# KANNUR UNIVERSITY

# FACULTY OF ENGINEERING

## Curricula, Scheme of Examinations & Syllabus for Semesters V & VI of B.Tech. Degree Programme in Applied Electronics & Instrumentation with effect from 2007 Admissions

**FIFTH SEMESTER**

| Code | Subject | Hours/Week | | | Sessional Marks | University Examination | |
|---|---|---|---|---|---|---|---|
| | | L | T | P/D | | Hrs | Marks |
| 2K6 AEI 501 | Engineering Mathematics IV | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 502 | Economics and Business Management | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 503 | Instrumentation Systems | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 504 | Computer Organization & Architecture | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 505 | Linear Integrated Circuits | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 506 | Microprocessors and Microcontrollers | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 507(P) | Linear Integrated Circuits Lab | - | - | 3 | 50 | 3 | 100 |
| 2K6 AEI 508(P) | Computer Programming Lab | - | - | 3 | 50 | 3 | 100 |
| **TOTAL** | | **18** | **6** | **6** | **400** | **-** | **800** |

**SIXTH SEMESTER**

| Code | Subject | Hours/Week | | | Sessional Marks | University Examination | |
|---|---|---|---|---|---|---|---|
| | | L | T | P/D | | Hrs | Marks |
| 2K6AEI 601 | Environmental Engineering & Disaster Management | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 602 | Control Systems | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 603 | Industrial Instrumentation | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 604 | Digital Signal Processing | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 605 | Process Dynamics and Control | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 606 | Elective-I | 3 | 1 | - | 50 | 3 | 100 |
| 2K6 AEI 607(P) | Industrial Instrumentation Lab | - | - | 3 | 50 | 3 | 100 |
| 2K6 AEI 608(P) | Microprocessors & Microcontrollers lab | - | - | 3 | 50 | 3 | 100 |
| **TOTAL** | | **18** | **6** | **6** | **400** | **-** | **800** |

**Elective I**

1. 2K6 AEI 606(A) : DESIGNING WITH VHDL
2. 2K6 AEI 606(B) : HIGH SPEED DIGITAL DESIGN
3. 2K6 AEI 606(C) : LINEAR SYSTEMS ANALYSIS
4. 2K6 AEI 606 (D) : DATA STRUCTURES & ALGORITHMS
5. 2K6 AEI 606 (E) : FUZZY SYSTEMS & APPLICATIONS
5. 2K6 AEI 606 (F) : VLSI SYSTEM DESIGN

## 2K6 AEI 501 ENGINEERING MATHEMATICS IV

3 hours lecture and 1 hour tutorial per week

**Module I Probability distributions (13 hours)**
Random variables-Probability distributions - binomial distribution –Poisson distribution-normal distribution –Mean, variance and Moment generating function -Poisson process - Chebyshev's theorem- Geometric Distribution-Uniform Distribution, Gamma distribution, Beta Distribution, Exponential Distribution and Hyper-Geometric Distributions.

**Module II Statistical inference (13hours)**
Population and Sample-Sampling Distributions of Mean and Variance-Point Estimation-Interval Estimation -Null Hypotheses and Significance tests-Hypotheses concerning one mean- Confidence Intervals of mean and variance - Estimation of Variances-Hypotheses concerning one variance-Hypotheses concerning two variance- Chi square test as test of goodness of fit.

**Module III (Series solutions of differential equations (13hours)**
Power series method of solving ordinary differential equations - series solution of Bessel's equation – Recurrence formula for Jn(x)-expansions for $J_0$ and $J_1$ – value of $J_{1/2}$- generating function for Jn(x)- Orthogonality of Bessel functions - Legendre's equation – series solution of Legendre's differential equation -Rodrigues formula-Legendre Polynomials – Generating function for Pn(x)- Recurrence formulae for Pn(x) -Orthogonality of Legendre polynomials

**Module IV Quadratic forms and Fourier Transforms (13 hours)**
Quadratic forms - Matrix associated with a quadratic form - Technique of Diagonalization using row and column transformations on the matrix - Definite, Semidefinite and Indefinite forms - their identification using the Eigen values of the matrix of the quadratic form.
Fourier Transform-Properties of Fourier Transforms-Linearity property-Change of scale property-shifting properties – Modulation property-Transform of the Derivative-simple problems- Fourier Cosine transform-Fourier Sine Transform.

**Text book**
Johnson RA, Miller & Freund's Probability and Statistics for Engineers, Prentice Hall of India
(For Module I and II only)

**Reference Books**
1. Wylie C R & Barrett L. C., Advanced Engineering Mathematics, Mc Graw Hill
2. Kreyszig E., Advanced Engineering Mathematics, John Wiley.
3. Bali N. P. & Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications
4. Grewal B. S, Higher Engineering Mathematics, Khanna Publishers

| **Sessional work assessment** | |
|---|---|
| Two tests | 2 x 15 = 30 |
| Two assignments | 2 x 10 = 20 |
| Total marks | = 50 |

**University Examination Pattern**
Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions of 15 marks each from module I with choice to answer any one.
Q III - 2 questions of 15 marks each from module II with choice to answer any one.
Q IV - 2 questions of 15 marks each from module III with choice to answer any one.
Q V - 2 questions of 15 marks each from module IV with choice to answer any one.

## 2K6 AEI 502 ECONOMICS & BUSINESS MANAGEMENT

3 hours lecture and 1 hour tutorial per week

**Module I (12 hours)**

Definition of economics-nature and scope f economic science-nature and scope of managerial economics-central problems of an economy-scarcity and choice-opportunity cost-objectives of business firms-forms of business-proprietorship-partnership-joint stock company-co-operative organization-state enterprise

**Module II (14hours)**

Consumption – wants –characteristics of wants- law of diminishing marginal utility- demand – law of demand- elasticity of demand- types of elasticity-factors determining elasticity-measurement- its significance in business-demand forecasting-methods of demand forecasting- supply – law of supply- elasticity of supply

**Module III (14hours)**

Production – factors of production – features of production – features of factors of production- division of labour – production function- Cobb-Douglas production function-production possibility curve-squats-marginal rate of technical substitution- properties of isoquants -law of variable proportions- returns to scale-isocost line-least cost combination of factors-expansion path-technical and economical efficiency-linear programming –graphical method-economics of large scale production.

**Module IV (12hours)**

Market structures and price determination – perfect competition-monopoly -monopolistic competition-oligopoly-kinked demand curve-money and banking-nature and functions of money-money market and capital market-commercial banks – functions-central banking functions-methods of credit control.

