West Bengal University of Technology
BF-142, Salt Lake City, Kolkata-700064

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(All periods will be of at least 50 minutes duration)

SEMESTER – III

Sl. No.	Subject Code	Subject	Periods	Credit Points
Theory			L+T	
1	EE 301(EI)	Circuit Theory and Networks	4+0	4
2	EC 301(EI)	Discrete Electronic Circuits	3+0	3
3	M 302	Mathematics	3+1	4
4	EC 302(EI)	Digital Integrated Circuits	4+0	4
5	EE 302(EI)	Electrical Measurements and Instruments	4+0	4
6	CS 302	Numerical Methods and Programming	3+1	4
PRACTICAL				
7	EE 391	Circuits and Networks Lab	3	2
8	EE 392	Electrical Measurements Lab	3	2
9	EC 392	Digital Electronics Lab	3	2
10	M(CS) 382	Numerical Methods and Programming Lab	3	2
			35	31

SEMESTER – IV

Sl. No.	Subject Code	Subject	Periods	Credit Points
THEORY			L+T	
1	EC 401(EI)	Analog Integrated Circuits	4+0	4
2	EI 402	Sensors and Transducers	4+0	4
3	EI 403	Industrial Instrumentation – I	4+0	4
4	CS 404(EI)	Computer Organization and Architecture	3+0	3
5	EI 405	Microprocessors and Microcontrollers	4+0	4
6	CS 405(EI)	Data Structures and Algorithms	4+0	4
PRACTICAL				
7	EI 491	Microprocessor and Microcontroller Lab	3	2
8	EI 492	Sensors and Transducers Lab	3	2
9	CS 492	Data Structures Lab	3	2
SESSIONAL				
10	HU 481	Technical Report Writing and Language Practice Lab	3	2
			35	31

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SEMESTER – V

Sl. No.	Subject Code	Subject	Periods	Credit Points
Theory			L+T	
1	EI 501	Industrial Instrumentation – II	4+0	4
2	EI 502	Microprocessor based Systems	4+0	4
3	EE 511(EI)	Control Theory	4+0	4
4	EC 511(EI)	Analog Communication Theory	4+0	4
5	EC 512(EI)	Digital Signal Processing	4+0	4
PRACTICAL				
6	EI 591	Industrial Instrumentation Lab	3	2
7	EE 581	Control Engineering Lab	3	2
8	EC 591	Analog Electronic Circuits Lab	3	2
9	EI 592	Microprocessor based Systems Lab	3	2
			32	28

SEMESTER – VI

Sl. No.	Subject Code	Subject	Periods	Credit Points
THEORY			L+T	
1	EI 601	Process Control – I	4+0	4
2	EC 601(EI)	Digital Communication	4+0	4
3	EI 602	Optoelectronics and Optical Instrumentation	4+0	4
4	CS 611(EI)	Computer Networking	4+0	4
5	EI 603	Electronic Instrumentation and Measurement	4+0	4
PRACTICAL				
6	EC 691	Communication Lab	3	2
7	CS 691	Computer Networking Lab	3	2
8	EI 691	Electronic Instrumentation and Measurement Lab.	3	2
SESSIONAL				
9	EI 682	Group Discussions and Seminar	3	2
10	EI 683	Industrial Training and Evaluation?	3	2
			35	30

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SEMESTER – VII

Sl. No.	Subject Code	Subject	Periods	Credit Points
Theory			L+T	
1	EI 701	Telemetry and Remote Control	4+0	4
2	EE 701(EI)	Power Electronics	4+0	4
3	EI 702	Process Control – II	4+0	4
4	EI 703	Analytical Instrumentation	4+0	4
PRACTICAL				
5	EI 791	Process Control Lab	3	2
6	EI 792	Telemetry and Remote Control Lab	3	2
7	EI 793	Project	6	4
SESSIONAL				
8	EI 784	Seminar	3	2
			31	26

SEMESTER – VIII

Sl. No.	Subject Code	Subject	Periods	Credit Points
THEORY			L+T	
1	EI/CS 801	Elective – I	4+0	4
2	EC/IT 802	Elective – II	4+0	4
3	HU 801	Values and Ethics in Profession	3+0	3
4	HU 802(EI)	Industrial Management	4+0	4
Sessional				
5	EI 882	General Viva-Voce		4
6	EI 883	Project	6	4
PRACTICAL				
7	EE 894	Power Electronics Lab	3	2
			24	25

	Sl. No.	Subject code	Subject
Elective – I	(a)	EI 801(a)	Power Plant Instrumentation
	(b)	EI 801(b)	Non-destructive Testing Methods
	(c)	CS 801(c)	Soft-computing Techniques
	(d)	EI 801(d)	Biomedical and Ecological Measurements

	Sl. No.	Subject code	Subject
Elective – II	(a)	EC 802 (a)	Digital System Design using VHDL
	(b)	EC 802 (b)	Embedded Systems
	(c)	IT 802 (c)	Multimedia Techniques
	(d)	EC 802 (d)	Mobile Communication

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CIRCUIT THEORY AND NETWORKS
Code : EE 301(EI)
Contacts : 4L
Credits : 4

Topic	No. of periods
Module I	
Systems Concepts: Causality, linearity and time-invariance, Principle of superposition, Circuit as a system, Integro-differential equation representation, duality	6
Passive Elements and Sources: Mathematical representation of ideal resistors, inductors and capacitors, Real or non-ideal passive elements	3
Module II	
Ideal independent voltage and current sources, Dependent sources.	4
DC Circuits: Ohm's law revisited, ohmic and non-ohmic elements, Kirchoff's current and voltage laws, Series and parallel circuits, Maxwell's mesh current method, Node voltage method, Thevenin's theorem, Norton's theorem, Source transformation and its application, Maximum power transfer theorem	6
Module III	
Two port networks, Open circuit Impedance and Short circuit Admittance parameters, Transmission parameters, hybrid parameters, and their inter-relations	4
Sinusoidal Steady-state Analysis: Sinusoid and its transformation to a phasor, Current and voltage phasors in single-element circuits, Simple R-L and R-C series circuits, Concepts of reactance, impedance, susceptance and admittance as phasors	8
Module IV	
Parallel and series-parallel circuits, Apparent, real and reactive power, Power factor, Maxwell's mesh current method and Thevenin's theorem in AC circuits, Series resonance, Bandwidth and Q-factor, Parallel resonance, Mutual inductance and coupled circuits, general two-port networks.	6
Module V	
Transients in DC Circuits: Application of Laplace Transforms in circuit theory, Concept of s-domain variables. Solution of simple R-L, R-C and R-L-C circuits containing dc excitation	6
3-Phase Circuits: Generation of a balanced, 3-phase supply and its phasor representation, Phase and line voltages and currents for star- and delta-connected loads, Power and reactive power measurement using two-wattmeter method.	5
	48

Books:

1. Network Analysis, M.E.Van Valkenburg (Pearson Education)

2. Engineering Circuit Analysis, W.H.Hayt, J.E.Kenmerly, S.M.Durbin,(TMH)
3. Network and Systems, Ashfaq Husain,(Khanna Book Publisher)
4. Network and Systems, D.Roychowdhury,(New Age International)
5. Modern Netwok Analysis, F.M.Reza & S.Seely, McGraw Hill.

DISCTRETE ELECTRONIC CIRCUITS
Code : EC 301(EI)
Contacts : 3L
Credits : 3

Topic	No. of periods
Module I	
Review of basic transistor circuits: CE, CB and CC modes of operation, Biasing, Q-point.	8
Module II	
Types and classification of amplifiers a) Small signal amplifiers – analysis and frequency response of different modes (CB, CE, CC). b) Large signal amplifiers (Power amplifiers: Class A, Class B, Class C) – analysis, Power and efficiency calculations, push-pull, complementary symmetry, quasi-complimentary symmetry.	12
Module III	
Different configurations of feedback amplifiers-voltage series, voltage shunt, current series and current shunt, effects on gain, i/p and o/p impedances.	8
Module IV	
Oscillator: Criterion for oscillation, RC oscillator - phase shift and Wien Bridge oscillator, LC oscillators – Hartley, Colpitt and tuned circuits.	8
	36

Books:

1. Integrated Electronics: Millman and Halkias, TMH
2. Discrete Electronic Circuits: Schilling and Belove, TMH
3. Microelectronic Circuits : A. S. Sedra and K. C. Smith, Oxford University Press

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MATHEMATICS
Code : M 302
Contacts : 3L + 1T
Credits : 4

Topic	No. of periods
Module I	
Fourier Series: Introduction: Euler's formula; Problems on general Fourier Series; Conditions for Fourier Expansion; Fourier Expansions of Discontinuous Functions; Even and Odd functions; Change of interval; Half range series; Typical Waveforms (Square, Saw-toothed, Triangular, Half Wave rectifier, Full Wave rectifier); Parseval's Identity (statement only); Fourier Transform (FT) and its properties; Inverse Fourier Transform (statement only); Fourier transform of derivative (statement only); Convolution (statement only); Application of Fourier Transform in solving partial differential equations — Laplace's Equation (2D only), Heat Conduction Equation (1D only) and Wave Equation (1D only).	12
Module II	
Calculus of Complex Variable: Functions; Limits and Continuity; Analytic Functions; Cauchy Riemann Conditions; Analytic Continuation; Complex Integration and Cauchy's Theorem; Cauchy's Integral Formula; Taylor's and Laurent Series; Zeros of an Analytic Function; Poles; Essential Singularities; Residue Theorem (statement only) and it's application to evaluation of integral; Introduction to Conformal Mapping; Simple problems.	14
Module III	
Probability and Statistics: Mean, Median, Mode and Standard Deviation; Samples Space; Definition of Probability; Conditional Probability; General Multiplication Theorem; Independent Events; Bayes' Theorem; Random Variable; Discrete and Continuous Probability Distributions - Probability mass function; Probability density function; Distribution Function; Expectation; Variance; Probability Distribution—Binomial, Poisson and Normal. Correlation and Regression; Method of Least Squares; Linear Curve Fitting.	10
Module IV	
Graph Theory: Graphs, Digraphs; Isomorphism; Walk; Path; Circuit; Shortest Path: Dijkstra's Algorithm; Tree; Properties of Tree; Binary Tree; Fundamental Circuit; Minimal Spanning Tree: Kruskal's Algorithm; Prim's Algorithm. Cut Set; Fundamental Cut Set and Cut Vertices; Matrix Representation of Graphs (Adjacency and Incidence Matrices); Network; Flow Augmenting Path; Ford-Fulkerson Algorithm for Maximum Flow; Max Flow – Min Cut Theorem (statement only).	12
	48

Books:

1. Rathor, Choudhari,: Discrete Structure And Graph Theory.
2. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics - Sultan Chand & Sons.
3. Lipschutz S: Theory and Problems of Probability (Schaum's Outline Series) - McGraw Hill Book. Co.
4. Spiegel M R: Theory and Problems of Probability and Statistics (Schaum's Outline Series) - McGraw Hill Book Co.

