equipments and their working alone to be taught – derivation to be omitted

Text Books:

1. Dryden's outlines of chemical technology – by Gopal Rao
2. Shreve's chemical process industries Mc Grew Hill
3. Unit operations of chemical engg – Mccabe & smith Mc Grew Hill

References:

1. Perry's chemical engg's hand book - Mc Graw Hill

BIC415 DATA ACQUISITION & COMMUNICATION 3 0 0 3

DATA CONVERTERS

D/A Converters – Implementing a DAC function – Use of ladder networks – Bipolar coded DAC's-Resolution, Setting time Transient errors – A/D converters – parallel A/D, feed back A/D, ramp type A/D, Dual slope A/D, successive approximation A/D, Resolution, Convertion time – Comparison of A/D conversion techniques Typical IC's for D/A, A/D conversion – Isolation amplifiers.

DATA ACQUISITION SYSTEMS

Sampling theorem – Sampling and digitising – Aliasing – Sample and hold circuit – Practical implementation of sampling and digitising – Review of programme peripherals – Definition, design and need for data acquisition systems – Interfacing A/D and D/A with microprocessor / PC – Multiplexed channel operation – Ground returns – Microprocessor/PC based acquisition systems.

REVIEW OF ANALOG AND DIGITAL COMMUNICATION SYSTEM

Multiplexing – FDM and TDM – Data communication – Transmission lines and digital signals. Frequency components of pulse waveforms – Practical line interface circuits, capabilities – Serial asynchronous communications protocol – Hardware UART's – Intel 8251 A – Software – UART – Base band interface – Standard 20mA current loop interface – EIA interface standards.

COMMUNICATION NETWORK

Telephone network, Network hierarchy and switching – transmission characteristics of the network – local loop and signalling – MODEMS – error detection, correction and encryption – LAN – Topology, protocols – standard ETHERNET AND ARCNET configurations, Specifications.

FIBER OPTIC COMMUNICATION SYSTEMS

Buildings blocks – Light sources, LED's and LASER diodes – Optical fibers – Types Dispersion – Losses – Optical fiber cable – Couplers and connectors-Detectors, PIN and APD – Role of Optical fiber in data acquisition and communication – Transmitter, receiver and repeaters.

TEXT BOOKS

1. G.B.Clayton, Data Converters – The Mac Millian Press Ltd., 1982.
2. Paul Bates, Practical Digital and Data communications, Prentice Hall, 1987.

REFERENCES

1. Hughes, Introduction to Data Communications & Practical Approach.
2. Douglas V.Hall, Microprocessors and Interfacing – McGraw-Hill, 1986.
3. Wayne Tomasi, Advanced Electronic Communication Systems, Prentice Hall 1987.
4. Keiser, Optical Fiber communication systems, McGraw-Hill, 1983.

BEI405 COMPUTER NETWORKS AND DISTRIBUTED CONTROL SYSTEM 3 0 0 3

DATA NETWORK FUNDAMENTALS

Network hierarchy and switching – open system interconnection model of ISO – Data link control protocol – BISYNC – SLDC – HLDC – media access protocol – Command – response – Token passing – CSMA/CD, TCIP/IP.

INTER NETWORKING

Bridges – Routers – Gateways – open system with bridge configuration – open system with gateway configuration – Standard ETHERNET and ARCNET configuration – Special requirement for networks used for control.

DISTRIBUTED CONTROL SYSTEMS

Evolution – Different architecture – local control unit – Operator interface – Displays – Engineering interface

APPLICATIONS OF DCS

DCS applications in Power plants, Iron and Steel plants, Chemical plants, Cement plants and Pulp and Paper plants

HART ABD FIELD BUS

Introduction – Evolution of signal standards – HART communication protocol – communication modes – HART networks – Control system interface – HART commands – HART field controller implementation – HART and OSI model – Field bus – Introduction – General field bus architecture – basic requirements of field bus standard – field bus topology – interoperability – interchangeability.

TEXT BOOKS

1. A.S.Tanenbaum, Computer Networks, Third Edition, Prentice Hall of India, 1996
2. Michal P.Lucas, Distributed control systems, Van nostrand Reinhold Co., 1986

REFERENCES

1. Romily Bowden, HART application guide and the OSI communication foundation. 1999
2. G.K.McMillan, Process/ Industrial instrument and handnook, McGraw-Hill, New york, 1999.
3. Popovic D. and Bhatkar V.P., Distributed Computer Control for industrial automation, Marcel Dekkar Inc., 1990 (for Unit 4)
4. Buchanan W., Computer Busses, Arnold Publishers, London, 2000.