**Text books and References**


1 Varshney R.L & Maheshwari K.L , Managerial economics, S Chand & Co. Ltd..
2 Dwiivedi D.N, Managerial Economics, Vikas Publishing House Pvt Ltd
3. Dewett K.K, Modern Economic theory, S Chand & company Ltd.
4. Barthwal A.R ,Industrial Economics, New Age International Publishers
5. Benga T.R & Sharma S.C, Industrial Organization and Engineering Economics , Khanna Publishers
6. Ahuja H.L Modern Micro Economics –Theory and Applications , S Chand & Co. Ltd
7. Koutsoyiannis A , Modern Microeconomics, Macmillan Press Ltd.
8. Joel Dean, managerial Economics Prentice-Hall of India Pvt Ltd.
9. Dewett .K.K& Verma J.D,Elementary Economic Theory , S Chand & Co. Ltd.
10. Jhingan M.L., Macro Economic theory , Vrinda Publications Pvt.Ltd.


**Sessional work assessment**

| | |
|---|---|
| Two tests | 2 x 15 = 30 |
| Two assignments | 2 x 10 = 20 |
| Total | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6 AEI 503 INSTRUMENTATION SYSTEMS

3 hours lecture and 1 hour tutorial per week

**Module I (14 hours)**

Instrumentation system-measuring instruments-control instruments and control instrument systems-open and closed loop systems-analysis and control-representation of operating components and concept of mathematical block diagrams-active and passive components-Null and deflection methods of measurements-calibration of instruments-errors in measurements-types of errors.

**Module II (12 hours)**

Methods of measurement-probability distribution function-Gaussian distribution-Chisquare test-Regression analysis-Modeling of simple instruments-Mechanical, Pneumatic, hydraulic, thermal, electrical systems-dynamic static-Generalized mathematical models of measurement systems-zero, first and second order systems.

**Module III (14 hours)**

Definition of transducers-Classification of transducers-principles of variable resistive transducers-potentiometer-RTD-Thermocouple-Thermistor-temoerature compensation-piezo electric materials, properties, equivalent circuit-transformation-modes of deformation-Elastic transducers-springs-Bellows-diaphragms-twin plate-membranes-capsules-Variable inductive transducers-LVDT-RVDT-principle, types and construction of variable capacitive transducers.

**Module IV (12 hours)**

Measurement of displacement, velocity, acceleration, force, RPM and torque-density measurement-Different methods of application-Load cell method-Pneumatic hydraulic load cells-methods of weight measurement-float principle-Measurement of turbidity-principles, methods and application.

*Text Books:*


1. Ernest Doebelin, "*Measurement Systems"*, 5th edn., McGraw Hill
2. Helfrick & Cooper, "*Modern Electronic Instrumentation and Measurement", Techniques*, PHI
3. D.A.Bell, "*Electronic Instrumentation and Measurements"*, PHI, 2003
4. D. V. S. Murthy, "*Transducers and Instrumentation"*, PHI
5. John P. Bentley, "*Principles of Measurement Systems"*, 3rd edn., Pearson Education


*References:*


1. Clyde F Coombs, "Jr. Electronic Instrument Hand book", 3rd edn, 1999, Mc Graw Hill
2. Joseph J. Carr, "Elements of Electronic Instrumentation and Measurements", 3/e, Pearson Education India
3. Jones B.E," *Instrumentation, Measurement and feedback"*,Tata McGraw Hill
4. Cook N.H & RabinoWicz E, "*Physical Measurements and its Analysis"*, Addison Wesley
5. Sawheny .A.K.,"*A course in Mechanical Measurements"*, Dhanpat Rai


**Sessional work assessment**

| | |
|---|---|
| Two tests | 2 x 15 = 30 |
| Two assignments | 2 x 10 = 20 |
| Total | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6 AEI 504 COMPUTER ORGANISATION & ARCHITECTURE

3 hours lecture and 1 hour tutorial per week

**Module I (14 hours)**

Computer as a hierarchical system, History of computers, Designing for performance, Computer components, Computer functions, Interconnection structures, Bus interconnection, PCI Bus structure, Data transfer and Arbitration.
CPU- Computer arithmetic, ALU, Integer representation and Arithmetic, Floating point representation and arithmetic, Machine instruction characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Processor organization, Register organization, Instruction cycle, Instruction pipelining, RISC Architecture.

**Module II (14 hours)**

Characteristics of memory systems, The memory hierarchy, Cache memory principle, Cache size, Mapping function, Replacement algorithms, Write policy, Line size, Number of Caches, Semi conductor main memory organization, DRAM and SRAM, ROM, Chip logic, Chip package, Module organization, Error correction, Synchronous DRAM, Rambus RAM, Cache DRAM.

**Module III (12 hours)**

Magnetic read write mechanism, Data organization and formatting, Disk performance parameters, RAID level 0 to 6, Compact disk, DVD, Magnetic tape, I/O Module, Programmed I/O, Interrupt driven I/O, DMA, I/O channels and processors, Fire wire serial bus, Infini band. Operating system overview, Scheduling, Memory management.

**Module IV (12 hours)**

Control unit, Micro operation, Control of the processor, Hardwired implementation, Micro programmed control unit, Micro instruction sequencing, Micro instruction execution, Multiple processor organization, Symmetric multi processors, Cluster computer architecture, Vector computation.

**Text books**

1. Hamacher C.V, "Computer Organisation-4th Edition", Mc Graw Hill, NewYork ,1997
2. Stallings William,"Computer Organisation and architecture" 6th Edition, Pearson Education 2003

**References:**

1.Hayes J.P, "Computer Organisation and Architecture-2nd Edition Mc Graw Hill
2.D.A Pattersen and J.L Hennesy "Computer Organisation and Design: The hardware /software Interface", 2nd Edition Harcourt Asia Private Ltd (Morgan Kaufman) Singapore 1998.
3. Andrew S. Tanenbaum "Structured Computer Organisation- 4th Edition Pearson Education

.