5. Goon A.M., Gupta M K and Dasgupta B: Fundamental of Statistics - The World Press Pvt. Ltd.
6. Spiegel M R: Theory and Problems of Complex Variables (Schaum's Outline Series) - McGraw Hill Book Co.
7. Bronson R: Differential Equations (Schaum's Outline Series) - McGraw Hill Book Co.
8. Ross S L: Differential Equations - John Willey & Sons.
9. Sneddon I. N.: Elements of Partial Differential Equations - McGraw Hill Book Co.
10. West D.B.: Introduction to Graph Theory - Prentice Hall
11. Deo N: Graph Theory with Applications to Engineering and Computer Science - Prentice Hall.
12. Grewal B S: Higher Engineering Mathematics (thirtyfifth edn) - Khanna Pub.
13. Kreyzig E: Advanced Engineering Mathematics - John Wiley and Sons.
14. Jana- Undergradute Mathematics
15. Lakshminarayan- Engineering Math 1.2.3
16. Gupta- Mathematical Physics (Vikas)
17. Singh- Modern Algebra
18. Rao B: Differential Equations with Applications & Programs, Universities Press
19. Murray: Introductory Courses in Differential Equations, Universities Press
20. Delampady, M: Probability & Statistics, Universities Press
21. Prasad: Partial Differential Equations, New Age International
22. Chowdhury: Elements of Complex Analysis, New Age International
23. Bhat: Modern Probability Theory, New Age International
24. Dutta: A Textbook of Engineering Mathematics Vol.1 & 2, New Age International
25. Sarveswarao: Engineering Mathematics, Universities Press
26. Dhami: Differential Calculus, New Age International

DIGITAL INTEGRATED CIRCUITS
Code : EC 302(EI)
Contacts : 4L
Credits : 4

Topic	No. of periods
Module I	
Number systems and codes - Positional number system, Radix conversion, Different types of BCD, ASCII, EBCDIC, Gray.	3
Binary Arithmetic - R's and (R-1)'s complement representation, Subtraction using 1's and 2's complement representation, Concept of overflow, BCD addition.	4
Fundamental logic operators, Boolean Algebra.	2
Module II	
Combinational Logic Design – Definition, Truth Table, SOP and POS realization from truth table	2
Logic minimization using K-map, Minterms and Maxterms, Minimization with don't care terms; Examples. Concept of combinational hazard	2
Quine-McClusky's tabular method of logic minimization	2
Examples of combinational logic design : Adder / Subtractor circuits; 2's complement ripple carry adder/subtractor circuit, Parity generator/checker circuit, Circuit for Binary to Gray and Gray to Binary conversion.	4

Encoder, Decoder, Demultiplexer and Multiplexer, Function realization using decoder and multiplexer.	4

Module III

Sequential machine design - Concept of Moore and Mealy machine, State transition diagram and State transition table	2
Various memory elements, latch and its use, Clocked flip-flops, SR, JK, D, T. Timing constraints on edge triggered flip-flops	4
Conversion of one type of Flip-flop to another type, Design of sequence detector. Asynchronous and synchronous counter design. Different types of registers. Sequence generator.	8

Module IV

Programmable Logic Devices – PROM, PLA, PAL, FPGA	4
Integrated Circuit Logic Families - TTL, PMOS, NMOS, CMOS	4
	45

Books:

1. Leach & Malvino—Digital Principles & Application, TMH
2. M. Mano - Digital Logic Design, Pearson .
3. Digital Fundamentals – T. L. Floyed, Pearson .

ELECTRICAL MEASUREMENTS AND INSTRUMENTS
Code : EE 302(EI)
Contacts : 4L
Credits : 4

Topic	No. of periods

Module I

General features – Construction and principle of operation of moving coil, moving iron, Dynamometer, Thermal and Rectifier type deflecting instruments. Deflecting, controlling and damping torques, extension of instrument ranges using shunts, multipliers and instrument transformers.	14

Module II

Measurement of low, medium and high resistances, Kelvins double bridge, multimeters, megger, localization of cable faults using Murray and Varley loop methods.	9

Module III

D.C. and A.C. potentiometers, Measurement of high voltage, Electrostatic instruments, measurement of inductances, capacitance and frequency by A.C. Bridges – Maxwell, Schering, Anderson, De-Sauty, Wien.	12

Module IV

Measurement of active power in polyphase circuits, various wattmeter connections. A.C. and D.C. energy meters.	8
	43

Books:

1. Golding E.W. & Wides F.C. : Electrical Measuring Instruments & Measurements ; Wheeler
2. Harris, F. K. – Electrical Measurements, Wiley.

NUMERICAL METHODS AND PROGRAMMING
Code : CS 302
Contacts : 3L + 1T
Credits : 4

Topic	No. of periods
Module I	
Computer Number Systems; Overflow and underflow; Approximation in numerical computation; Truncation and round off errors; Propagation and control of round off errors; Chopping and rounding off errors; Pitfalls (hazards) in numerical computations (ill conditioned and well conditioned problems).	4
Interpolation: Lagrange's Interpolation, Newton's forward & backward Interpolation Formula. Extrapolation; Newton's Divided Difference Formula; Error; Problems.	6
Module II	
Numerical Differentiation: Use of Newton's forward and backward interpolation formula only.	2
Numerical Integration: Trapezoidal formula (composite); Simpson's 1/3rd formula (composite); Romberg Integration (statement only); Problems.	4
Numerical Solution of System of Linear Equations: Gauss elimination method; Matrix Inversion; Operations Count; LU Factorization Method (Crout's Method); Gauss-Jordan Method; Gauss-Seidel Method; Sufficient Condition of Convergence.	4
Module III	
Numerical Solution of Algebraic and Transcendental Equations: Iteration Method: Bisection Method; Secant Method; Regula-Falsi Method; Newton-Raphson Method.	6
Numerical solution of Initial Value Problems of First Order Ordinary Differential Equations: Taylor's Series Method; Euler's Method; Runge-Kutta Method (4^{th} order); Modified Euler's Method and Adams-Moulton Method.	6

Module IV

C Language Overview: Loop; Recursion; Function; Array; Pointers; Structures and Unions; Various types of File Access Methods: Sequential, Indexed Sequential, Random; Binary. Various types of Files in C and Various types of File Handling Statements in C. Implementation above Numerical & Statistical Problems in C Language;	14
	46

Books:

1. Numerical Analysis & Algorithms, Pradeep Niyogi, TMH, 1st ed.
2. C Language and Numerical Methods by C.Xavier
3. Introductory Numerical Analysis by Dutta & Jana
4. Numerical Method:Balagurusamy
5. Numerical Mathematical Analysis by J.B.Scarborough
6. Numerical Methods (Problems and Solution) by Jain, Iyengar , & Jain
7. Numerical Methods In Computer Applications – P.U.Wayse. EPH
8. Computer Oreinted Numerical Method- Dutta,N. ,Vikas
9. Numerical Methods with Programs in Basic Fortran Pascal & C++ - S.B.Rao, Universities Press
10. Computer Programming & Numerical Analysis – N.Dutta, Universities Press
11. Numerical Methods for Engineers – Gupta, New Age International
12. Numerical Solutions of Differential Equations – Jain M.K.,New Age International
13. Numerical Methods for Scientific & Engg Computation – Jain M.K.,New Age International
14. Numerical Analysis – Rao G.S.,New Age International
15. Discrete Mathematical Structures – Rao G.S., New Age International
16. Foundations of Discrete Mathematics – Joshi K.D., New Age International
17. Applied Discrete Structures – Joshi, New Age International
18. Groups, Rings & Modules with Applications – Adhikari, M.R.,Universities Press

ANALOG INTEGRATED CIRCUITS
Code : EC 401(EI)
Contacts : 4L
Credits : 4

Topic	No. of periods

Module I

Operational Amplifier Fundamentals: Amplifier Fundamentals, The Operational Amplifier, Op-Amp Characteristics. Op-Amp in open loop comparator mode, Different applications	2
Linear Op-Amp Circuits: Basic Op-Amp Circuits, V-I Converter with floating and grounded load, Current amplifier, Difference amplifier, Instrumentation amplifier, Analysis of some typical Op-Amp circuits.	6

Module II

Non-linear Op-Amp Circuits: Schmitt trigger and applications, Precision rectifiers, Analog switches, Peak detectors, S/H circuits	6
Practical Op-Amp limitations: D.C errors, Slew rate, Frequency response, Noise effect	2

Module III

Ideal and Practical Integrators, Differentiators and solution of differential equations.	4
Active filters, Realization of Butterworth filters	2
Generalized Impedance Converter	2

Module IV

Multivibrators : Astable, Monostable	4
Signal Generators: Wien bridge oscillator, Triangular wave generator, Sawtooth wave generator	5
Log/Antilog Amplifiers, Analog Multipliers and their applications	3

Module V

IC Voltage regulators – IC 723, 317, 78xx	3
Analogue to Digital Converters, Successive Approximation type, Dual Slope Integrator type and Flash type. Digital to Analog Converters.	6
Integrated Circuit Timer 555 and its applications	3
	48

Book:

1. Millman & Halkias – Integrated El;ectronics, Tata McGraw Hill.
2. Franco—Design with Operational Amplifiers & Analog Integrated Circuits, TMH
3. Schilling & Belove—Electronic Circuit : Discrete & Integrated , TMH
4. Gayakwad R.A - OpAmps and Linear IC's, Pearson .
5. Coughlin and Driscoll – Operational Amplifier and Linear Integrated Circuits – Pearson Education Asia.

SENSORS AND TRANSDUCERS
Code : EI 402
Contacts : 4L
Credits : 4

Topic	No. of periods

Module I

Definition, principles of sensing and transduction, classification	1
Mechanical and Electromechanical sensors	1
▪ Resistive (potentiometric) type: Forms, materials, resolution, accuracy, sensitivity	2
▪ Strain Gauges: theory, types, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesives, rosettes	2
▪ Inductive sensors: common types- reluctance change type, mutual inductance change type, transformer action type, magnetostrictive type- brief discussion with respect to materials, construction and input output variables, Ferromagnetic plunger type-short analysis	3
▪ LVDT: Construction, materials, output-input relationship, I/O curve, discussion	2
▪ Proximity sensor	1

Module II

Capacitive sensors: Variable distance- parallel plate type, Variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type: calculation of sensitivities	3
Stretched Diaphragm type: microphones, response characteristics	2
Piezoelectric elements: piezoelectric effects, charge and voltage coefficients, crystal model, materials, natural and synthetic types – their comparison, force and stress sensing, ultrasonic sensors	3

Module III

Thermal sensors: Material expansion type: solid, liquid, gas and vapour	2
Resistance change type: RTD, materials, construction, tip sensitive and stem sensitive type, Thermister materials, shapes, ranges, accuracy specifications.	3
Thermoemf sensors: types, thermoelectric powers, general consideration	1
Junction semiconductor type IC and PTAT type	2
Radiation sensors: types, characteristics and comparisons	2
Pyroelectric type	1

Module IV

Magnetic sensors: Sensors based on Villari effect for assessment of force, torque, proximity; Wiedemann effect for yoke coil sensors, Thomson effect. Hall effect and Hall drive, performance characteristics	4
Radiationsensors: LDR, photovoltaic cells, photodiodes, photo emissive cells- types, materials, construction, response	2
Geiger counters, Scintillation detectors	2
Introduction to Smart sensors	2
	41

Books:

1. D Patranabis, Sensors and Transducers, PHI, 2nd ed.
2. E. A. Doebelin, Measurement Systems: Application and Design
   Mc Graw Hill, New York
3. H. K. P. Neubert, Instrument Transducers, Oxford University Press, London and Calcutta