BIC405 **INDUSTRIAL INSTRUMENTATION LABORATORY** **0 0 3 2**

1. Discharge coefficient of orifice plate
2. Calibration of pressure gauge
3. Calibration of thermocouple
4. Calibration of flowmeter
5. Torque measurement
6. Viscosity measurement
7. Vacuum pressure measurement
8. Level measurement using d/p transmitter
9. UV – Visible spectrophotometer
10. IR spectrophotometer
11. pH meter standardisation and measurement of pH values of solutions
12. Conductivity meter calibration and measurements of conductivity of test solutions.

BEI409 **DESIGN PROJECT LABORATORY** **0 0 3 2**

1. Design of instrumentation amplifiers
2. Design of active filters
3. Design of regulated power supply
4. Design of V/I and I/V converters
5. Design of linearising circuit and cold – junction compensation circuit for thermocouples
6. Design of signal conditioning circuits for strain gauge and RTD
7. Design of orifice plate and rotameter
8. Design of control valve (sizing and flow – lift characteristic)
9. Design of PID controllers (using operational amplifier and microprocessor)
10. Piping and Instrumentation Diagram – case study
11. Preparation of documentation of instrumentation project (process flow sheet, instrument index sheet and instrument specifications sheet
12. Preparation of project scheduling (Job scheduling, installation procedure and safety regulations).

SEMESTER-VIII

BIC412 **INDUSTRIAL INSTRUMENTATION** – II **3 0 0 3**

MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE

Viscosity terms - say bolt viscometer – rotameter type viscometer – industrial consistency meters – humidity terms – dry and wet bulb psychrometers – hot wire electrode type hygrometer – dew cell – electrolysis type hygrometer – commercial type dew point meter – moisture terms – different methods of moisture measurement – moisture measurement in granular materials, solid penetrable materials like wood, web type material.

MECHANICAL TYPE FLOW METERS

Theory of fixed restriction variable head type flow meters – orifice plate – venturi tube – flow nozzle – dall tube – installation of head flow meters – piping arrangement for different fluids – pilot tube.

QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS

Positive displacement flow meters – constructional details and theory of operation of mutating disc, reciprocation piston, oval gear and helix type flow meters – inferential meter – turbine flow meter – rota meter – theory and installation – angular momentum mass flow meter - coriolis mass flow meters – thermal mass flow meter – volume flow meter plus density measurement – calibration of flow meters – dynamic weighing method.

ELECTRICAL TYPE FLOW METER

Principle and constructional details of electromagnetic flow meter – different types of excitation – schemes used – different types of ultrasonic flow meters – laser doppler anemometer systems – rortex shedding flow meter – target flow meter – solid flow rate measurement – guidelines for selection of flow meter.

LEVEL MEASUREMENT

Gauge glass technique coupled with photo electric readout system – float type level indication – different schemes – level switches level measurement using displacer and torque tube – bubbler system. Boiler drum level measurement – differential pressure method – hydra step systems – electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors.

TEXT BOOKS

1. D.Patranabis, Principles of Industrial Instrumentation Tata McGraw-Hill Publishing Co., New Delhi, 1999
2. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi 1999.

REFERENCES

1. Ernest O.Doebelin, Measurement systems application and design international student Edition, Tata McGraw Hill Publishing Co., New Delhi, 1999.
2. Patranabis, Principles of Industrial Instrumentation Tata McGraw-Hill Publishing Co., New Delhi, 1999
3. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, Delhi 1999.
4. A.K.Sawhney, A course in Electrical and Electronic Measurement and Instrumentation – Dhanpat Rai and Sons, New Delhi, 1999.
5. Eckman D.P.M Industrial Instrumentation – Wiley Eastern Limited, 1990.
6. Liptak B.G. Instrument Engineers Handbook (Measurement), Chilton Book Co., 1994.

BIC404 **COMPREHENSION** **0 0 3 3**

The objective of comprehension is to provide opportunity for the student to apply the knowledge acquired during the academic programme to real –life problems that he/she may have to face in future as an engineer.

Three periods per week shall be allotted in the time table for this activity and this time shall be utilized by the student to receive guidance form the members of faculty on solving real-life problems, practice solving these problems and on group discussions, seminar presentations, library reading as assigned by the faculty member in-charge. The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time. For which,

1. Two written tests of objective type question from the courses up to 6th semester may be conducted.
2. Seminars on latest topics may be conducted.
   Oral Exams on G.K, Technical knowledge, reasoning, may be conducted. Group discussions may be conducted.