**Sessional work assessment**

| | |
|---|---|
| Two tests | 2 x 15 = 30 |
| Two assignments | 2 x 10 = 20 |
| Total | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6 AEI 505 LINEAR INTEGRATED CIRCUITS

3 hours lecture and 1 hour tutorial per week

**Module I (13 hours)**

BJT differential amplifier analysis - concept of CMRR - methods to improve CMRR - constant current source - active load - current mirror - Darlington pair - differential input impedance - various stages of an operational amplifier - simplified schematic circuit of op-amp 741 - need for compensation - lead, lag and lead lag compensation schemes - typical op-amp parameters - slew rate - power supply rejection ratio - open loop gain - unity gain bandwidth - offset current & offset voltage

**Module II (12 hours)**

MOS differential amplifier - source coupled pair - source cross coupled pair - current source load and cascode loads - wide swing current differential amplifier - wide swing constant transconductance differential amplifier - CMOS opamp with and without compensation - cascode input opamp - typical CMOS opamp parameters

**Module III (11 hours)**

Linear opamp circuits - inverting and noninverting configurations - analysis for closed loop gain - input and output impedances - virtual short concept - current to voltage and voltage to current converters - instrumentation amplifier - nonlinear opamp circuits - log and antilog amplifiers - 4 quadrant multipliers and dividers - phase shift and wein bridge oscillators - comparators - astable and monostable circuits - linear sweep circuits

**Module IV (16 hours)**

Butterworth, Chebychev and Bessel approximations to ideal low pass filter characteristics - frequency transformations to obtain HPF, BPF and BEF from normalized prototype LPF - active biquad filters - LPF & HPF using Sallen-Key configuration - BPF realization using the delyannis configuration - BEF using twin T configuration - all pass filter (first & second orders) realizations - inductance simulation using Antoniou's gyrator.

**Text books**


1. Jacob Baker R., Harry W Li & David E Boyce, '*CMOS- Circuit Design, Layout & Simulation*', PHI
2. Sergio Franco, '*Design with Operational Amplifiers and Analog Integrated Circuits*', McGraw Hill Book Company
3. James M Fiore, '*Operational Amplifiers and Linear Integrated Circuits*', Jaico Publishing House
4. Gaykward, *Operational Amplifiers*, Pearson Education


**Reference books**


1. Gobind Daryanani, '*Principles of Active Network Synthesis & Design*', John Wiley
2. Sedra A.S. & Smith K.C., "*Microelectronic Circuits*', Oxford University Press
3. Robert F Coughlin & Frederick F Driscoll, '*Operational Amplifiers and Linear Integrated Circuits*', Fourth Edition, Pearson Education
4. Mark N Horenstein, '*Microelectronic Circuits & Devices'*, PHI


**Sessional work assessment**

| | |
|---|---|
| Two tests | 2 x 15 = 30 |
| Two assignments | 2 x 10 = 20 |
| Total | =50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6 AEI 506 MICROPROCESSORS & MICROCONTROLLERS

3 hours lecture and 1 hour tutorial per week

**Module I (15 hours)**

Intel 8086 processor – Architecture- Pin configuration - Memory addressing -Addressing modes - Instruction set - Assembly language programming - Assemblers- Interrupts - - Timing diagrams - Minimum and maximum mode – Multiprocessor configuration

**Module II (12 hours)**

Interfacing - Address decoding - Interfacing chips-Architecture and Programming- Programmable peripheral interface (8255) - Programmable communication interface(8251) - Programmable timer (8254) – DMA controller (8257) – Programmable interrupt controller (8259) - Keyboard display interface (8279)

**Module III (12 hours)**

Introduction to 80386 - Memory management unit - Descriptors, selectors, description tables and TSS - Real and protected mode - Memory paging – Special features of the Pentium processor - Branch prediction logic – Superscalar architecture

**Module IV (13 hours)**

Intel 8051 microcontroller –architecture –ports, timers, interrupts, serial data transmission, instruction set –programming.

**Text Books**

1. A.K Ray, K.M. Bhurchandi, Advanced Microprocessors and peripherals, 2nd Edition, TMH
2. Ajay V Deshmukh, Microcontrollers theory and applications, TMH
3. Hall D.V., Microprocessors & Interfacing, McGraw Hill
4. Brey B.B., The Intel Microprocessors- Architecture, Programming & Interfacing, Prentice Hall
5. Liu Y. C. & Gibsen G.A, Microcomputer System: The 8086/ 8088 Family, Prentice Hall of India
6. Hintz K.J. & Tabak D., Microcontrolers- Architecture, Implementation & Programming. McGraw Hill
7. Myke Predko, Programming and Customising the 8051 Microcontroller,Tata Mc Graw Hill

**Reference books**

1Intel Data Book Vol.1, Embedded Microcontrollers and Processors
2Tribel W.A. & Singh A., The 8088 and 8086 Microprocessors, McGraw Hill
3.Intel Data Book EBK 6496 16 bit Embedded Controller Handbook

**Sessional work assessment**

| | |
|---|---|
| Two tests | 2 x 15 = 30 |
| Two assignments | 2 x 10 = 20 |
| Total | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6AEI 507(P) LINEAR INTEGRATED CIRCUITS LAB.

(3 hours practical per week)

1. Measurement of op-amp parameters - CMRR, slew rate, open loop gain, input and output impedances
2. Inverting and non-inverting amplifiers, integrators and differentiators - frequency response
3. Instrumentation amplifier - gain, CMRR and input impedance
4. Single op-amp second order LFF and HPF - Sallen-Key configuration
5. Narrow band active BPF - Delyiannis configuration
6. Active notch filter realization using op-amps
7. Wein bridge oscillator with amplitude stabilization
8. Astable and monostable multivibrators using op-amps
9. Square, triangular and ramp generation using op-amps
10. Voltage regulation using IC 723
11. Astable and monostable multivibrators using IC 555
12. Design of PLL for given lock and capture ranges & frequency multiplication
13. Precision limiter using op-amps
14. Multipliers using op-amps - 1,2 & 4 quadrant multipliers

**Text books**


1.Jacob Baker R., Harry W Li & David E Boyce, '*CMOS- Circuit Design, Layout & Simulation*', PHI

2.Sergio Franco, '*Design with Operational Amplifiers and Analog Integrated Circuits*', McGraw Hill Book Company

3.James M Fiore, '*Operational Amplifiers and Linear Integrated Circuits*', Jaico Publishing House

4.Gaykward, *Operational Amplifiers*, Pearson Education


**Reference books**


1.Gobind Daryanani, '*Principles of Active Network Synthesis & Design*', John Wiley

2.Sedra A.S. & Smith K.C., "*Microelectronic Circuits*', Oxford University Press

3.Robert F Coughlin & Frederick F Driscoll, '*Operational Amplifiers and Linear Integrated Circuits*', Fourth Edition, Pearson Education