INDUSTRIAL INSTRUMENTATION-I
Code : EI 403
Contacts : 4L
Credits : 4

Topic	No. of periods

Module I

Static and Dynamic errors: Standard inputs and system analysis for evaluation of such errors. Definition of precision, hysteresis, nonlinearity, sensitivity, speed of response,	4

fidelity.	
Statistical error analysis, mean, median, mode, average, estimates, distribution, probable error, standard deviation, test of normal distribution, chi-squared test curve fitting (a) method of sequential differences (b) method of extended differences and (c) method of least squares	6

Module II

Industrial weighing systems : Link–lever mechanism, Load cells – pneumatic, piezo-electric, elastic and magneto-elastic types - their mounting, pressductor, different designs of weighing systems, conveyors type, weighfeeder type.	6
Linear and angular measurements; Measurement of straightness, flatness, roundness and roughness.	3

Module III

Measurement of Force, Velocity, Acceleration, Torque, Strain gauge or piezoelectric force cells, Tachometers – Eddy current type, Stroboscopes, Encoders, non-contact type rpm meters (optical & magnetic), seismic accelerometer, piezoelectric accelerometer, Measurement of vibration and shock.	6
Small displacement measurement/ Proximity measurement - Inductive / magnetic, optical, capacitive and ultrasonic techniques Flapper nozzle system- pneumatic force balance and motion balance system.	4

Module IV

Pneumatic relay, filters, regulators, pneumatic transmitters, Electronic transmitters - hardware/software, linearization, isolation.	6
Reliability: definition on the basis of Gaussian and normal distribution function, MTTF, Bath Tub curve, operating life and cumulative failure analysis.	4
Instrumentation in hazardous area: site, material and temperature classification. Intrinsic safety, pressurization, incendiary and non-incendiary systems, Combustible gas detection, enclosures- explosion proof type, other classification. Safety standards: IP and NEMA.	5
	44

Books:

1. D. Patranabis, Principles of Industrial Instrumentation, TMH, New Delhi, 2nd Ed.
2. D.V.S. Murthy, Transducers and Instrumentation, PHI, Delhi
3. B. G. Liptak, Instrument Engineers Handbook, vol-I and vol-II, Chilton Book Co. Philadelphia
4. M.M.S. Anand, Electronic Instruments and Instrumentation Technology, PHI, Delhi
5. D. Patranabis, A Textbook of Instrumentation and Control, Umesh Publications, Delhi.

COMPUTER ORGANIZATION AND ARCHITECTURE
Code : CS 404(EI)
Contacts : 3L
Credits : 3

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Topic	No. of periods

Module I

Brief history of Computers, General organization of a digital computer, Introduction to Von Neumann architecture	4
Interconnection Structure, Bus, Bus interconnection	2

Module II

Arithmetic Logic Unit: arithmetic and logic operations, arithmetic and logic operands, construction of an arithmetic and logic unit, bit slice unit, IEEE standards for floating point number representation, truncation techniques	8
Processor organization, Register organization, Instruction cycle	4

Module III

Instruction sets, formats and types	2
Control unit design, Hardwired and Microprogrammed control	8

Module IV

Semiconductor, magnetic and optical memories (Primary, Secondary and tertiary storage), memory organization, virtual memory, cache memory and interleaved memory, CD ROM, Static and Dynamic RAM	4
Interrupt, interrupt generation, interrupt handling and interrupt service routine, exception,	2
Concepts of I/O organization, Data transfer methods, Programmed I/O, DMA, Interrupt based transfer, I/O channels, I/O processors	2

Module V

Architecture classification, Parallel computers-classification, Harvard architecture, Pipelining, pipeline hazards, Multiprocessors, Array processors	8
	44

Books:

1. Computer Architecture & Organization, J.P.Hayes, McGraw Hill
2. Computer System Architecture, M. Mano, Pearson .
3. Computer Organisation & Architecture, W. Stallings, Pearson .
4. Computer Architecture – A Quantitative Approach, John Hennessy and David A Patterson.

MICROPROCESSORS AND MICROCONTROLLERS
Code : EI 405
Contacts : 4L
Credits : 4

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Topic	No. of periods

Module I

Introduction to microprocessors : Hardware Overview of 8085: Internal architecture, Address bus, Data bus and Control bus, Clocking, Reset operation, Status pins	2
Programming the 8085: Introduction to microprocessor programming paradigm, Assemblers, Linkers, Loaders and Cross-compilers. Assembly language Programming - Instruction format, Instruction set. Use of flowcharts to build-up simple programs, Stack and Stack handling, Programming exercises	12

Module II

Timing Diagrams: Instruction cycle, machine cycle, T-states. Analysis of Memory and I/O read/write cycles. Generic state transition diagram	4
Interrupts: Introduction, Interrupt vector table, Interrupt service routine, Interrupt timing, Design of programs using interrupts	5

Module III

Data Transfer Schemes & Interfacing: Serial and parallel data transfer schemes, Polling and interrupt driven data transfer, Direct memory access, Interfacing input-output ports, Programmable peripheral devices (PPI) – Intel 8255, Programmable interval timer – Intel 8254, Interfacing A/D and D/A converters	8

Module IV

Introduction to single chip microcontrollers: Intel MCS-51 family features - 8051/8031 architecture - pin configuration - basic assembly language programming & application examples.	12
	43

Books:

1. Douglas V. Hall – Microprocessors & Interfacing, Tata McGraw-Hill
2. Predko, Programming & Customising 8051 Microcontroller, TMH
3. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085A/8080A, Wiley Eastern Limited.
4. Muhammed Ali Mazidi and Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education Inc., Fifth Edition, 2003

DATA STRUCTURES AND ALGORITHMS
Code : CS 405(EI)
Contacts : 4L
Credits : 4

Topic	No. of periods

West Bengal University of Technology
BF-142, Salt Lake City, Kolkata-700064

Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Module I

Time and Space Analysis of Algorithms -Order Notations	4
Linear Data Structures -Sequential Representations -Arrays and Lists, Stacks, Queues and Dequeues, Strings. Applications.	8

Module II

Linked Representation Linear linked lists. Circular linked lists. Doubly linked lists, Applications.	5
Recursion Design of recursive algorithms, Tail Recursion, When not to use recursion. Removal of recursion.	4

Module III

Non-linear Data Structures: Trees - Binary Trees, Traversals and Threads. Binary Search Trees, Insertion and Deletion algorithms. Height-balanced and weight-balanced trees, B-trees, B+- trees, Application of trees	10

Module IV

Graphs Representations. Breadth, first and Depth-first Search, Shortest Path algorithm, Minimal Spanning Tree.	4
Hashing .Hashing Functions, Collision Resolution Techniques.	3

Module V

Sorting and Searching Algorithms -Bubble sort. Selection Sort. Insertion Sort, Quick sort, Merge Sort. Heap sort and Radix Sort	8
	46

Books :

1. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., “Data Structures and Algorithms”, Pearson .
2. Horowitz Ellis & Sartaj Sahni, “Fundamentals of Data Structures”, Galgotria Pub.
3. S. Chattopadhyay, D. Ghoshdastidar and M. Chattopadhyay, “Data Structures through C Language”, BPB Publications
4. Weiss Mark Allen, “Algorithms, Data Structures, and Problem Solving with C++”, Pearson ..

INDUSTRIAL INSTRUMENTATION-II
Code : EI 501
Contacts : 4L
Credits : 4

Topic	No. of periods

Module I

Measurement of Pressure and Vacuum:	

Pressure: Manometer- various types, accuracy, ranges. Elastic types - Bourdon gauge, diaphragm type, Bellows element type Pressure and DP switches. D/P transmitters, Electronic type :capacitive, piezoresistive and resonator type. Installation of pressure measuring devices and systems with accessories like seals, snubbers, manifolds. Vacuum: Mcleod Gauge, thermal conductivity gauge, ionization gauge	11

Module II

Temperature Measurement: Temperature scale, ITS 90, fixed points and interpolation equations Filled in systems: liquid, gas and vapour, ranges, media, errors, construction details and comparison, classification Bimetal elements, Thermostats, RTD: measuring circuits, ranges, errors and minimization of errors Thermocouples including MI thermocouples: Circuits, ranges, errors, cold junction compensation, compensating cables Thermowell IC temperature sensors.Thermistors: material, construction, analysis, errors and ranges, temperature switches Radiation Thermometer sensors used, spectral and other characteristics, Optical Pyrometers.	10

Module III

Level Measurement : Gauge glass, float, displacers and hydrostatic types - their construction, errors and ranges, D/P type sensors and their installation arrangement. Capacitive type, Conductivity type Bi-colour level gauges, Magnetic level gauges Ultrasonic type, Microwave type, Radiation type Level gauges Level switches	8

Module IV

Flow rate Measurement: General consideration of fluid flow rate meters, units etc. Laminar flow, Reynolds's number, Effect of temperature and pressure on flow rate measurement, Calibration of flow meters. Head type: orifice, venturi, flow nozzle, annubar- analysis and calculation. Area flow meter: Rotameter and Piston type. Mass flow meter: Coriolis, Thermal, Impeller type. Electromagnetic type, Ultrasonic type, Vortex type, Turbomagnetic type,	16

Target type. Positive displacement type. Open channel flowmeter. Solid flowrate measurement .	
	45

Books:

1. D. Patranabis, Principles of industrial Instrumentation, TMH, New Delhi, 2nd Ed.
2. B. G. Liptak, Instrument Engineers Handbook, vol-I and vol-II, Chilton Book Co. Philadelphia
3. D. M. Considine and G. D. Considine (Eds.) Process Instruments and controls Handbook, Mc Graw Hill, New York

MICROPROCESSOR BASED SYSTEMS
Code : EI 502
Contacts : 4L
Credits : 4

Topic	No. of periods

Module I

INTRODUCTION Block Diagram of a typical microprocessor based system pointing out the role of microprocessor and other peripheral blocks.	1
MICROPROCESSOR Intel 8086/8088 Microprocessor: Architecture, Clock Generator, Resetting the microprocessor, Wait State Inserting, Bus Buffering, Interrupts, and Assembly Language Programming.	12

Module II

Interfacing Memory Classification, Memory Timing, Interfacing requirements, Interfacing Slow Memory, Interfacing Static RAM (6116 – 2K, 6264 – 8K), Interfacing EPROM (2764 – 8K, 27256 – 32K), Address decoding (using logic gates and decoders, using PAL), Designing Memory Modules (higher capacity say 512K) using memory chips (say 8K), Interfacing Memory Modules to the microprocessor, Interfacing Dynamic RAM, Non Volatile Memories	9

Module III

Interfacing I/O Devices I/O Controllers – 8279, 8259A, 8237A	12

Interfacing of Digital I/O Devices: Handshaking Logic, Programmed I/O, Interrupt driven I/O, Direct memory access, High Power Device Interfacing – Wave shaping, Driving and level shifting, Isolation Examples: Interfacing and assembly language monitor program for Key Board (one dimensional, two dimensional) and Display (7-segment, dot-matrix, alphanumeric)through 8255A and 8279, Data Transfer between two microprocessor based systems through 8255As, Mechanical and solid state Relays, Stepper Motor. Analog Interfacing and Industrial Control: Examples: Interfacing and assembly language monitor program for D/A Converter (MC1408 8-bit D/A, DAC 1208 12-bit D/A), A/D Converter (ADC0808 8-bit ADC, ICL7109 12-bit ADC)	