ODD SEMESTER ELECTIVES:

BEIE01 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 3 0 0 3

INTRODUCTION TO ARTIFICIAL INTELLIGENCE
Overview of Al-general concepts-problem spaces and search –search techniques – BFS, DFS-Heuristic search techniques

KNOWLEDGE REPRESENTATION
Knowledge –general concepts- predicate logic-representing simple fact- instance and ISA relationships –resolution –natural deduction.

KNOWLEDGE ORGANISATION AND MANIPULATION
Procedural Vs declaration knowledge – forward Vs backward reasoning – matching techniques – control knowledge/strategies – symbol reasoning under uncertainty – introduction to non – monotonic reasoning – logic for monotonic reasoning.

PERCEPTION – COMMUNICATION AND EXPERT SYSTEMS
Natural language processing – pattern recognition – visual image understanding – expert system architecture

KNOWLEDGE ACQUISITION
Knowledge acquisition – general concepts – learning – learning by induction – explanation based learning.

TEXT BOOKS
1. Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw-Hill, New Delhi, 1991.
2. Stuart Russell and Peter Norvig, Artificial Intelligence: A modern approach. Prentice Hal, 1995

REFERENCES
1. Nelson N.J. Principles of Artificial Intelligence, Springer Verlag, Berlin, 1980.
2. Patterson, Introduction to Artificial Intelligence and Expert systems, Prentice Hall of India, New Delhi, 1990.

BEIE03 NEURAL AND FUZZY LOGIC CONTROL 3 0 0 3

INTRODUCTION AND DIFFERENT ARCHITECTURES OF NEURAL NETWORKS
Artificial neuron – MLP – Back propagation – Hope field networks – Kohonen self-organising maps – adaptive resonance theory.

NEURAL NETWORKS FOR CONTROL
Schemes of neuro-control – identification and control of dynamical systems – adaptive neuro controller – case study.

INTRODUCTION TO FUZZY LOGIC
Fuzzy sets – fuzzy relations – fuzzy conditional statements – fuzzy rules – fuzzy algorithm. Fuzzy logic controller – fuzzification interface – knowledge base – decision making logic – defuzzification interface – design of fuzzy logic controller – case study.

NEURO-FUZZY LOGIC CONTROL
Optimisation of membership function and rules base of fuzzy logic controller using neural networks – genetic algorithm – fuzzy neuron – adaptive fuzzy systems – case study.

TEXT BOOKS
1. Laurance Fausett, Fundamentals of Neural Networks, Prentice Hall, Englewood cliffs, N.J, 1992.
2. Zimmermann H.J., Fuzzy set theory and its applications, Allied Publication Ltd., 1996.

REFERENCES
1. Tsoukalas L.H, and Robert E.Uhrig, Fuzzy and Neural approach in Engineerin,John Wiley and Sons, 1997.
2. Jacek M.Zurada, Introduction to artificial Neural Systems, Jaico Publishing House Mumbai, 1997.
3. Klir G.J.and Yuan B.B, Fuzzy sets and fuzzy logic, Prentice Hall of India, New Delhi, 1997.
4. Driankov D., Hellendron. H. Reinfrank M., An Introduction to Fuzzy control, Narosa publishing House, New Delhi, 1996.
5. Millon W.T., Sutton R.S.and Webrose P.J., Neural Networks for control, MIT Press, 1992.

BEIE05 SYSTEMS THEORY 3 0 0 3

FREQUENCY DOMAIN DESCRIPTIONS
Properties of transfer functions – Impulse response matrices – Poles and zeros of transfer function matrices – Critical frequencies – Resonance – Steady state and dynamic sponse – Bandwidth.

STATE SPACE DESCRIPTION
Review of state model for systems – State transition matrix and its properties - Free and forced responses – Controllability and observability – Kalman decomposition – Minimal realisation – Balanced realisation.

DESIGN IN STATE SPACE SYSTEMS
State feedback – Output feedback – Design methods – Pole assignment – Full order and reduced order observers – Deadbeat control – Deadbeat observers – Introduction to optimal control.

NON-LINEAR SYSTEMS
Types of non-linearity – Typical examples – Phase plane analysis – Limit cycles -Equivalent linearization – Describing functions – Chaotic behaviour. Need for model reduction – Aggregation techniques – Dominant pole concept – Model reduction via partial realisation – Time moment matching and pade approximation – Hankel norm model reduction – Comparative merits of various methods.

STABILITY
Stability concepts – Equilibrium points – BIBO and asymptotic stability – Direct method of Lyapunov – Application to non-linear problems – Frequency domain stability criteria – Popov's method and its extensions.