**Sessional work assessment**

| | |
|---|---|
| Lab practical & record | = 35 |
| Test | = 15 |
| Total marks | =50 |

## 2K6AEI 508(P) COMPUTER PROGRAMMING LAB

(3 hours practical per week)

**Set 1 (3 lab sessions)**

C Programming - HCF (Euclid's algorithm) and LCM of given numbers - Conversion of numbers from binary to decimal, hexadecimal, octal and back - Evaluation of functions like $e^x$, sinx, cosx etc. for a given numerical precision using Taylor's series - String manipulation programs: sub-string search, deletion

**Set 2 (2 lab sessions)**

C Programming - Matrix operations: Programs to find the product of two matrices - Inverse and determinant (using recursion) of a given matrix - Solution to simultaneous linear equations using Jordan elimination. Files: Use of files for storing records with provision for insertion - Deletion, search, sort and update of a record

**Set 3 (2 lab sessions)**

JAVA - String handling programs, Implementation of Inheritance, Polymorphism, Overriding and Exceptions

**Set 4 (3 lab sessions)**

JAVA- Input/Output File Operations, Applet and Graphic Programming

**Reference books**


1. Schildt H., *C: The Complete Reference*, Tata McGraw Hill
2. Kelley, Al & Pohl, Ira.,., *A Book on C- Programming in C*, 4th Ed,, Pearson Education
3. Balagurusamy E., Programming with Java: A Primer, 3rd Ed., Tata McGraw-Hill


| **Sessional work assessment** | |
|---|---|
| Lab practical & record | = 35 |
| Test | = 15 |
| Total marks | = 50 |

## 2K6 AEI 601 ENVIRONMENTAL ENGINEERING & DISASTER MANAGEMENT

3 hours lecture and 1 hour tutorial per week

**MODULE I (12 HOURS)**

Multidisciplinary nature of Environmental studies – Definition – scope and importance – need for public awareness
Natural resources – renewable and non-renewable resources – natural resources – forest resources - water resources
Mineral resources – food resources – energy resources – Land resources – use, overuse and misuse of these resources with appropriate case studies to substantiate – effect on the environment – role of individual in conservation of natural resources – equitable use of resources for sustainable lifestyle.

**MODULE II (12 HOURS)**

Ecosystem – concept – structure and function – producers, consumers & decomposers – energy flow in the ecosystem- Ecological successive food chains - food webs ( all in brief)
Ecological pyramids – introduction, types and characteristic features, structure and function of forest, grassland, desert and acquatic ecosystems ( ponds, lakes, streams, rivers, oceans and estuaries) Biodiversity and its conservation – Introduction – definition : genetic species and ecosystem diversity – Biogeographical classification of India – value of biodiversity – consumptive and productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels –India as a mega-diversity nation – hot spots of biodiversity – threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

**MODULE III ( 13 HOURS)**

Environmental Pollution – Definition – causes - effects and control measures of : Air Pollution – water Pollution – soil Pollution – marine Pollution – noise Pollution – thermal Pollution – Nuclear hazards .
Solid waste management – causes, effects and control measures of urban and industrial wastes – Role of an individual in preventing Pollution – Environmental Protection Act – Prevention and control of air and water Pollution – Wildlife Protection Act – Forest Conservation Act – Issues involved in Enforcement of Environmental Legislation – Public awareness.
Disaster Management – Principles of disaster management – nature and extent of disasters – natural disasters , hazards, risks and vulnerabilities – man-made disasters – chemical, industrial, nuclear and fire. – preparedness and mitigation measures for various hazards – financing relief expenditure – legal aspects - post disaster relief – voluntary agencies and community participation at various stages of disaster management – rehabilitation programmes.

**MODULE IV ( 10 HOURS)**

Social Issues and the Environment – From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting , watershed management – resettlement and rehabilitation of people ; its problems and concerns, case studies – environmental ethics : Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies – waste land reclamation – consumerism and waste products.
Human population and the environment – Population growth, variations among nations – population explosion – Family welfare programmes – Environment and human health – Pollution hazards, sanitation and health – Human rights for a clean environment – value education – HIV/AIDS – social concern – Women and Child welfare – role of Information Technology in environment and human health – Case studies.

**FIELD WORK ( 5 HOURS)**

- Visit to a local area to document environmental assets – river / forest / grassland / hill / mountain
- Visit to local polluted site – urban / rural / industrial / agricultural
- Study of common plants, insects , birds
- Study of simple ecosystems – pond, river, hill slopes, etc.

**Text book**


1. Clarke. R.S. Marine Pollution. Clanderson Oress Oxford.`
2. Mhaskar A.K. Matter Hazardous. Techno-Science Publications.
3. Townsend. C., Harper. J. and Michael Begon, Essential of Ecology. Blackwell Science.
4. S. Deswal & A . Deswal, A Basic Course in Environmental Studies, Dhanpat Rai & Co
5. Environmental Studies – Dr. B . S. Chauhan, University Science Press.
6. Kurien Joseph & R. Nagendran, Essentials of Environmental Studies, Pearson Education.
7. Trivedi. R.K. and Goel. P.K. Introduction to air pollution. Techno-Science Publications.


**Reference Books**


1. Agarwal.K.C. Environmental biology. Nidi Publ.Ltd. Bikaner.
2. Bharucha erach, Biodiversity of India, Mapin Publishing Pvt.Ltd.,.
3. Brunner,R.C.. Hazardous Waste Incineration. McGraw Hill Inc..
4. Cunningham W.P. , Cooper T.H., Gorhani E. & Hepworth M.T. Environmental Encyclopedia ,Jaico Publ.House ,.
5. De A.K. Environmental Chemistry.Wiley Eastern Ltd.
6. Hawkins R.E. Encyclopediaof Indian Natural History, Bombay Natural History Society ,.
7. Heywood V.H. & Watson R.T.. Global Biodiversity Assessment. Cambridge Univ. Press.
8. Jadhav H. & Bhosale V.M.. Environmental Protection and Laws. Himalaya Pub. House,
9. Odum E.P. Fundamentals of Ecology W.B. Saunders Co..
10. Rao M.N. & Datta A.K. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd..
11. Sharma B.K.. Environmental Chemistry Goel Publ. House, Meerut
12. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol.I & II.Enviro Media.
13. Wagner K.D. Environmental Management. W.B. Saunders Co.