Module IV

System Design Designing microprocessor based systems with monitor programs for single/ multipoint Temperature Monitoring, Data Logger.	6
Serial Communication: Asynchronous serial data communication, Serial Data transmission methods and standards, USART and Intel 8251, RS-232C Serial Data Standard.	6
	46

Books:

1. Douglas V. Hall – Microprocessors & Interfacing, Tata McGraw-Hill
2. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
3. Predko, Programming & Customising 8051 Microcontroller, TMH
4. John Uffenbeck – Microcomputers and Microprocessors, PHI/ Pearson Education
5. Chowdhury & Chowdhury, Microprocessor & Perpherals, Scitech
6. Thyagarajan, Microprocessor & Microcontrollers, Scitech
7. Michel Slater – Microprocessor Based Design, PHI
8. Walter A. Tribel – The 8088 and 8086 Microprocessors, Pearson Education
9. Barry B. Brey – The Intel Microprocessors, PHI/Pearson Ed. Asia
10. Mathivanan, Microprocessors PC Hardware & Interfacing, PHI

CONTROL THEORY
Code : EE 511(EI)
Contacts : 4L
Credits : 4

Topic	No. of periods

Module I

Introduction: Control systems, Physical elements of a control system, Abstract elements of a control system, The design process	2

Mathematical Model of Physical Systems: Introduction, Differential equation representation of physical systems, Transfer function concepts, Block diagram algebra, Signal flow graphs, Concepts of state, state variables and state model, State models of linear continuous-time systems, Concept on Controllability and Observability, Illustrative examples.	4
Feedback Characteristics of Control Systems: Introduction, Reduction of parameter variation by use of feedback, Control of system dynamics by use of feedback, Control of effects of disturbance signals by use of feedback, Regenerative feedback, Illustrative examples.	4

Module II

Control System Components: Introduction, DC servomotors, DC tacho-generators, AC servomotors, AC tacho-generators, Stepper motors, Synchro error detectors, Areas of Application.	4
Time Response Analysis: Introduction, Standard test signals, Performance indices, Time response of first order system, Time response of second order systems, Design specifications of second order systems, Compensation schemes, Design specifications of higher order systems.	6

Module III

Stability Analysis in Time Domain: The concept of stability, Assessment of stability from pole positions, Necessary conditions for stability, Routh Stability Criterion, Relative stability analysis, Illustrative examples.	6
Root Locus Technique : Introduction, The root locus concept, Root locus construction rules, Root contours, Case studies.	3

Module IV

Frequency Response Analysis: Introduction, Performance indices, Frequency response of second order systems, Polar plots, Bode plots, All pass systems, Minimum-phase and Non-minimum-phase systems, Illustrative examples.	6

Module V

Stability Analysis in Frequency Domain: Introduction, A brief review of Principle of Argument, Nyquist stability criterion, Assessment of relative stability – Gain Margin and Phase Margin, Closed loop frequency response, Illustrative examples.	6
Introduction to Design: The design problem, Concepts of cascade and feedback compensation, Realization of basic compensators, Case studies.	4
	45

Books :

1. Nagrath I. J. and Gopal M.,"Control Systems Engineering", New Age International (P) Ltd.
3. Ogata K, "Modern Control Systems", Pearson Education
4. Benjamin C. Kuo, "Automatic Control Systems", PHI
5. Gopal: Modern Control System, New Age International

ANALOG COMMUNICATION
Code : EC 511(EI)
Contacts : 4L

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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Credits : 4

Topic	No. of periods
Module I	
Signal Transmission through Linear Systems : Condition for distortionless transmission of signals through networks. Different types of distortion and their effect on the quality of output signals. Transmission of transient signals, distortion analysis.	6
Module II	
Amplitude Modulation : Modulation principle and definitions, spectrum and power considerations, DSB,SSB, VSB and AM principles. Different type of modulator circuits, Square law modulator, Balanced modulator. Different circuits for generation of SSB and VSB. Basic principle of coherent detections, Square law detectors, Average envelope and peak envelope detectors. Carrier recovery.	14
Module III	
Frequency and Phase Modulation : Principles and definitions, Relationship between frequency and phase modulations. Circuit for realization of FM and PM. Different type of demodulator, discriminator, use of PLL etc.	14
Module IV	
Basic block diagram of radio transmitter (AM and FM), Basic block diagram of a radio receiver, Super-heterodyne principle, its advantages. Mixer principle and circuit, AGC.	6
Module V	
System Noise : Signal to noise ratio of SSB, DSB, AM for coherent and envelope and square law detection, Threshold effect. Signal to noise calculation for FM and threshold.	6
	46

Books :

1. G. Kennedy -Electronic Communication System , TMH
2. Lathi B.P., HRT -Modern Digital and Analogue Communications System , Rinhart & Winstory Inc. Int. End.
3. Hancock – An introduction to the Principles of Communication Theory –TMH.
4. Singh& Sapre: Communication Systems: Analog and Digital, TMH
5. Taub and Schilling – Principles of Communication system –TMH
6. Haykin S. - Communication systems –PHI
7. Carlson R.B. – Communication Systems 4 /e, Mc. Graw Hill.

DIGITAL SIGNAL PROCESSING
Code : EC 512(EI)
Contacts : 4L
Credits : 4

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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Topic	No. of periods
Module I	
Description of Signals and Systems: Types of signals and their characteristics, types of systems and their behavior.	2
Discrete-time description of signals: Discrete-time sequences, their frequency domain behaviour, comparison with analog signals, convolution of two sequences, sampling a continuous function to generate a sequence, reconstruction of continuous-time signals from discrete-time sequences.	4
Module II	
Discrete-time description of systems: Unit-sample response of a system, Time-invariant systems, Superposition principle for linear systems, Stability criterion for discrete-time systems, Causality criterion for discrete-time systems, Linear constant-coefficient difference equations.	6
Module III	
Discrete-time Fourier transform: Definition of Fourier transform (FT), important properties of FT, properties of FT for real-valued sequences, use of FT in signal processing, FT of special sequences, the inverse FT, FT of the product two discrete-time sequences	4
Discrete Fourier Transform: The definition of the Discrete Fourier Transform (DFT), computation of the DFT from the discrete-time sequence, properties of the DFT, circular convolution, performing a linear convolution with the DFT, computations for evaluating the DFT	6
Module IV	
Z-transform: Definition of the z-transform, properties of the z-transform, the system function of a digital filter, combining filter sections to form more complex filters, digital filter implementation from the system function	6
Relationship between the Fourier transform and the z-transform, the z-transform of symmetric sequences, the inverse z-transform	3
Module V	
Digital filter: Definition and anatomy of a digital filter, frequency domain description of signals and systems, typical applications of digital filters, replacing analog filters with digital filters, filter categories: IIR and FIR, recursive and non-recursive	6
Digital Filter Structures: The direct form I and II structures, Cascade combination of second-order sections, parallel combination of second-order sections, Linear-phase FIR filter structures, Frequency-sampling structure for the FIR filter.	6
Effect of word length: Round off error, truncation error, qunatization error, limit cycle	2
	45

Books :

1. Theory and Applications of Digital Signal Processing – Rabiner and Gold, Pearson
2. Digital Signal Processing – Oppenheim and Schafer, Pearson
3. Digital Signal Processing : A Computer Based Approach, Sanjit K. Mitra, TMH

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PROCESS CONTROL –I
Code : EI 601
Contacts : 4L
Credits : 4

Topic	No. of periods
Module I	
The basic process control loop - different blocks in it, how is it different from 'servo' loop.	2
Process modelling, process equations – their limitations - general approach. Typical processes and derivation of their transfer functions.	3
Effect of disturbances and variation in set point in process control. Offset - why does it appear, analysis, how is it eliminated ?	3
Module II	
Process Reaction Curves, Controllability - using (i) deviation reduction factors (ii) gain bandwidth product, State controllability, Self regulation.	4
Schemes and analysis of (i) On-off control, Time proportional control (ii) PI and PID Control – Ziegler – Nichols method, Cohen - Coon method and 3-C method of parameter adjustment	2 3
Module III	
Controllers - development, diagrams and brief analysis (i) Pneumatic (ii) Hydraulic (iii) Electronic (iv) Test of Controllers	5
Multiloop control strategies: schemes, brief analysis and uses (i) Ratio control (ii) Cascade control (iii) Feedforward control (iv) Multivariable control	6
Module IV	
Schemes of control of Flow, Level, Pressure, Temperature.	3
Final Control Element: Types of Actuators and Control valves, Safety and solenoid valves, Pneumatic Actuators, Electrical Actuators, Valve characteristics, Cv values, Valve sizing, Valve selection, cavitation, linearization, positioners, P-I and I-P converters (Drive circuits for Electrical Actuators).	7
Module V	
Elements of a digital control loop. Development of a control algorithm, Direct digital control, Hierarchical control.	2
Control of a specific plant like: (i) Distillation column.	6

(ii) Combustion control in a boiler. (iii) Drum Level Control.	
	46

Books:

1. D. Patranabis, Principles of Process Control, TMH, New Delhi, 2nd Ed.
2. D. P. Eckman, Automatic Process control, John Wiley, New York
3. B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia
4. P. Harriott, Process control, Mc Graw Hill, New York

DIGITAL COMMUNICATION
Code : EC 601(EI)
Contacts : 4L
Credits : 4

Topic	No. of periods
Module I	
Introduction to Pulse Code Modulation, Linear and Non-linear quantization, Calculation of Quantization Errors, Inter symbol Interference, Eye Pattern and Equalization, Delta Modulation.	6
Quantization Error, Limitations of Delta Modulation - Slope Overload. Adaptive Delta Modulation, Differential PCM, Linear Predictive Encoding.	6
Module II	
Base-band Signal Receivers, Optimum Filtering, Matched Filtering. Coherent Reception Correlation, ASK, PSK, DPSK, FSK, MSK Principles, Error analysis of coherent detection of PSK and FSK signals QPSK, MSK Principles and System	10
Module III	
Time Division Multiplexing - Pulse Stuffing and Word Stuffing, Frequency Division Multiplexing and Concept of Code-Division Multiplexing.	6
Need for synchronization, Bit Synchronizer, In-phase and Mid-phase Synchronizer, Early late Gate Synchronizer, Frame Synchronization.	6
Module IV	
Fixed Equalizer, Linear Equalizers and Decision Directed Equalizers, Partial Response Signaling.	6
Block Codes. Definitions, Generator and Parity Check, Matrix Error Control Capacity, Standard Array, Cyclic Codes-Description, Encoding with an (n-k) Stage Shift Registrar and (k) - Stage Shift Register, Syndrome Calculation and Error Detection	6
	46

Books :

1. Digital and Analog Communication Systems - Leon W. Couch, II, Pearson Education
2. Modern Digital and Analog Communication Systems - B. P. Lathi, Oxford University Press

3. Digital Communications- Fundamentals and Applications - Bernard Sklar, Addison Wesley Longman

OPTOELECTRONICS AND OPTICAL INSTRUMENTATION
Code : EI 602
Contacts : 4L
Credits : 4