REFERENCE BOOKS

1. M.Gopal, "Modern Control Engineering", Wiley, 1996.
2. Ogatta, "Modern Control Engineering", PHI, 3rd Edition, 1997.
3. G.J.Thaler, "Automatic control systems", Jaico publishers, Chennai, 1993.

BICE01 POWER PLANT INSTRUMENTATION 3 0 0 3

OVERVIEW OF POWER GENERATION
Brief survey of methods of power generation – hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – thermal power plants – building blocks – details of boiler processes UP&I diagram of boiler – cogeneration.

MEASUREMENTS IN POWER PLANTS
Electrical measurements – current, voltage, power, frequency, power – factor etc. – non electrical parameters – flow of feed water, fuel, air and steam with correction factor for temperature – steam pressure and steam temperature – drum level measurement – radiation detector – smoke density measurement – dust monitor.

ANALYZERS IN POWER PLANTS
Flue gas oxygen analyser – analysis of impurities in feed water and steam – dissolved oxygen analyser – chromatography – PH meter – fuel analyser – pollution monitoring instruments.

CONTROL LOOPS IN BOILER
Combustion control – air/fuel ratio control – furnace draft control – drum level control – main stem and reheat steam temperature control – superheater control – attemperator – deaerator control – distributed control system in power plants – interlocks in boiler operation.

TURBINE – MONITORING AND CONTROL
Speed, vibration, shell temperature monitoring and control – steam pressure control – lubricant oil temperature control – cooling system

TEXT BOOKS

1. Sam G. Dukelow, The control of Boilers, instrument Society of America, 1991.
2. Modern Power Station Practice, Vol.6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.

REFERENCES

1. Elonka,S.M.and Kohal A.L.Standard Boiler Operations, McGraw-Hill, New Delhi, 1994.
2. R.K.Jain, Mechanical and industrial Measurements, Khanna Publishers, Delhi, 1995.

BICE13 SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL 3 0 0 3

NON PARAMETRIC METHODS
Non parametric methods: Transient analysis – frequency analysis – correlation analysis spectral analysis

PARAMETRIC METHODS
Linear Regression: The least square estimate – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models – prediction error methods: description of prediction error methods – optimal prediction – relationships between prediction error methods and other identification methods – theoretical analysis. Instrumental variable methods: Description of instrumental variable methods – theortical analysis – covariance matrix of IV estimates – comparison of optimal IV and prediction error estimates.

RECURSIVE IDENTIFICATION METHODS
The recursive least squares method – the recursive instrumental variable method – the recursive prediction error method – model validation and model structure determination. Identification of systems operating in closed loop: identifiability considerations – direct identification – indirect identification – joint input – output identification.

ADAPTIVE CONTROL SCHEMES
Introduction – uses – definitions – auto tuning – types of adaptive control – gain scheduling controller – model reference adaptive control schemes –self-tuning controller

MRAC AND STC:
Approaches – the gradient approach –liapunov functions – passivity theory – pole placement method – minimum variance control – predictive control.

ISSUES IN ADAPTIVE CONTROL AND APPLICATION
stability – convergence – robustness – application of adaptive control.

REFERENCES

1. Ljung L, system identification: Theory for the user, Prentice Hall, Englewood Cliffs, 1987
2. Soderstorm, T. and Petre Stoica, System Identification, Prentice Hall International (UK) Ltd., 1989
3. Sastry S. and Bodson M., Adaptive control – stability, convergence and Robustness, Prentice Hall inc., New Jersey, 1989.

BICE15 MODERN CONTROL SYSTEMS 3 0 0 3

STATE VARIABLE ANALYSIS AND DESIGN

State models – solution of state equations – controllability and observability- pole assignment by state feedback – full and reduced order observers.

NONLINEAR SYSTEMS

Common types of non-linear phenomena – Linearisation – singular points – phase plane method – construction of phase trajectories – system analysis by phase plane method – describing function method – describing function of non-linear elements.

STABILITY ANALYSIS OF NON LINEAR SYSTEM

Stability analysis by describing function method – jump resonance – Liapunov's and Popv's stability criteria.

OPTIMAL CONTROL

Problem formulation – necessary conditions of optimality – state regulator problem – Matrix Riccati equation – infinite time regulator problem – output regulator and tracking problems – Pontryagin's minimum principles – time - optimal control problem.

ADAPTIVE CONTROL

Classification – MRAC systems – Different configuration, classification, mathematical description – direct and indirect MRAC – self tuning regulator – different approach to self tuning, recursive parameter estimation, implicit and explicit STR.

TEXT BOOKS

1. Nagrath I.J., and Gopal, M., Control system Engineering Wiley Eastern Reprint 1995.
2. Kirk D.E., "Optimal control theory-an introduction", Prentice Hall, N.J. 1970.