**Sessional work assessment**

| | | |
|---|---|---|
| Two Tests | 2 × 15 | = 30 marks |
| Two Assignment | 2 × 10 | = 20 marks |
| Total | | = 50 marks |

**University Examination Pattern**

Q I – 8 short answer type questions of 5 marks, 2 from each module.
Q II- 2 questions of 15 marks each from module I with choice to answer any one.
Q III- 2 questions of 15 marks each from module II with choice to answer any one.
Q IV- 2 questions of 15 marks each from module III with choice to answer any one.
Q V- 2 questions of 15 marks each from module IV with choice to answer any one.

## 2K6 AEI 602 CONTROL SYSTEMS

(3 hours lecture and 1 hour tutorial per week)

**Module I (12 hours)**

General schematic diagram of control systems - open loop and closed loop systems - concept of feedback - modelling of continuous time systems - laplace transform - properties - application in solution of differential equations - transfer function - block diagrams - signal flow graph - mason's gain formula - block diagram reduction using direct techniques and signal flow graphs - examples - derivation of transfer function of simple systems from physical relations - low pass RC filter - RLC series network - spring mass damper - definitions of poles, zeros, order and type

**Module II (14 hours)**

Analysis of continuous time systems - time domain solution of first order systems - time constant - time domain solution of second order systems - determination of response for standard inputs using transfer functions - steady state error - concept of stability - Routh-Hurwitz techniques - construction of bode diagrams - phase margin - gain margin - construction of root locus - polar plots and theory of Nyquist criterion - theory of lag, - lead and lag-lead compensators

**Module III (16 hours)**

Modelling of discrete - time systems - sampling - mathematical derivations for sampling - sample and hold - Z-transforms-properties - solution of difference equations using Z - transforms - examples of sampled data systems - mapping between s plane and z plane - cyclic and multi-rate sampling (definitions only) - analysis of discrete time systems - pulse transfer function - examples - stability - Jury's criterion - bilinear transformation - stability analysis after bilinear transformation - Routh-Hurwitz techniques - construction of bode diagrams - phase margin - gain margin.

**Module IV (10 hours)**

State variable methods - introduction to the state variable concept - state space models - physical variable - phase variable and diagonal forms from time domain (up to third order only) - diagonalisation - solution of state equations - homogenous and non homogenous cases (up to second order only) - properties of state transition matrix - state space representation of discrete time systems - solution techniques - relation between transfer function and state space models for continuous and discrete cases-relation between poles and Eigen values

**Reference books**


1. Benjamin C. Kuo, "Automatic *Control Systems*", 2nd Edition, Oxford University Press
2. Ogata K., "*Modern Control Engineering*", 3rd Edition, Prentice Hall India
3. Richard C. Dorf & Robert H. Bishop, "*Modern Control Systems*", 8th Edition, Addison Wesley
4. Benjamin C. Kuo, "*Digital Control Systems*", 2nd Edition, Oxford University Press
5. Ogata K., "*Discrete Time Control Systems*", Pearson Education Asia
6. Nagarath I.J. & Gopal M., "*Control System Engineering*", Wiley Eastern Ltd.
7. Ziemer R.E., Tranter W.H. & Fannin D.R., "*Signals and Systems*", 4th Edition, Pearson Education Asia


**Sessional work assessment**

| | |
|---|---|
| Two tests | 2 x 15 = 30 |
| Two assignments | 2 x 10 = 20 |
| Total marks | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6AEI 603 INDUSTRIAL INSTRUMENTATION -I

3 hours lecture and 1 hour tutorial per week

**Module I (15 hours)**

Measurement of temperature - definitions and units - standards of temperature - thermometry and pyrometry - thermocouples - Peltier effect, Thomson effect, Seebeck effect - types of thermocouples (chromel-copper, chromel-alumel, copper-constantan, iron-constantan, platinum-rhodium- platinum) - cold junction compensation - lead compensation - thermopiles - resistance thermometers - principles of operation - law of RTDs - copper RTD - platinum RTD - construction of RTDs - 3 wire connection - 4 wire connection - thermistors - quartz crystal sensors - expansion thermometers - bimetallic thermometers - liquid filled thermometers - gas filled thermometers - vapor pressure thermometers - principle of operation - construction and application ranges - pyrometry - Stefan Boltzmann's law - black body radiation - optical radiation pyrometers - disappearing filament photo electric pyrometer - unchopped DC& chopped AC broad band radiation thermometers - two colour radiation thermometers - IR imaging systems - pyroelectric radiation detectors - temperature instrumentation - pneumatic and electrical temperature transmitters - thermal system installation - linearisation of temperature transducers - testing and maintenance for process condition -temperature control technique.

**Module II (12 hours)**

Measurement of pressure - introduction - units and definitions - standards of pressure - pressure and vacuum pressure measuring elements - bourdon gauge - McLeod gauge - float pressure gauges - ionization gauges - Knudsen gauge - momentum transfer gauges - thermal conductivity gauges - Pirani gauge - dynamic effect of volumes and connecting tubing - dynamic testing of pressure - pressure and vacuum pressure measuring systems - pressure measuring strain gauges - differential pressure elements - U tube manometer - inclined manometer - ring balance type manometer - bellows - principle of operation, theory and construction - pressure transducers - differential pressure transducers - pneumatic and electrical pressure transmitters - pressure switches - very high pressure measurement transducer - pressure regulation and control - pressure signal multiplexing

**Module III (12 hours)**

pH measurements - basic principle of pH measurements - different types of pH electrodes - amplifiers for pH electrodes - problems in pH meters - digital pH meters - installation and maintenance - need for pH measurement - ORP measurement - viscosity measurement - different methods of measuring viscosity - different viscometers - continuous measurement of viscosity - rotameter for viscosity measurement - special type of flowmeter for viscosity measurement - future trends - maintenance

**Module IV (13 hours)**

Gas and liquid sampling techniques in process industry - flue gas analysers - industrial need for ORSAT apparatus - paramagnetic oxygen analyzers, CO2 analyser - environmental monitoring instrument - dust precipitators used in thermal power plant - Zirconium type sensor - chromatography - basic principle - gas, liquid solid chromatography - different types of columns, detectors, recorders - sampling techniques - sampling for liquids and gases for analysis purpose - components - automatic sampling maintenance - thermal conductivity gas analyser - heat of reaction methods - estimation of O2, H2, CH4, CO2, CO etc. in binary or complex gas mixtures - non dispersive IR analyser - methods for monitoring SOx, NOx & Ozone - application of gas analysis in pollution control instrumentation.