Topic	No. of periods
Module I	
Introduction- Definitions, wave- particle duality, radiometry principles	2
Geometrical optics: Optical path, formation principle, image formation, refractive index, Hygienic principle of wave front, laws of reflections and refractions. Gaussian and Newtonian formulae for single surface, simple lenses, mirrors, primary observations	5 5
Module II	
Mechanism of eye, single camera, aperture and stops Microscope, telescope, Numerical aperture, profile projector Dispersion - prisms, refractometers - gratings, monochromator, spectrometer	4 5 2 3
Module III	
Optoelectronics : LED, LDR, photoelectric cells, PIN diodes, photo diodes, optoisolators, optocouplers – characteristics, noise figures, applications	5
Laser sources – mechanisms of generations, types – gas, liquid, semiconductors, general analysis	5
Module IV	
Fiber optics, materials, construction, operational modes, applications as sensors	5
Holographic techniques	4
	45

Books:

1. P. Bhattacharjee, Semiconductor Optoelectronic Devices, Pearson
2. W. Hawkes, Optoelectronics- An Introduction, PHI
3. C. K. Sarkar, Optoelectronics and Fiberoptics communication, New Age International

COMPUTER NETWORKING
Code : CS 611(EI)
Contacts : 4L
Credits : 4

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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Topic	No. of periods

Module I

Introduction of Computer Networks and Data Communication Services, Roles of Network	2
Network Topologies, Data Transmission modes – Simplex, Duplex, Half-duplex, The Reference Models: OSI, TCP/IP	6

Module II

Physical layer, Different communication media, Digital to digital encoding techniques, Digital to analog encoding techniques, QAM, Synchronous and asynchronous data transmission, DTE and DCE, Circuit switching, packet switching and message switching, Multiplexing, ISDN services, ATM networks	9

Module III

Introduction to mobile communication – GSM and CDMA, Ad hoc Networks	2
Design of data link layer, data link protocol, framing, error and flow control. Error detection and correction. Example of data link protocols – HDLC, Multiple access protocols – CSMA/CD, Wireless LAN protocols, IEEE standards	8

Module IV

Network layer - its internal organization, routing algorithms, hierarchical routing, routing for mobile hosts, congestion control algorithms. The network layer in Internet, the IP protocol/addresses/header	6
Transport layer services, Internet transport protocols	2
Network Devices – Repeater Hub, Switch, Bridge, Router, Gateway	1

Module V

TCP/IP protocols – ARP, RARP, BOOTP, Telnet, FTP, DNS, HTTP, SMTP, DHCP, The Electronic Mail, Email gateways, the World Wide Web	8
Network security concepts.	2
	46

Books:

1. A S Tanenbaum – Computer networks, Prentice Hall of India, 3rd Ed/ Pearson Education
2. W Stallings – Data & Computer Communication, Peasrson Education
3. Forouzan, Data Communication & Networking, (3rd Edition), TMH
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data Communication & Networking, PHI

ELECTRONIC INSTRUMENTATION AND MEASUREMENTS
Code : EI 603
Contacts : 4L
Credits : 4

Topic	No. of periods

West Bengal University of Technology
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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Module I

Building blocks of Electronic Instruments: Voltage controlled oscillators, Phase Locked Loop, Charge Amplifier, Programmable Gain Amplifier, Current Mirror, Voltage to frequency and frequency to voltage converters	8

Module II

Analogue Electronic Instruments: Introduction, Basic Emitter Follower Voltmeter, Voltmeters with IC Operational Amplifiers, True R.M.S Voltmeter, Peak Response and rectifying type AC Voltmeters, Digital voltmeters, Electronic Ohmmeters, Q meter	8

Module III

Current measurement with Analogue Electronic Instruments – Current-to-voltage converter type Electronic Ammeters, Chopper stabilized amplifiers for measurement of very low voltages and currents.	4
Electronic Measurement of Power.	2

Module IV

Cathode ray oscilloscopes and its applications: Cathode Ray Tube, Deflection Amplifiers, Oscilloscope Time Base, Dual-Trace Oscilloscopes, Oscilloscope Controls, Oscilloscope Probes, Delayed time base oscilloscope, Digital Storage Oscilloscope.	6
Digital instruments: Introduction, Basic Digital Displays – LEDs and LCD panels. Display Drivers and Latches, Time Base generation with Crystal Oscillators and Dividers.	3
Design and Implementation of a simple Digital Frequency Meter, Errors in frequency measurement – possible remedies, Time and Ratio measurement.	4

Module V

Spectrum Analyzer	3
Introduction to Virtual Instrumentation	3
Interference and Noises	4
	45

Books:

1. Helfrick A.D. & Cooper W.D. : Modern Electronic Instrumentation & Measuring Instruments; Pearson
2. Bell, David : Electronic Instrumentation & Measurement, Reston Publishers
3. Wolf S., Student Reference Manual for Electronic Instrumentation Laboratories, Englewood Cliffs, Prentice Hall

TELEMETRY AND REMOTE CONTROL
Code : EI 701
Contacts : 4L
Credits : 4

Topic	No. of periods

West Bengal University of Technology
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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Module I

Purpose of telemetry, basic scheme, voltage, current and frequency telemetry, line length limitations	2
Concepts of Information transfer, bits, symbols, codes -source, line, channel, BCD, ABCII, BAUDOT, AMI, CMI, Manchester, HDBM, Block, Differential, Hamming, Conduction	6

Module II

Modulation codes: PAM, PFM, PTM, PCM	2
Bit error rate, Inter symbol, noise, parity checking	3
Review of modulation and multiplexing: FM-AM, FM-FM, PAM-AM, PAM-FM, PCM-AM, etc. Quantization and conversion methods, error in quantization, bandwidth consideration	2

Module III

FDM systems, IRIG standards in FDM systems in FDM telemetry, SCO's, Mux and Demux circuits, Detectors and Demodulators, Pulse averaging, Quadrature FM and PLL, Mixers	6
TDM systems (architecture)- TDM- PAM, PAM- PM, TDM- PCM systems, synchronization, PCM generation, differential PCM, PCM reception and detection	6

Module IV

Modems, Digital modulation and Shift-keying, FSK, PSK, DPSK, QPSK, QAM, Modem Protocols	4
Satellite telemetry, TT and C services, subsystems, The earth station	4

Module V

Fiber optic Telemetry- The Fibre as transmission medium, Interconnections, Repeters, Sources, Dectors, WDM	4
Remote control: concept and example from a typical industrial siteration	3
	42

Books:

1. D. Patranabis, Telemetry principles, TMH, New Delhi
2. E. L. Gruenberg, Handbook of Telemetry and Remote control, Mc Graw Hill
3. A. S. Tanenbaum, Computer Networks, Pearson

POWER ELECTRONICS
Code : EE 701(EI)
Contacts : 4L
Credits : 4

Topic	No. of periods

West Bengal University of Technology
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Module I

Power Semiconductor Devices: Rectifier diodes, fast recovery diode and Schottky barrier diode. Power BJT and power Darlington transistors, Power MOSFET. The thyristor family: SCR, triac, inverter-grade SCR, asymmetric SCR, reverse-conducting thyristor (RCT) and gate turn-off thyristor (GTO). SCR turn-on and turn-off methods. Insulated gate bipolar transistor (IGBT).	8
Common triggering devices and their applications: UJT, diac and PUT.	4

Module II

Converters : (a) Rectifiers: ▪ Single phase and three phase uncontrolled bridge rectifiers with inductive load / RL load, free wheeling diodes ▪ Single phase and three phase controlled bridge rectifiers with inductive load / RL load, free wheeling diodes (b) DC to DC converters (Choppers) : principle of step up and step down converters with R / RL load (c) DC to AC converters (inverters) : Single phase and three phase inverters	 3 3 4 4

Module III

Converters (contd.) (d) Cycloconverters : Single phase and three phase circuits, blocked group operation, circulating current mode (e) Converter operation : Overlap, power factor, inversion, regulation, P-pulse converters	 5 5

Module IV

DC line communication : parallel capacitor turn off, resonant turn off (series), impulse communication	6
Applications : DC and AC drives, Speed controller of DC and AC motors, Power supplies – Switched mode, uninterrupted type.	6
	48

Books:

1. P.C. Sen, Power Electronics, TMH, New Delhi
2. M. H. Rashid, Power Electronics, PHI/Pearson Education
3. C. W. Lander, Power Electronics, Mc Graw Hill
4. B. K. Bose, Modern Power Electronics, Jaico

PROCESS CONTROL –II
Code : EI 702
Contacts : 4L
Credits : 4

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Topic	No. of periods
Module I	
Digital Control Loop with computer as controller. Loop structure with continuous process and digital controller.	1
Signal discretization- Sampling of continuous signal, signal reconstruction. Principles of discretization–trapezoidal techniques, pole-zero matching, Z-transform method, W-plane transforms, stability studies	7
Analysis of a single input-single output system by Z-transform techniques.	3
Module II	
Digital control Algorithms: Controller design using: (a) Dead beat control (b) Dahlin's algorithm	4
Controller design by: (a) Digital modelling of loop (b) Discrete approximation (c) Transformation to W-domain and use of Bode diagram. Comparative study.	6
Module III	
PLC- Architecture, Programming and Application.	4
DCS- Architecture and elements, networks, gateways, connectivity, redundancy, software protocol, interfacing units, operating stations	6
Module IV	
OCS- Architecture, Control domain, Information domain, relational database management, spreadsheet packages, simulation & design, Protocol security.	4
Introduction to Fuzzy logic control.	3
Module V	
Control of Specific process: (Any two) (a) Control of thickness in rolling of sheet metal. (b) Control of concentration through pH control (c) Control of heat exchangers.	6
	44

Books:

1. J. R. Leigh, Applied Digital Control, Prentice Hall International, London
2. C. L. Smith, Digital Computer Process Control, Intex Publishers, Scranton
3. B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia
4. D. Patranabis, Principles of Process Control, TMH, New Delhi, 2nd Ed.
5. P.B. Deshpande and R. H. Ash, Elements of Computer Process Control, ISA, prentice Hall, Englewood

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ANALYTICAL INSTRUMENTATION
Code : EI 703
Contacts : 4L
Credits : 4

Topic	No. of periods
Module I	
Humidity and Moisture, Viscosity and Consistency, Density and Specific gravity	5
Gas Analysis: (a) Thermal conductivity method (b) Heat of Reaction method	 2
Module II	
Oxygen Analysis: (a) Paramagnetic method (b) Thermomagnetic method (c) Zirconia cell type (d) Continuous oxygen analysis with micro electrodes.	 3
Spectroscopic methods: IR radiation absorption type, IR sources and detectors, their comparison, single channel and dual channel IR methods, Dispersive spectrometry using monochromaters, FT-IR Spectrometers.	5
Module III	
Liquid Analysis: (a) Electrodes-Ion selective, Molecular selective types- their variations and application. (b) Dissolved oxygen analysis cells (c) pH electrodes-pH analysis with circuits and applications (d) Conductivity cells – standards, circuits, applications (e) Polarography- apparatus, circuits and techniques-pulse polarography, applications (f) Absorption spectrometry in UV and visible range, sources and their spectral ranges, detectors, monochromaters (g) Colorimetry (h) Atomic spectral methods	 2 1 2 1.5 1.5 3 1 2
Module IV	
Emission and Absorption methods of Visible, UV and X-rays - sources, detectors, techniques, sample preparation	6
Chromatography – GC, GLC, LC, HPLC types, columns, Detectors and techniques, applications	6
Methods using Nuclear Magnetic Resonance, Electron Spin Resonance – techniques and applications	4