REFERENCES

1. Chalam V.V., Adaptive control systems Marcel Dekker, INC New York and Bassel, 1987
2. Gopal. M., Modern control system Theory, Wiley Eastern Ltd., II Edition Reprint 1995.
3. Stanley M.Shinners, Modern Control System Theory and Design, John Wiley and Sons, 1998.

BICE07 PC BASED INSTRUMENTATION 3 0 0 3

INTRODUCTION

Review of microprocessors, microcomputers, micro processing systems - Input-output structures - Measurement of digital computer power and performance.

INTERFACING

Analogue signal conversion – Interface components and techniques - Signal processing - Interface systems and standards – Communications.

SOFTWARE

Real time languages – Programming real time systems - Discrete PID algorithms -Real time operating systems - Case studies in instrumentation.

APPLICATION EXAMPLES IN MEASUREMENT AND CONTROL

PC based data - Acquisition systems - Industrial process measurements, like flow temperature, pressure, and level PC based instruments development system.

REFERENCE BOOKS

1. Ahson, S.I., "Microprocessors with applications in process control", Tata McGraw-Hill Publishing Company Limited, New Delhi, 1984.
2. George Barney C., "Intelligent Instrumentation", Prentice Hall of India Pvt. Ltd., New Delhi, 1998.
3. Krishna Khan, "Computer based industrial control", Prentice Hall, 1997.

BICE09 DIGITAL INSTRUMENTATION 3 0 0 3

INTRODUCTION

Digital codes – Memory devices – Basic building blocks – Gates, FF and counters – Discrete data handling – Sampling – Sampling theorem – Aliasing errors – Reconstruction – Extrapolation – Synchronous and asynchronous sampling.

DIGITAL METHODS OF MEASUREMENTS

Review of A/D, D/A techniques – F/V and V/F conversion techniques – Digital voltmeters and multimeters – Automation and accuracy of digital voltmeters and multimeters – Digital phase meters – Digital tachometers – Digital frequency, period and time measurements – Low frequency measurements – Automatic time and frequency scaling – Sources of error – Noise – Inherent error in digital meters, hidden errors in conventional ac measurements – RMS detector in digital multimeters – Mathematical aspects of RMS.

DIGITAL DISPLAY & RECORDING DEVICES

Digital storage oscilloscopes – Digital printers and plotters – CDROMS – Digital magnetic tapes, dot matrix and LCD display CROs, colour monitor, digital signal analyser and digital data acquisition.

SIGNAL ANALYSIS

Amplifiers, filters, transmitter, receiver, wireless base and mobile station test sets, noise figures meters, RF network analyser and high frequency signal sources.

CURRENT TRENDS IN DIGITAL INSTRUMENTATION
Introduction to special function add on cards – Resistance card – Input and output cards – Counter, test and time of card and digital equipment construction with modular designing; interfacing to microprocessor, micro controllers and computers - Computer aided software engineering tools (CASE) – Use of CASE tools in design and development of automated measuring systems – Interfacing IEEE cards – Intelligent and programmable instruments using computers.

REFERENCE BOOKS

1. Bouwens, A.J., "Digital Instrumentation", McGraw Hill, 1984.
2. John Lenk, D., "Handbook of Micro computer based Instrumentation and Control", PHI, 1984.
3. Doebelin, 'Measurement System, Application & Design', IV Ed, McGraw-Hill, 1990.
4. 'Product catalogue', Hewlet Packard, 1996.

BICE17 OPTIMAL CONTROL SYSTEM 3 0 0 3

INTRODUCTION
The performance measure and linear optimal control, standard regular problem, The Hamilton-Jacobi-Bellman equation, Finite-time and Infinite-time horizon problems Regulators with a prescribed degree of stability, Asymptotic properties and quadratic weight selection.

DYNAMIC PROGRAMMING
The principle of optimality, An optimal control system, The recurrence relation of Dynamic programming, Computational procedure, The H-J-B equation and analytical results for discrete and continuous linear regulator problems.

THE CALCULUS OF VARIATIONS
Fundamental concepts, Functionals of a single function and functionals involving several independent functions, piecewise-smooth externals, constrained extrema, necessary condition for optimal control, Linear regulator problems.

THE MINIMUM (MAXIMUM) PRINCIPLE
Pontryagin's minimum principle and state inequality constraints, minimum time problem, minimum control energy problems, relationship between dynamic programming and minimum principle, singular intervals in optimal control, numerical techniques.