**Reference books**


1. Jain R.K., "Mechanical And Industrial Measurements", Khanna Publishers
2. Austin E. Fribance, "Industrial Instrumentation Fundamentals", McGraw Hill
3. Earnust O Doebelin, "Measurement System Application & Design", McGraw Hill
4. Andrews W.G., "Applied Instrumentation in Process Industries"
5. Patranabis D., "Principles Of Industrial Instrumentation", Tata McGraw Hill
6. Jones E.B., "Instrument Technology", Scientific Publications
7. Liptak B.G., "Instrument Engineers Handbook" .

| **Sessional work assessment** | | |
|---|---|---|
| Two tests | 2x15 | = 30 |
| Two assignments | 2x10 | = 20 |
| Total marks | | = 50 |

**University examination pattern**

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

## 2K6 AEI 604 DIGITAL SIGNAL PROCESSING

3 hours lecture and 1 hour tutorial per week

**Module I Discrete Fourier transform (12 hours)**

Discrete Fourier series - properties of DFS - periodic convolution – DTFT and DFT - properties - linear convolution using DFT - computation of DFT - circular convolution - decimation in time and decimation in frequency algorithms - FFT algorithm for a composite number.

**Module II (14 hours)**

Signal flow graph representation - basic filter structures - structures for linear phase - finite word - length effects in digital filters - quantizer characteristics - saturation overflow - quantization in implementing systems - zero Input limit cycles

**Module III: Digital filter design (14 hours)**

Design of IIR digital filters from analog filters - Butterworth and Chebyshev filters - design examples -impulse invariant and bilinear transformation methods - spectral transformation of IIR filters - FIR filter design - linear phase characteristics - window method

**Module IV: DSP hardware & advanced concepts (12 hours)**

Digital Signal Processors – Architecture . General Purpose processors. Special purpose DSP hardwares. Applications and Design aspects. Evaluation boards for real time signal processing. Equalization of digital audio signals. Spectral analaysis of audio signals. Adaptive Digital Filter – Concepts and Applications. Multirate DSP – Concepts. Sampling rate alteration devices. Design of Decimators and Interpolators.

**Reference books**

1. Alan V Oppenheim, Ronald W Schafer, John R Buck, “Discrete-time Signal Processing”, 2nd Ed., Prentice Hall Signal Processing Series, Pearson

2.Ifeacher E C, Jerris B W, “Digital Signal Processing – A Practical Approach”, Addison Wisley.

3.Proakis & Manolakkis, “Digital Signal Processing – Principle, Algorithms & Applications”, Prentice Hall India

**Sessional work assessment**

| | | |
|---|---|---|
| Two tests | 2x15 | = 30 |
| Two assignments | 2x10 | = 20 |
| Total marks | | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

## 2K6 AEI 605 PROCESS DYNAMICS AND CONTROL

3 hours lecture and 1 hour tutorial per week

**Module I (15 Hours)**

Introduction to process control – Process variables – degrees of freedom. Introduction to process modeling. Review of Laplace transforms and transfer functions, Poles and zeroes of transfer function, Linearization. Mathematical model of flow process, Thermal process, Mixing process and Chemical reaction. Dynamics of 1st and 2nd order systems – lead-lag, Inverse response systems. Interacting & non interacting systems – Batch process and Continuous process – Self regulation – System identification.

**Module II (12 Hours)**

Characteristics of ON-OFF, Proportional, integral and derivative modes – Composite control schemes – PI, PD and PID Response of controllers – Integral windup – Selection of control mode for different processes – Control Schemes for level, flow, pressure and temperature. Controller design using frequency response methods.

**Module III (13 Hours)**

Optimum controller settings - Tuning by process reaction curve method – Continuous cycling method – damped oscillation method – Colien coon tuning – Ziegler Nichol's tuning – ¼ decay ratio. – Stability of control systems – Advanced Control Strategies – Feed forward control – Ratio Control - Cascade control – Averaging control – Internal Model Control – Adaptive control – Multivariable control – Inferential control.

**Module IV(15 Hours)**

Pneumatic and electric actuators – I/P, P/I converters – Valve positioner - Control valve – Characteristics – Different types – Control Valve sizing – Cavitation – Flushing in control valves – Response of pneumatic transmission lines. Distillation column – Modelling – Dynamics – Control of top and bottom product compositions – Reflux ratio – Control of chemical reactor – Control of heat exchangers. Steam boiler – drum level control and combustion.

**Text Books:**


1. George Stephenopoulos," *Chemical Process Control : An Introduction to Theory and Practice"*, Prentice Hall, 1984
2. Curtis D Johnson ," *Process Control Instrumentation Technology"*, PHI, 1986
3. D E Seborg etal," *Process Dynamics & Control* ", Wiley, 1986
4. Peter Harriot," *Process Control* ", TMH
5. D R Conghanowr," *Process Systems Analysis and Control* ", Mc Graw Hill – 2/e, 1991


**References:**


**1.**W Luyben ,"*Process Medeling, Simulation and Control for chemical Engineers"*, 2/e, 1990, MGH
2. Patranabis D," *Principles of Process Control"*, TMH, 1981
3. Eckman D P," *Automatic Process Control*, Wiley Eastern", 1985
3. Carlos A Smith etal," *Principles & Practice of Automatic Process Control"*, John Wiley & Sons, 1985
4. Douglas M Considine," *Process / Industrial Instruments & Controls Hand Book"*, 4/e, MGH


**Sessional work assessment**

| | | |
|---|---|---|
| Two tests | 2x15 | = 30 |
| Two assignments | 2x10 | = 20 |
| Total marks | | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

## 2K6 AEI 606(A) DESIGNING WITH VHDL

3 hours lecture and 1 hour tutorial per week

**Module I (14 HOURS)**

Identifiers, data objects, Data types, and operators in VHDL. Entity declaration. Architecture modelling - structural, behavioural & data flow. Constant, signal, aliases, and variable assignments. Conditional statements – if then else , when else, with select , and case statements. Loop statements – for, while, loop, and generate statements. exit, next, block, assertion, and report statements..

**Module II (14 HOURS)**

Generics. Configurations - specification declaration, default rules, conversion functions, instantiation, and incremental binding. Subprograms - functions and procedures, operator overloading. Packages and libraries – package declaration, package body, design of file, design of libraries. Attributes- user defined and predefined.

**Module III (12 HOURS)**

Introduction to test bench generation –waveform generation, wait statement, text file reading and dumping results in text file. Testing – fault models, different faults. Fault simulation- ATPG, DFT, boundary scan, and BIST Top-down design, FSM implementation in VHDL.