	45

Books:

1. D. A. Skoog, Principles of Instrumental Analysis, Saunders College Publishing, Philadelphia
2. H. H. Willard, L.L. Merrit, J. A, Dean and F. A. Settle, Instrumental methods of Analysis, CBS Publishers, Delhi
3. D. Patranabis, Principles of Industrial Instrumentation, TMH, New Delhi
4. R.S. Khandpur, Handbook of Analytical Instruments, TMH, New Delhi

POWER PLANT INSTRUMENTATION
Code : EI 801(a)
Contacts : 4L
Credits : 4

Topic	No. of periods
Module I	
Concepts of power plants of different types: Setups, energy conversions and measurement requirements, examples of Thermal, Hydal, and Nuclear plants	5
Thermal power plant and system instrumentation	4
Module II	
Boiler: control, monitoring and test instruments	2
Instrumentation for : (i) Turbines	2
(ii) Condensers	2
(iii) Generators	2
(iv) Coal handling	2
(v) Water treatment	2
(vi) Feed water, combustion air and flue gases	2
Module III	
Instrumentation for safety interlocks - protective gears, emergency measures, Alarm systems and Analysis etc.	7
Pollution measurement, monitoring and control	3
Module IV	
Data handling-processing, logging, acquisition, accounting, display and storage	7
Instrumentation for Generator and Busbar coupling	2
Introduction to power plant modeling/simulation	4
	46

Books:

1. B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia
2. D. Patranabis, Principles of Industrial Instrumentation, TMH New Delhi

3. Electric Power Engineering Handbook – Edited by L. L. Grigsby.

NON-DESTRUCTIVE TESTING METHODS
Code : EI 801(b)
Contacts : 4L
Credits : 4

Topic	No. of periods
Module I	
Surface feature inspection and testing: General, Visual, Chemical, and Mechanical.	6
Optical - laser probe, holography, and ultrasonic surface wave probing	8
Module II	
Magnetic - magnetization, flux, and Electro potential, Electrical resistivity, Electromagnetic - eddy current techniques, Penetrant, Radiation backscatter	9
Module III	
Sub - surface (Internal feature inspection and Testing: Thermal - temperature sensing, Electrical resistivity, ultrasonic - longitudinal and shear wave methods, acoustic emission methods,	9
Module IV	
X rays - refraction / diffraction and fluorescence, Gamma rays - radiography. IQI (image quality indicator), Xerography,	8
Image intensification methods, Electron microscopic techniques. ISO specifications and other certifications.	6
	46

Books:

1. Mclutive P (Ed) – NDT Handbook, American Society for NDT, 1989.
2. Hull B and John V – Non Destructive Testing, FI BS/McMillan.
3. J. M. Farley and R. W. Nichols – Non Destructive Testing, Proceedings of the 4th European Conference, London; UK, September 1987, Pergmon Press.
4. Balder Raj, T. Jayakumar and M. Thavasimuthu – Practical Non Destructive Testing, 2nd Edition, Narosa.

SOFT-COMPUTING TECHNIQUES
Code : CS 801(c)
Contacts : 4L
Credits : 4

Topic	No. of periods

West Bengal University of Technology
BF-142, Salt Lake City, Kolkata-700064

Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Module I

Introduction to Soft-computing, Its Constituent components	2
Fuzzy Sets, General Idea and importance in practical life, definition	3
Basic Operators, T- Norms, S- Norms, other aggregation operators	3

Module II

Fuzzy relations, implications, extensions, projections and compositions	3
Approximate reasoning, compositional rule of inference, rule based systems, term set	3
Fuzzification, reasoning, defuzzification	3

Module III

Different Fuzzy models (MA/TS), Applications of Fuzzy rule based systems	6
Introduction to Artificial Neural Networks	2
Basic models like Hop field network/structure, multi layer perception and learning, Vector quantization networks	4

Module IV

Self-organizing Features, Maps, their properties and applications	4
Basics of Genetic Algorithm, its adaptation for computing, Application	6

Module V

Studies of some Fuzzy-neural, Neuro-fuzzy and Fuzzy-GA systems	7
	46

Books:

1. Dirankov and Hellemdron Fuzzy logic control, Narosa
2. Rajsekhar and Pai, Neural Networks, Fuzzy logic and Genetic Algorithm: Synthetic and Applications, Pearson Education

BIOMEDICAL AND ECOLOGICAL MEASUREMENTS
Code : EI 801(d)
Contacts : 4L
Credits : 4

Topic	No. of periods

Module I

Physiological parameters relevant to biomedical aspects – their measurement problems	2
Biopotentials and biopotential electrodes – their adaptation in measurement of bioparameters – general review	2
Transducers used in biomedical applications – strain gauge, piezo-electric, thermistor.	2
Safety consideration in the use of electrical systems for in-vivo measurements	2

Module II

Blood pressure measurements – manual / automatic systems, invasive and non invasive types, Sphygmomanometer, Blood flow measurements using ultrasonic and electromagnetic flowmeters	3

Modeling of heart from the viewpoint of measurement of heart problems, Electrocardiograph – the comprehensive system with error sources and elimination techniques	4
Pacemaker – general description and instrumentation details, Defibrillator	3

Module III

X-ray methods in medical diagnosis – X-ray generation, control and biomedical imaging techniques	3
Application of computer in medicine - Principles, data acquisition and analysis, Instrument description and diagnostics, CAT and CT.	3
Biotelemetry – Techniques and Applications	5

Module IV

Pollution – classification and its effects on environment	2
Air pollution – types and scales of measurement, different factors for its manifestation, sampling	2
Aerosol- properties, methods of settling and precipitation, the working system	3

Module V

Measurements of NO_X, SO_2, CO, CO_2 in air/gas, Colour Dosimeter tubes	4
Sound pollution, effect on environment, acoustic noise level, measuring techniques-microphone, sound level meter	3
Water pollution – classification and measurement techniques	2
	45

Books:

1. L. Cromwell, 'Biomedical Instrumentation and Measurements', Pearson Education
2. R. S. Khandpur, 'Handbook of Biomedical Instrumentation', TMH, New Delhi
3. J. S. Webster, 'Medical Instrumentation- Application and Design'
4. Rana, 'Essentials of Ecology and Environmental Science', PHI
5. P. Saha and A. K. Chakraborty, 'Environmental Studies', Allied Publishers
6. Venugopal Rao, 'Text Book of Environmental Engineering', PHI

DIGITAL SYSTEM DESIGN USING VHDL
Code : EC 802(a)
Contacts : 4L
Credits : 4

Topic	No. of periods

Module I

Review of Combinational Logic and Sequential State Machine designs.	4
Concepts of Digital System Design Process, Design automation, Hardware Description	4

Language, Hardware Simulation, Oblivious Simulation, Event-driven simulation, Hardware synthesis, Level of abstraction.	

Module II

Basic concepts in VHDL: Characterizing Hardware Language, Timing, Concurrency, Hardware modeling, Objects & Classes, Signal assignment, Inertial delay, Mechanism, Transport delay mechanism, Comparing Inertial and Transport	4
Concurrent and Sequential Assignment: concurrent assignment, Event and Transaction, Delta delay, Sequential placement of transaction	4

Module III

Type declaration and usage, Enumeration type for multi value logic, Array declaration, VHDL Operators, subprogram parameters, Types and overloading, Array attributes, Type attributes, Signal attributes, Entity attributes	3
Sequential processing : Process statement, Signal assignment versus Variable assignment, Sequential statements – IF, CASE, LOOP, ASSERT, WAIT etc., Concurrent assignment problem, Passive processes	2
Structural Specification of Hardware: Inverter model, NAND gate model, Logic Design of Comparator, VHDL description of comparator, VHDL description of a simple test-bench, simulation, Logic design of Latch, Flip-flop, Counter and Registers	4

Module IV

Subprograms and Packages : Subprograms, Functions, Conversion functions, Resolution functions, Procedures. Packages, Package declaration, Deferred constants, Subprogram declarations, Package body.	4
Aliases, Qualified expressions, User-defined attributes, Generate statements, Text I/O.	2
Data flow Description in VHDL: Multiplexing and data selection, General Multiplexing, Guarded signal assignments, Block Declaration Parameters, Resolving between several driving values	2

Module V

State machine description, A sequence detector, Allowing multiple active states, Mealy and Moore machine, Generic State Machine, General data flow circuits.	4
Design configurations: Default configurations, Component configurations, Mapping library entities, Generics in configurations, Architecture configurations	4
System Design – a case study:	4
	45

Books:

1. VHDL – Douglas L. Perry, McGraw Hill International
2. Fundamentals of Digital Logic with VHDL Design – S. Brown and Z. Vranesic, TMH
3. A VHDL Premier – J. Bhasker, Pearson Education Asia
4. VHDL : Analysis and Modeling of Digital Systems – Z. Navabi, McGraw Hill International

EMBEDDED SYSTEMS
Code : EC 802(b)
Contacts : 4L

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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Credits : 4

Topic	No. of periods
Module I	
Introduction to embedded systems, Categories and requirements of embedded systems, Challenges and issues related to embedded software development, Hardware/Software co-design, Introduction to IC technology, Introduction to design technology	6
Concepts of concurrency, processes, threads, mutual exclusion and inter-process communication,	4
Module II	
System partitioning, Models and languages for embedded software, Synchronous approach to embedded system design, Scheduling paradigms, Scheduling algorithms, Input and output processing, Timing requirements, Hardware and software partitioning	6
Microprocessor selection, Microprocessor versus microcontroller analysis, CISC versus RISC, Study of major embedded processor architectures, Memory system design, System optimization	5
Module III	
Software selection issues, Selecting an RTOS, RTOS performance metrics, RTOS scalability and tool support, Compiler selection	4
Real world interaction issues, A/D and D/A conversion, Fault tolerance	4
Module IV	
Establishing a software development environment, C runtime environments, Embedded debuggers, Cross-development methods, Embedded file formats, readers, Creating object files - the build process, Loading software into remote targets	6
Module V	
Fundamentals of HW/SW integration, Methods of embedded debugging, Specialized tools for real time system debug, Strategies for real time system observation, Code instrumentation	6
Methods of performance analysis and software validation, Static and dynamic methods of code inspection	5
	46

Books :

1. Embedded System Architecture, Programming and Design – Raj Kamal, TMH
2. An Embedded Software Primer – David E. Simon, Pearson Education
3. The 8051 Microcontroller and Embedded Systems – M. a. Mazidi and J. G. Mazidi, pearson Education
4. Embedded System Design : A Unified Hardware/Software Introduction – Frank Vahid and Tony Givargis, John Wiley

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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

MULTIMEDIA TECHNIQUES
Code : IT 802(c)
Contacts : 4L
Credits : 4

Topic	No. of periods
Module I	
Introduction: Components, uses, different media, channels and modes of communication, Hypertext and Hypermedia	3
Analogue and Digital representations, data rate, video and audio standards, colour-space and models, communication standards	4
Communication and interactive peripherals, Display devices and screen, storage devices	3
Module II	
Attributes and guidelines, Text markup, Hypertext document: HTML, XML	4
Digital audio, MIDI, Compression techniques, MPEG compression standards, Spatial and Temporal redundancy, frame compression	5
Module III	
Animation types and techniques, key frame animation, morphing, compression techniques used in animation	6
Design and development of multimedia – support tools, environment authoring and generation, media synchronization, evaluation and testing	6
Module IV	
Human computer interfacing and interactions – objectives, design, stages of actions, rotations, design norms and guidelines	6
Multimedia database and design for information management	3
Failure developments - devices, support, knowledge base and management, interaction strategies	3
Copyright intellectual property	2
	46