CASE STUDIES
Optimal control in selected applications – distillation column, boiler, paper manufacturing plant with simulation packages.
REFERENCES:

1. Donald Kirk, Optimal Control Theory, Prentice Hall.
2. B.D.O. Anderson and J.B. Moore, Optimal Control: Linear Quadratic Methods, Prentice Hall, 1990
3. T.Basar and G.J.Olsder Dynamic Noncoperative Game Theory, SIAM classics in Applied Mathematics, 1999.
4. Andrew P.Sage and Chelsea C.White, Optimum Systems Control, 2nd edition, Prentice Hall,
5. D.P. Bertsekas, Dynamic Programming and Optimal Control Vol.I, 2nd edition, Athena Scientific, 2000
6. M.Athans and P.L. Falb, Optimal ontrol, McGraw Hill, 1966
7. A.E. Bryson and Y.C. Ho, Applied Optimal Control, 2nd edition, Blaisdel, 1975
8. LB. Lee and L. Markus, Foundations of optimal control theory, wiley, 1967.

EVEN SEMESTER ELECTIVES

BEIE02 MECHATRONICS 3 0 0 3
INTRODUCTION
Mechatronics – definition and key issues – evolution – elements – mechatronics approach to modern engineering design.

SENSORS AND TRANSDUCERS
Types – displacement, position, proximity and velocity sensors – signal processing – data display**.**

ACTUATION SYSTEMS
Mechanical types – applications – electrical types – applications – pneumatic and hydraulic systems – applications – selection of actuators

CONTROL SYSTEMS
Types of controllers – programmable logic controllers – applications – ladder diagrams – microprocessor applications in mechatronics – programming interfacing – computer applications

RECENT ADVANCES
Manufacturing mechatronics – automobile mechatronics – automobile mechatronics – medical mechatronics – office automation – case studies.

TEXT BOOKS

1. Bulton, N., Mechatronics : Electronic Control system for Mechanical and Electrical Engineering, Longman, 1995.
2. Dradly, D.A. Dawson., D, Burd, N.C., and Loader, A.J., Mechatronics: Electronics in products and processes, Chapman & Hall, 1993.

REFERENCES

1. HMT Mechatronics, Tata McGraw-Hill, New Delhi, 1968
2. Galip Ulsoy, A., and Devires, W.R. microcomputer Applications in manufacturing John wiley, USA 1989.
3. James Harter, Electromechanics : Principles, concepts and devices – Prentice Hall –New Jersey 1995.

BEIE04 ROBOTICS AND AUTOMATION 3 0 0 3

BASIC CONCEPTS
Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

POWER SOURCES AND SENSORS Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

MANIPULATORS, ACTUATORS AND GRIPPERS
Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

KINEMATICS AND PATH PLANNING
Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill climbing techniques – robot programming languages

CASE STUDIES
Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

TEXT BOOKS
1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

REFERENCES
1. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
2. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.
4. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.
5. Issac Asimov I Robot, Ballantine Books, New York, 1986.

BICE02 INSTRUMENTATION IN PETROL CHEMICAL INDUSTRY 3 0 0 3

PETROLEUM PROCESSING
Petroleum exploration – recovery techniques – oil – gas separation processing wet gases – refining of crude oil.

UNIT OPERATIONS IN PETROLEUM INDUSTRY
Thermal cracking – catalytic cracking – catalytic reforming – polymerization – alkylation – isomerization - production of ethylene, acetylene and propylene from petroleum

CHEMICALS FROM PETROLEUM PRODUCTS
Chemical from petroleum – methane derivatives – acetylene derivatives – ethylene derivatives – propylene derivatives – other products

MEASUREMENT IN PETROCHEMICAL INDUSTRY
Parameters to be measured in refinery and petrochemical industry – selection and maintenance of measuring instruments – intrinsic safety of instruments

CONTROL LOOPS IN PETROCHEMICAL INDUSTRY
Process control in refinery and petrochemical industry-control of distillation column control of catalytic crackers and pyrolysis unit-automatic control of polyethylene production-control of vinyl chloride and PVC production.

TEXT BOOKS
1. Waddams A.L, Chemical from petroleum, Butter and Janner Ltd., 1968
2. Balchan.J.G. and Mumme K.I., Process Control Structures and Applications, Van Nostrand Reinhold Company, New York, 1988.

REFERENCES
1. Austin G.T.Shreeves, Chemical Process Industries, McGraw-Hill International student edition, Singapore, 1985.
2. Liptak B.G. Instrumentation in Process Industries, Chilton Book Company, 1994.

BICE04 INTELLIGENT CONTROLLERS 3 0 0 3

INTRODUCTION
Definition – architecture – difference between conventional and expert system

KNOWLEDGE ACQUISITION
Knowledge representation and formal logic-knowledge engineer – knowledge acquisition techniques – concept formalisation – knowledge representation development – knowledge acquisition for core problem knowledge acquisition without knowledge engineers.