**Module IV (12 HOURS)**

Design issues in synchronous machines-clock skew, gating the clock, asynchronous inputs. synchronizer failure, metastability resolution time, reliable synchronizer design. Moore & Melay machines. State encoding, interacting state machines. Introduction to CPLD, FPGA & design with CPLD and FPGA.

**References:**


1. Kevin Skahill,*"VHDL for Programmable Logic"*, Addison & Wesley.
2. John F. Wakerly,*" Digital Design Principles and Practices"*, PHI.
3. J Bhasker ,*"VHDL Primer"*, Pearson Education.
4. Nawabi,*"VHDL - Analysis and Modelling of Digital Systems"*, 2nd ed., Mc Graw Hill.
5. Douglas Perry,*"VHDL"*, Mc Graw Hill.
6. VHDL, IEEE Standard Reference Manual.


**Sessional work assessment**

| | |
|---|---|
| Assignments | 2x10 = 20 |
| 2 tests | 2x15 = 30 |
| Total marks | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6 AEI 606(B) HIGH SPEED DIGITAL DESIGN

3 hours lecture and 1 hour tutorial per week

**Module I (14 hours)**

**Introduction to high-speed digital design -** frequency, time and distance - capacitance and inductance effects - high speed properties of logic gates - speed and power - measurement techniques - rise time and bandwidth of oscilloscope probes - self inductance, signal pickup and loading effects of probes - observing crosstalk

**Module II (14 hours)**

**Transmission line effects and crosstalk -** transmission lines - point to point wiring - infinite uniform transmission lines - effects of source and load impedance - special transmission line cases - line impedance and propagation delay - ground planes and layer stacking - crosstalk in solid ground planes, slotted ground planes and cross-hatched ground planes - near and far end crosstalk

**Module III (12 hours)**

**Terminations and vias -** terminations - end, source and middle terminations - AC biasing for end terminations - resistor selection - crosstalk in terminators - properties of vias - mechanical properties of vias - capacitance of vias - inductance of vias - return current and its relation to vias

**Module IV (12 hours)**

**Stable reference voltage and clock distribution -** stable voltage reference - distribution of uniform voltage - choosing a bypass capacitor - clock distribution - clock skew and methods to reduce skew - controlling crosstalk on clock lines - delay adjustments - clock oscillators and clock jitter.

**Reference books**

1.Howard Johnson & Martin Graham, "*High Speed Digital Design: A Handbook of Black Magic*", Prentice Hall PTR
2.William S. Dally & John W. Poulton, "*Digital Systems Engineering*", Cambridge University Press
3.Masakazu Shoji, "*High Speed Digital Circuits*", Addison Wesley Publishing Company

**Sessional work assessment**

| | |
|---|---|
| Two tests | 2 x 15 = 30 |
| Two assignments | 2 x 10 = 20 |
| Total marks | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

## 2K6 AEI 606(C) LINEAR SYSTEMS ANALYSIS

3 hours lecture and 1 hour tutorial per week

**Module I: System concepts and modelling of systems (11 hours)**

Systems - subsystems - elements - systems approach - classification of systems - static and dynamic systems - linear and nonlinear systems - distributed and lumped systems - time invariant and time varying systems - stochastic and deterministic systems - system modeling and approximations - superposition principle - homogeneity and additivity - modelling of electrical systems - active and passive elements - resistance inductance and capacitance - dynamic equations using Kirchhoff's current and voltage laws. RL, RC and RLC circuits and their dynamic equations - block diagrams and signal flow graphs - masons gain formula

**Module II: Modelling of non-electrical systems (11 hours)**

Modelling of translational and rotational mechanical systems - differential equations for mass spring dashpot elements - D'Alembert's principle - rotational inertia - stiffness and bearing friction - gear trains - equivalent inertia and friction referred to primary and secondary shafts - dynamic equations for typical mechanical systems - electromechanical analogues - force-current and force-voltage analogue - capacitance and resistance of thermal, hydraulic pneumatic systems - dynamic equations for simple systems - comparison of electrical, electromechanical, hydraulic and pneumatic systems

**Module III: Transfer function and time domain analysis (15 hours)**

Use of Laplace transforms - concept of transfer function - impulse response - convolution integral - response to arbitrary inputs - transfer function of typical systems discussed in Module I - time domain analysis - test inputs - step - velocity and ramp inputs - transient and steady state response - first and second order - under damped and over damped responses - maximum overshoot - settling time - rise time and time constant - higher order systems - steady state error - error constants and error different types of inputs - Fourier series expansion of periodic functions - symmetry conditions - exponential form of Fourier series - Fourier integrals and Fourier transform - spectral properties of signals - analysis by Fourier methods

**Module IV: State space analysis and stability of systems (15 hours)**

Concept of state - state space and state variables - advantage over transfer function approach - state equations for typical electrical and mechanical and electromechanical systems - representation for linear time varying and time invariant systems - solution of state equation for typical test inputs - zero state and zero input response - concept of stability - bounded input bounded output stability - Lyapunov's definition of stability – asymptotic stability - stability in the sense of Lyapunov- Routh Hurwitz criterion of stability for single input single output linear systems described by transfer function model

**Reference books**


1. Cheng D.K," *Linear Systems Analysis"*, Addison Wesley
2. Tripati J.N.," *Linear Systems Analysis"*, New Age International


**Sessional work assessment**

| | |
|---|---|
| Assignments | 2x10 = 20 |
| 2 tests | 2x15 = 30 |
| Total marks | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

## 2K6 AEI 606 (D) DATA STRUCTURES & ALGORITHMS

3 hours lecture and 1 hour tutorial per week

**Module I (12 hours)**

Review of data types - scalar types - primitive types - enumerated types - subranges structures types - character strings - arrays - records - sets - tiles - data abstraction - complexity of algorithms - time and space complexity of algorithms using "big oh" notation - recursion - recursive algorithms - analysis of recursive algorithms

**Module II (12 hours)**

Linear data structures - stacks - queues - lists - stack and queue implementation using array - linked list - linked list implementation using pointers

**Module III (12 hours)**

Non linear structures - graphs - trees - sets - graph and tree implementation using array linked list - set implementation using bit string, linked list

**Module IV (16 hours)**

Searching - sequential search - searching arrays and linked lists - binary search - searching arrays and binary search trees - hashing - introduction to simple hash functions - resolution of collisions - sorting: $n^2$ sorts - bubble sort - insertion sort - selection sort - NlogN sorts - quick sort - heap sort - merge sort - external sort - merge files