Books:

1. Jakob Nielsen: Hypertext and Hypermedia: Academic Press,1990
2. A. C. Luther: Design interactive media, Bantam books,1992
3. J. K. Buford: Multimedia systems: Pearson education, 2000
4. N. Chapman and J. Chapman: Digital multimedia, John Wiley, 2000

MOBILE COMMUNICATION
Code : EC 802(d)
Contacts : 4L
Credits : 4

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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Topic	No. of periods
Module I	
Introduction: Review of wireless communication and wave propagation, Multiple access schemes: FDMA, TDMA, CDMA, packet radio, radio telephony	8
Cellular communication system	4
Module II	
AMPS system: switching and networking	4
PCS services	2
Indoor and Outdoor propagation models	3
Pagers, GSM, GPRS, IS-95 systems	4
Module III	
Cordless telephony, PCN	3
Mobile computing	4
Wireless networks, LAN etc.	3
Module IV	
Mobile satellite communication	3
Wireless Access Protocol	3
Generation of Mobile communication - examples : 2G - 3G systems and future systems	5
	46

Books:

1. Schiller - Mobile Communication, Pearson Ed.
2. Garg - Wireless Network Evolution, Pearson Ed.

VALUES AND ETHICS IN PROFESSION
Code : HU-801
Contacts : 3L
Credits : 3

Topic	No. of periods
Module I	

Science, Technology and Engineering as knowledge and as Social and Professional Activities	4
Effects of Technological Growth: Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics Appropriate Technology Movement of Schumacher; later developments Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis. Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.	12

Module II

Ethics of Profession: Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.	10

Module III

Profession and Human Values: Values Crisis in contemporary society Nature of values: Value Spectrum of a good life Psychological values: Integrated personality; mental health Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution. Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity Moral and ethical values: Nature of moral judgments; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.	12
	38

Books :

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

INDUSTRIAL MANAGEMENT
Code : HU 802(EI)
Contacts : 4L
Credits : 4

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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

Topic	No. of periods
Module I	
Growth of Industries, Management thoughts and scientific management, Taylorism; Factory system of production, Introduction to management problems, Types of manufacture, Planning analysis and control aspects in industries.	6
Types of business ownership, means of finance and business combinations, organization structures, committee organization, authority and responsibility, duty and span of control.	6
Module II	
Plant location, factory buildings and physical facilities, plant layout, tools and techniques of plant layout, materials - handling arrangements. Product development, standardization, simplification and diversification.	4
Functions of production, planning and control, production forecasting, production scheduling and network techniques, Gantt chart, CPM, PERT.	7
Module III	
Work study, job evaluation and merit rating; purchase system and inventory control. Inspection and quality control of systems, statistical quality control, maintenance and replacement policies for machine and equipments; decision making theories, breakeven analysis cost benefit analysis, evaluation of financial and managerial efficiencies	7
Introduction to operational research techniques. Application of fuzzy logic in modern management concepts.	6
Module IV	
Human relations in industry and labour compensation. Personnel management, provision of industrial legislations in India. Wage and salary administrations. Welfare and safety provisions, trade union acts.	6
Study of environmental impacts and environmental laws. Professional ethics.	4
	46

Books:

1. Production and operations management: S.N.Chari
2. Industrial Management : Basu & Majmundar (Birla Pub., Newdelhi)
3. Quantitative techniques in management : N.D.Vohra (Tata Mcgraw Hill)
4. Production systems analysis and control : Riggs
5. Works organization and management : Basu, Sahoo & Dutta.
6. Fuzzy logic with Engineering applications : Timothy J. Ross (Mcgraw Hill)

CIRCUITS & NETWORKS LAB
Code : EE 391
Contacts : 3P
Credits : 2

List of Experiments:

1. Transient response in R-L and R-C Network: Simulation/hardware
2. Transient response in R-L-C Series & Parallel circuits Network: Simulation/hardware
3. Determination of Impedance (Z) and Admittance(Y) parameters of two port network
4. Frequency response of LP and HP filters
5. Frequency response of BP and BR filters
6. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form
7. Evaluation of convolution integral, Discrete Fourier transform for periodic & non-periodic signals and simulation of difference equations using MATLAB
8. Representation of poles and zeros in z-plane, determination of partial fraction expansion in z-domain and cascade connection of second order system using MATLAB
9. Determination of Laplace transform and inverse Laplace transformation using MATLAB
10. Spectrum analysis of different signals

Note: An Institution/College may opt for some other software or hardware simulation wherever possible in place of MATLAB

ELECTRICAL MEASUREMENTS LAB
Code : EE 392
Contacts : 3P
Credits : 2

List of Experiments:

1. Instrument workshop- observe the construction of PMMC, Dynamometer, Electro thermal and Rectifier type instrument, Oscilloscope and digital multimeter
2. Calibrate moving iron and electrodynamometer type ammeter/volmeter by potentiometer
3. Calibrate dynamometer type Wattmeter by potentiometer
4. Calibrate A.C. energy meter
5. Measure the resistivity of material using Kelvin Double Bridge
6. Measurement of Power using Instrument transformer
7. Measurement of Power in Polyphase circuits
8. Measurement of Inductance by Anderson Bridge
9. Measurement of Capacitance by De Sauty Bridge

DIGITAL ELECTRONICS LAB
Code : EC 392
Contacts : 3P
Credits : 2

1. Realization of basic gates using Universal logic gates.
2. Code conversion circuits- BCD to Excess-3 & vice-versa.
3. 4-bit parity generator & comparator circuits.
4. Construction of simple Decoder & Multiplexer circuits using logic gates.

5. Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.
6. Construction of simple arithmetic circuits-Adder, Subtractor.
7. Realization of RS-JK & D flip-flops using Universal logic gates.
8. Realization of Universal Register using JK flip-flops & logic gates.
9. Realization of Universal Register using multiplexer & flip-flops.
10. Construction of Adder circuit using Shift Register & full Adder.
11. Realization of Asynchronous Up/Down counter.
12. Realization of Synchronous Up/Down counter.
13. Design of Sequential Counter with irregular sequences.
14. Realization of Ring counter & Johnson's counter.
15. Construction of adder circuit using Shift Register & full Adder.

NUMERICAL METHODS & PROGRAMMING LAB
Code : M(CS) 382
Contacts : 3P
Credits : 2

1. Assignments on Interpolation: Newton forward & backward, Lagrange.
2. Assignments on Numerical Integration: Trapezoidal Rule, Simson's 1/3rd Rule, Weddle's Rule.
3. Assignments on Numerical solution of a system of Linear Equations: Gauss elimination, Gauss Jordan, Matrix Inversion, Gauss Seidel.
4. Assignments on Solution of Algebraic Equations: Bisection, Secant, Regula-Falsi, Newton-Raphson Methods.
5. Assignments on Ordinary Differential Equations: Taylor Series, Euler's Method, Runge-Kutta (4^{th} Order).
6. Assignments on Statistical Problems: Mean, Median, Mode, Standard deviation (for simple & frequency type data), Linear Correlation & Regression.

MICROPROCESSOR AND MICRO-CONTROLLER LAB
Code : EI 491
Contacts : 3P
Credits : 2

Sl. No. NAME OF THE EXPERIMENTS

1. Familiarization with 8085 trainer kit components.

2. a) Familiarization with 8085 simulator on PC.
a) Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator.
b) Assignments based on above

3. PROGRAMMING USING KIT/SIMULATOR FOR
i) Table look up
ii) Copying a block of memory
iii) Shifting a block of memory
iv) Packing and unpacking of BCD numbers
v) Addition of BCD numbers
vi) Binary to ASCII conversion
vii) String Matching
viii) Multiplication using Booth's Algorithm

4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit eg, subroutine for delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train etc

5. Interfacing any 8-bit Latch (eg, 74LS373) with trainer kit as a peripheral mapped output port with absolute address decoding

6. INTERFACING WITH I/O MODULES:

a) ADC
b) Speed control of mini DC motor using DAC
c) Stepper motor

7. STUDY OF 8051 MICRO CONTROLLER KIT AND WRITING PROGRAMS FOR THE FOLLOWING TASKS USING THE KIT

a) Table look up
b) Basic arithmetic and logical operations
c) Interfacing of Keyboard and stepper motor

8. FAMILIARIZATION WITH EPROM PROGRAMMING AND ERASING

SENSORS AND TRANSDUCERS LAB
Code : EI 492
Contacts : 3P
Credits : 2

1. Temperature measurement using AD590 IC sensor.
2. Displacement measurement by using a capacitive transducer.
3. Pressure and displacement measurement by using LVDT.
4. Study of a load cell with tensile and compressive load.
5. Torque measurement Strain gauge transducer.
6. Speed measurement using magnetic proximity sensor.
7. Speed measurement using a Stroboscope.
8. Study of the characteristics of a LDR.

DATA STRUCTURES LAB
Code : CS 492
Contacts : 3P
Credits : 2

1. Implementation of array operations.
2. Stacks and Queues : adding, deleting elements Circular Queue : Adding & deleting elements Merging Problem : Evaluation of expressions operations on Multiple stacks & queues.
3. Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists.
4. Polynomial addition, Polynomial multiplication.
5. Sparse Matrices : Multiplication, addition.

6. Recursive and Nonrecursive traversal of Trees.
7. Threaded binary tree traversal. AVL tree implementation.
8. Application of Trees. Application of sorting and searching algorithms.
9. Hash tables implementation, searching, inserting and deleting, searching & sorting techniques.

TECHNICAL REPORT WRITING & LANGUAGE PRACTICE LABORATORY
Code : HU 481
Contacts : 3S
Credits : 2

Topics to be covered and number of hours required for it:

1. Introductory lecture is to be given to the students so that they get a clear idea of the syllabus and understand the need for having such a practice lab in the first place(3 hours)
2. Conversion practice is done on given situation topics. The students are also made to listen to pre-recorded cassettes produced by British Council and also by the Universities of Oxford and Cambridge (6 hours)
3. Group Discussions:- The students are made to understand the difference between the language of conversion and group discussion. Strategies of such discussions are to teach to them. It is also helpful to use videocassettes produced by the U.G.C. on topics like group-discussion. After wards the class is divided into groups and the students have to discuss on given topics on current socio-economic-political-educational importance(12 hours)
4. Interview sessions-students are taught the do's and don'ts of facing a successful interview. They then have to face rigorous practices of mock-interviews. There simulations of real life interview sessions where students have to face an interview panel(12 hours)
5. Presentations: The secrets of an effective presentation are taught to the students. Then each and every student has to make lab presentations with the help of the Overhead projector/ using power point presentation and other audio-visual aids in the laboratory. They also have to face the question answer sessions at the end of their presentation (12 hours)
6. Classes are also allotted to prepare the students for competitive examinations like the T.O.E.F.L. by making the students listen to specially produced C.D. cassettes of such examinations (3 hours)

The overall aim of this course is to inculcate a sense of confidence in the students and help them to become good communicators in their social as well as professional lives.