EXPERT SYSTEM TOOLS
Problem solving start engines – languages for expert system development – expert system shells – LISP machines – PC-based expert system tools

FUZZY MODELLING AND CONTROL
Fuzzy sets – Fuzzy set operators – Fuzzy Reasoning – Fuzzy propositions – Linguistic variable – Decomposition and Defuzzification – Fuzzy systems- Case studies

NEURAL CONTROLLERS
Introduction: Neural networks – supervised and unsupervised learning – neural network models – single and multi layers – back propagation – learning and training. Neural controllers case studies.

TEXT BOOKS

1. Rolston, D.W., 'Principles of Artificial and Expert Systems Development', McGraw Hill Book Company, International Edition, 1998.
2. Kosko, B, 'Neural Networks and Fuzzy Systems', Prentice Hall of India Pvt. Ltd., 1994.

REFERENCES

1. Klir, G.J. and Folger, T.A., 'Fuzzy Sets, and Information', Prentice Hall, 1994.
2. James A.Freeman, David M.Skapura, 'Neural Networks Algorithms', Applications and programming Techniques', Addison Wesley Publishing company 1992.

BICE14 FIBRE OPTICS AND LASER INSTRUMENTS 3 0 0 3

OPTICAL FIBERS AND THEIR PROPERTIES

Principles of light propagation through a fiber – different types of fibers and their properties transmission characteristics of optical fiber – absorption losses – scattering losses – dispersion – optical fiber measurement – optical sources – optical detectors – LED – LD – PIN and APD

INDUSTRIAL APPLICATION OF OPTICAL FIBERS

Fiber optic sensors – fiber optic instrumentation system – different types of modulators – detectors – application in instrumentation – interferometric method of measurement of length – moiré fringes – measurement of pressure, temperature, current, voltage liquid level and strain – fiber optic gyroscope – polarization maintaining fibers.

LASER FUNDAMENTALS

Fundamental characteristics of lasers – three level and four level lasers – properties of laser – laser modes – resonator configuration – Q-switching and mode locking – cavity dumping – types of lasers: gas lasers, solid lasers, liquid lasers and semi conductor lasers

INDUSTRIAL APPLICATION OF LASERS

Laser for measurement of distance, length velocity, acceleration, current, voltage and atmospheric effect – material processing – laser heating, welding melting and trimming of materials – removal and vaporization.

HOLOGRAM AND MEDICAL APPLICATION

Holography – basic principle; methods; holographic interferometry and applications, holography for non – destructive testing – holographic components – medical applications of lasers; laser and tissue interaction – laser instruments for surgery, removal of tumors of vocal cords, brain surgery, plastic surgery, gynecology and oncology

TEXT BOOKS

1.John and Harry, Industrial lasers and their applications, McGraw-ill, 1974
2.Senior J.M., Optical Fiber Communication Principles and Practice, Prentice Hall, 1985

REFERENCES

1. John F Read, Industrial applications of lasers, Academic Press, 1978
2. MonteRoss, Laser applications, McGraw-Hill, 1968
3. Keiser G., Optical Fiber Communication, McGraw-Hill, 1991
4. Jasprit Singh, Semi conductor optoelectronics, McGraw-Hill, 1995

BICE08 VIRTUAL INSTRUMENTATION 3 0 0 3

REVIEW OF VIRTUAL INSTRUMENTATION

Historical perspective, advantages, etc., block diagram and architecture of a virtual instrument.

DATA – FLOW TECHNIQUES

Graphical programming in data flow, comparison with conventional programming.

VI PROGRAMMING TECHNIQUES

Vis and sub-Vis, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

DATA ACQUISITION AND INSTRUMENT INTERFACE

ADC, DAC, DIO, counters & timers, PC hardware structure, timing, interrupts, DMA, software and hardware installation, current loop, RS 232/RS485, GPIB, USB & PCMCIA.

ANALYSIS TOOLS AND APPLICATION

Some tools from the advanced analysis tools revalent to the discipline may be included e.g. Fourier Transform, power spectrum, correlation methods, windowing & filtering. VI applications in various fields – VISA and IVI – Image acquisition and processing.

REFERENCE BOOKS

1. Gary Johnson, 'Lab view graphical programming', II Ed., McGraw Hill, 1997.
2. Lisa K Wells & Jeffrey Travels, 'Lab view for everyone', Prentice Hall, 1997.
3. Sokoloff, 'Basic Concepts of lab view 4', Prentice Hall, 1998.
4. S. Gupta, J.P. Gupta, 'PC interfacing for Data Acquisition & Process Control', 2nd Ed., Instrument Society of America, 1994.