Text:
1. Sharma—Business Correspondence & Report Writing, TMH
2. Prasad—Group Discussion & Interview (With Audio Cassette) , TMH

Reference:
1. Sashi Kumar—Spoken English (with Cassette) , TMH

INDUSTRIAL INSTRUMENTATION LAB
Code : EI 591
Contacts : 3P
Credits : 2

1. Calibration of Pressure gauge by Dead weight tester.
2. Measurement of Temperature using Thermocouple.
3. Study of RTD characteristics and measurement of temperature with it.

4. Measurements of velocity of flow and flow rate of water by head type flow meter.
5. Measurements of flow rate and velocity of water by Area type flow meter.
6. Measurement of level using capacitive type sensor.
7. Measurement of moisture using moisture balance.
8. Measurement of viscosity.

CONTROL ENGG. LAB
Code : EE 581
Contacts : 3P
Credits : 2

1. Familiarization with MATLAB control system toolbox, MATLAB-SIMULINK toolbox and PSPICE.
2. Study of step response for first and second order system with unity feedback with display on CRT screen and calculation of parameters for different system designs.
3. Simulation of impulse response for types 0, 1 and 2 with unity feedback using MATLAB and PSPICE.
4. Determination of root-locus, Bode plot, Nyquist plot using MATLAB toolbox for a given second order transfer function and listing of the specifications.
5. Determine the effect of P, I, D actions on first order simulated process and obtaining the system transfer functions from Bode plot.

ANALOG ELECTRONIC CIRCUITS LAB

Code : EC 591
Contacts : 3P
Credits : 2

1. Introduction: Study of characteristics curves of B.J.T & F.E.T .
2. Construction of a two-stage R-C coupled amplifier & study of its gain & Bandwidth.
3. Study of class A & class B power amplifiers.
4. Study of class C & Push-Pull amplifiers.
5. Realization of current mirror & level shifter circuit using Operational Amplifiers.
6. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.
7. Construction & study of Bistable multivibrator using NE555.
8. Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
9. Construction of a simple function generator using IC.
10. Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).
11. Study of D.A.C & A.D.C.

MICROPROCESSOR BASED SYSTEMS LABORATORY
Code : EI 592
Contacts : 3P
Credits : 2

1. Familiarization with 8086/88 trainer kit components.
2. a) Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical)

b) Assignments based on above.

3. a) Familiarization with 8086/88 simulator on PC.
   b) Study of prewritten programs using basic instruction set (data transfer, Load/ Store, Arithmetic, Logical) on the simulator.
   c) Assignments based on above

4. PROGRAMMING USING KIT/SIMULATOR FOR

   Table look up
   - i) Copying a block of memory
   - ii) Shifting a block of memory
   - iii) Packing and unpacking of BCD numbers
   - iv) Addition of BCD numbers
   - v) Binary to ASCII conversion
   - vi) String Matching
   - vii) Sorting etc.

5. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g., subroutine for delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train etc

6. INTERFACING WITH I/O MODULES:
   - i) ADC
   - ii) Speed control of mini DC motor using DAC
   - iii) Temperature sensor and display temperature
   - iv) Relay
   - v) Keyboard through 8279 and 8255A
   - vi) Multi-digit Display with multiplexing through 8255A & 8279
   - vii) Stepper motor

COMMUNICATION LABORATORY
Code : EC 691
Contacts : 3P
Credits : 2

1. Study of Amplitude modulation & Demodulation technique.
2. Study of Double Side Band Suppressed Carrier (DSB-SC) & Demodulation technique.
3. Study of Single Side Band Suppressed Carrier (SSB-SC) & Demodulation technique.
4. Study of Frequency Modulation & Demodulation.
5. Study of Time Division Multiplexing (TDM) & Demultiplexing.
6. Study of Frequency Shift Keying (FSK).
7. Study of Pulse Amplitude Modulation (PAM).
8. Study of Pulse Width Modulation (PWM).

COMPUTER NETWORKING LAB.
Code : CS 691
Contacts : 3P
Credits : 2

Experiments are based on Linux / Unix / Solaris (Text Mode) Operating System

1. Familiarization of:
   NIC, different cabling options (e.g. UTP, Coaxial, optical fibre), Connectors – BNC, RJ45, RS-232C, Interconnecting Devices – Hub, switch, router etc.
2. Preparation of some UTP cables with RJ45 connectors and setting up a small network using either Hub or switch.
3. Configuring NIC, preparing routing table, assignment of IP address & net mask to each machine, concept of subnet, CIDR, socket interface
4. Configuring PPP
5. Configuring DNS server (e.g. Bind)
6. Configuring web server (e.g. Apache)
7. Configuring mail server (e.g. Postfix, Qmail etc.)
8. Configuring Telnet, FTP server
9. Configuring Firewall (e.g. IP chains, IP tables etc. in Linux)
10. Configuring NFS & NIS
11. C program to implement a simple client
12. C program to implement a simple server (e.g. echo)
13. Concurrent server using process
14. Concurrent server using thread (Linux, Windows)
15. C program to compute checksum
16. C program to implement stop-and-wait ARQ
17. C program to implement GO-back-n ARQ
18. C program to implement selective repeat ARQ

Symbols:

NIC – Network Interface Card
UTP – Unshielded Twisted Pair
CIDR – Classless Inter Domain Routing
PPP – Point to Point Protocol
DNS – Domain Name Server
FTP – File Transfer Protocol
NFS – Network File System
NIS – Network Information System
ARQ – Automatic Repeat reQuest

ELECTRONIC INSTRUMENTATION & MEASUREMENT LAB
Code : EI 691
Contacts : 3P
Credits : 2

1. Study of Static Characteristics of a Measuring Instrument
2. Study of Dynamic Characteristics of a Measuring Instrument
3. Acquaintance with basic structure of DMM and measurement of different electrical parameters
4. Realization of Data Acquisition system
5. Wave and spectrum analysis using Q meter
6. Realization of a V-to-I & I-to-V converter.

7. Statistical analysis of errors in measurement .
8. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).

GROUP DISCUSSIONS & SEMINAR
Code : EI 682
Contacts : 3S
Credits : 2

1. Introductory lecture is to be given to the students so that they get a clear idea of the syllabus and understand the need for having such a practice lab in the first place (3 hours).
2. Conversion practice is done on given situation topics. The students are also made to listen to pre-recorded cassettes produced by British Council and also by the Universities of Oxford and Cambridge (6 hours).
3. Group Discussions:- The students are made to understand the difference between the language of conversion and group discussion. Strategies of such discussions are to teach to them. It is also helpful to use videocassettes produced by the U.G.C. on topics like group-discussion. After wards the class is divided into groups and the students have to discuss on given topics on current socio-economic-political-educational importance (12 hours).
4. Interview sessions-students are taught the do's and don'ts of facing a successful interview. They then have to face rigorous practices of mock-interviews. There simulations of real life interview sessions where students have to face an interview panel (12 hours)
5. Presentations: The secrets of an effective presentation are taught to the students. Then each and every student has to make lab presentations with the help of the Overhead projector/ using power point presentation and other audio-visual aids in the laboratory. They also have to face the question answer sessions at the end of their presentation (12 hours).
6. Classes are also allotted to prepare the students for competitive examinations like the T.O.E.F.L. by making the students listen to specially produced C.D. cassettes of such examinations (3 hours).

The overall aim of this course is to inculcate a sense of confidence in the students and help them to become good communicators in their social as well as professional lives.

Text:
1. Sharma—Business Correspondence & Report Writing, TMH
2. Prasad—Group Discussion & Interview (With Audio Cassette), TMH

Reference:
1. Sashi Kumar—Spoken English (with Cassette), TMH

PROCESS CONTROL LABORATORY
Code : EI 791
Contacts : 3P
Credits : 2

1. Study of a typical Temperature Control Loop having Furnace, suitable final control element, SMART/Analog temperature transmitter (hand held communicator for SMART Transmitter), PID controller, and data logger etc.
2. Study of a typical Pressure Control Loop having Pressure source, Pneumatic control valve, I to P Converter, Compressor, SMART/Analog pressure transmitter, and PID controller etc.

3. Study of a typical Flow Control Loop having SMART/Analog DP/Mass Flow meter, Motorized / Pneumatic control valve (I to P Converter and Compressor for pneumatic control valve), and PID controller etc.
4. Study of a typical Level Control Loop having Ultra Sonic/ Capacitor Level Transmitter, Motorized / Pneumatic control valve (I to P Converter and Compressor for pneumatic control valve), and PID controller etc.
5. Study of a typical Duct Air Flow monitoring and Control.
6. PLC Programming through PC
7. Study of a PC based Simulation Software i.e. simulation of boiler of a power plant etc.
8. Study of flow/temperature control loop with DCS

Note:
All the experimental set-ups having SMART transmitters do not require separate hand held communicator.

TELEMETRY AND REMOTE CONTROL LAB
Code : EI 792
Contacts : 3P
Credits : 2

1. Study of voltage telemetry system using a process variable transducer.
2. Study of 4-20 mA current telemetry system: 2 wire and 3 wire systems.
3. Study of a frequency telemetry system using a VCO and a PSD.
4. Study of a FDM and Demultiplexing system using wire transmission for 2 to 4 channels.
5. Study of a PCM system.
6. Study of a Phase locked loop as a detector.
7. Study of a software based DAS.
8. Study of a (wireless) remote control system.

PROJECT
Code : EI 793
Contacts : 6P
Credits : 4

Design, implementation and testing of an Electronic / Instrumentation / Control or Software system. The topic will be chosen in consultation with the teacher concerned. The evaluation will be based on demonstration of the product, and oral as well as written presentation of the project report.

SEMINAR
Code : EI 784
Contacts : 3S
Credits : 2

Students will give technical presentations on topics that relate to the course curricula, preferably on recent technological advances or current developments.

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Revised Syllabus of B.Tech in AEIE(To be followed from the academic session,July 2006 ,i.e. for the students who were admitted in Academic Session 2005-2006)

POWER ELECTRONICS LABORATORY
Code : EE 894
Contacts : 3P
Credits : 2

1. Study of V-I Characteristics of an SCR
2. Study of V-I Characteristics of a TRIAC
3. Study of different Triggering Circuits for Thyristor
4. Study of Uni Junction Transistor (UJT) Triggering Circuit
5. Study of a firing Circuit suitable for single phase half controlled Converter
6. Simulation of a Single Phase AC-DC Uncontrolled Converter with & without source inductance
7. Simulation of a single phase AC to controlled DC Converter with and without source inductance
8. Single Phase half controlled Bridge Converter with two Thyristors and two Diodes
9. Single Phase fully controlled Bridge Converter using four Thyristors
10. PSPICE Simulation of DC to DC step down chopper
11. PSPICE Simulation of single phase controller with R-L Load
12. PSPICE Simulation of PWM Bridge Inverter of R-L Load using MOFET

PROJECT
Code : EI 883
Contacts : 6P
Credits : 4

Design, implementation and testing of an Electronic / Instrumentation / Control or Software system. The topic will be chosen in consultation with the teacher concerned. The evaluation will be based on demonstration of the product, and oral as well as written presentation of the project report. This may be a continuation of the project work (EI 793) done in the 7^{th} semester.