BICE10 CONTROL SYSTEM DESIGN 3 0 0 3

INTRODUCTION TO DESIGN

Systems performance and specifications – Compensators – Methodologies and assessment.

CLASSICAL CONTROLLERS DESIGN
Proportional (P) – Integral (I) – derivatives (D) – PI – PD – PID controllers – Characteristics – Design – Tuning - Manual and automatic.

FREQUENCY DOMAIN DESIGN
Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – MIMO design.

STATE VARIABLE DESIGN
Design by state feedback – Output feedback – Pole assignment technique – Design of state and output regulators – Design of reduced and full order observers – Introduction to robust control - H∞ control – Parameter optimisation.

CASE STUDIES
Radar tracking – Control of robot arm – Satellite altitude control – Temperature control.

REFERENCE BOOKS

1. S.Thompson, 'Control Systems Engineering and Design', Longman group, U.K.Ltd., 1989.
2. E.O.Doebelin, 'Control Systems Principles and Design', John Wiley 1990.
3. I.J.Nagrath and M.Gopal, 'Control Systems Engineering', Wiley eastern Ltd., 1982.
4. M.Gopal, 'Modern Control Systems Theory', Wiley Eastern Ltd, 1993.

BICE16 NANO TECHNOLOGY 3 0 0 3

INTRODUCTION:
Preliminary definitions, need for Nanotechnology, benefits of Nanotechnology a note on measures, elements of electricity, optics and electronics.

FUNDAMENTALS:
Electrons, atoms, ions, molecules, various metals, biosystems, molecular recognition, ohm's law, elements of quantum mechanics and magnetism.

TOOLS:
Tools for measuring nanostructures, scanning probe instruments, spectroscopy, electrochemistry and electron microscopy, tools for making nano structures, smart materials, nano scale biostructures , Energy capture, transformation and storage.

SENSORS & SELF HEALING STRUCTURES :
Self healing structures, recognition, separation, catalysis, heterogeneous nano structures and composites encapsulation, consumer goods, natural sensors, electromagnetic sensors, biosensors.

BIO MEDICAL APPLICATIONS :
Drugs, drug delivery, photodynamic therapy, molecular motors, neuro- electronics interfaces, protein engineering, nanobusiness, nanoethics.

References :

MarkRatner and Daniel Ratner, Nanotechnology Pearson Educatial

BICE18 BIO-MEDICAL INSTRUMENTATION 3 0 0 3

ANATOMY, PHYSIOLOGY AND TRANSDUCERS
Brief review of human physiology and anatomy – cell and their structures – electrical mechanical and chemical activities – action and resting potential – different types of electrodes – sensors used in biomedicine – selection criteria for transducers and electrodes – necessity for low noise pre- amplifiers – difference amplifiers – difference amplifiers – chopper amplifiers – electrical safety – grounding and isolation.

ELECTRO – PHYSIOLOGICAL MEASUREMENT
ECG – EEG – EMG – ERG – lead system and recording methods – typical waveforms.

NON – ELECTRICAL PARAMETER MEASUREMENTS
Measurement of blood pressure – blood flow cardiac output – cardiac rate – heart sound – measurement of gas volume – flow rate of CO_2 and O_2 in exhaust air – pH of blood – ESR and GSR measurements

MEDICAL IMAGING PARAMETER MEASUREMENTS
X- RAY machine – computer tomography – magnetic resonance imaging system – ultra sonography – endoscopy – different types of telemetry system – laser in biomedicine.

ASSISTING AND THERAPETIC DEVICES
Cardiac pacemakers – defibrillators ventilators – muscle stimulators – diathermy – introduction to artificial kidney artificial heart – heart lung machine – limb prosthetics – onthotics – elements of audio and visual aids.

TEXT BOOKS

1. Webster J.G., Medical Instrumentation: Application and Design, 3rd Edition, John Wiley and Son, 1999.
2. Khandpur R.S. Hand book of Biomedical Instrumentation and Measurements, Tata McGraw-Hill New Delhi 1987.

REFERENCES

1. Geddes and Baker, Principles of Applied Biomedical Instrumentation, John Wiley and Sons, USA, 1975.
2. Well G, Biomedical Instrumentation and Measurements, Prentice Hall, New Jersey, 1980.
3. Koryla J., Medical and Biological Application of electro chemical devices John Wiley and Sons, Chichester, 1980.
4. Wise D. L., Applied Bio- sensors, Butterworth USA, 1989.