**Text book**

1.Aho A.V., Hopcroft J.E. & Ullman J.D.," *Data Structures and Algorithms"*, Addison Wesley

**Reference books**

1.Sahni S., *"Data Structures, Algorithms, & Applications in C++"*, McGraw Hill
2.Wirth N., *"Algorithms +Data Structures = Programs"*, Prentice Hall
3.Cormen T.H., Leiserson C.E., & Rivest R.L., *"Introduction to Algorithms"*, MIT Press

**Sessional work assessment**

| | |
|---|---|
| Assignments | 2x10 = 20 |
| 2 tests | 2x15 = 30 |
| Total marks | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
QIII - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6 AEI 606 (E) FUZZY SYSTEMS & APPLICATIONS

(3 hours lecture and 1 hour tutorial per week**)**

**Module I (12 hours)**

Knowledge based systems. Process monitoring, fault diagnosis, knowledge based controllers(KBC),knowledge representations in KBCs. Crispness, vagueness, uncertainty and fuzziness. Crisp and fuzzy sets, properties of fuzzy sets, operations on fuzzy sets, fuzzy relations, operations on fuzzy relations.

**Module II (14 hours)**

Approximate reasoning, linguistic variables, fuzzy propositions, If-Then statements, inference rules. Representation and properties of a set of rules. Completeness, consistency, continuity. Structure of a fuzzy KBC (FKBC) and fuzzification module, knowledge base, inference engine. Defuzzification module - Rule based variables, contents of rules, derivation of rules, choice of membership functions and scaling factors, composition based and individual rule based inference, inference with a set of rules.

**Module III (14 hours)**

Methods of fuzzification and defuzzification and their performance evaluation, examples. Non-linear fuzzy control - FKBC as nonlinear transfer element fuzzification and defuzzification, rule base representation of transfer element.

**Module IV (12 hours)**

Fuzzy pattern recognition-feature analysis, partitions, identification, multifeature recognition. Fuzzy control systems-review of control theory for fuzzy controls, simple controllers, General controllers stability, models, inverted pendulum, aircraft landing control, air conditioner control. Genetic Algorithms and Fuzzy Logic- basics, design issues, convergence rate, Genetic Algorithm methods.

**Text Books:**

1. Driankov, D., Hellendoorn, H., Reinfrank, M.,*"An Introduction to Fuzzy Control"*, Narosa,1996.
2. Kosko, B.,"*Neural Networks and Fuzzy Systems"*, PHI,2007.
3.Timothy J. Ross, *"Fuzzy Logic with Engineering Applications"*, 2/e, McGraw Hill.

**Reference:**

1. Zimmerman, H.J., *"Fuzzy Set Theory and its Applications"*, **4/e**,Springer.2001.
2. Pedrycz, W.,Gomide, F.,*" An Introduction to Fuzzy Sets Analysis and Design"*, Prentice-Hall of India. 2005
3. Ganesh, M.,*" Introduction to Fuzzy Sets and Fuzzy Logic"*, PHI,2006.
4. Alavala, C.R., *"Fuzzy Logic And Neural Networks: Basic Concepts & Application"* , New Age International, 2008

**Sessional work assessment**

| | |
|---|---|
| Assignments | 2x10 = 20 |
| 2 tests | 2x15 = 30 |
| Total marks | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6 AEI 606 (F) VLSI SYSTEM DESIGN

3 hrs lecture and 1 hour tutorial per week

**Module I (10 hours)**

Introduction to MOS transistors- Linear and saturation regions of operation-bulk effect capacitance- CMOS fabrication process steps- basic principles- latch-up- static and dynamic analysis- power consumption and power delay products.

**Module II (12 hours)**

CMOS Inverter Design principles-Design layout rules-Construction of multiplexers- transmission gates-latches-flip flops. Overview of CMOS logic families- static complementary CMOS logic- ratioed CMOS logic, pass transistor logic. Dynamic CMOS logic-pseudo static CMOS, $C^2$MOS,NORA and TSPC logic families.

**Module III (14 hours)**

Combinational logic and sequential logic circuits- stick diagrams -Data path circuits-Adder multiplier architecture and accumulators Clocking strategies-single phase and two phase clocking-clock skew CMOS subsystem design-
CMOS testing.

**Module IV (16 hours)**

Programmable logic inter connect principles and types-Programmable logic elements- AND and OR arrays- Programming methods for FPGAs and CPLDs, Study of Altera 3000,4000 and Xilinx FPGA.

**Text Books**


1.Neil H.E. Weste & Kamran Eshraghian, Principles of CMOS VLSI Design: Addison Wesley.

2.Puck Nell D.A. & Eshraghian K. Basic VLSI Design- Systems & Circuits

3.Mead C., Conway L., Introduction to VLSI System, Addison Wesley

4.Wayne Wolf, Modern VLSI Design, Phipe.

5.Rabey J. M., Digital Integrated Circuits: A design Perspective, Prentice Hall, 1995


**Sessional work assessment**

| | |
|---|---|
| Assignments | 2x10 = 20 |
| 2 tests | 2x15 = 30 |
| Total marks | = 50 |

**University examination pattern**

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

## 2K6 AEI 607(P) INDUSTRIAL INSTRUMENTATION LAB

3 hours practical per week

1. Measurement of viscosity
2. Measurement of temperature
3. Measurement pH
4. Measurement of pressure
5. Measurement of level
6. Measurement flow
7. Dynamic response of first order system
8. Dynamic response of second order system
9. Pressure to current converter
10. Current to pressure converter
11. Use of LDR for measurement of physical variation
12. Measurement of strain/force
13. Measurement of speed
14. Calibration of Instruments


*Text Books:*

1. Ernest Doebelin, "*Measurement Systems"*, 5th edn., McGraw Hill
2. Helfrick & Cooper, "*Modern Electronic Instrumentation and Measurement", Techniques*, PHI
3. D.A.Bell, "*Electronic Instrumentation and Measurements"*, PHI, 2003
4. D. V. S. Murthy, "*Transducers and Instrumentation"*, PHI

*References:*

1. Clyde F Coombs, "Jr. Electronic Instrument Hand book", 3rd edn, 1999, Mc Graw Hill
2. Joseph J. Carr, "Elements of Electronic Instrumentation and Measurements", 3/e, Pearson Education India
3. Jones B.E," *Instrumentation, Measurement and feedback"*,Tata McGraw Hill
4. Cook N.H & RabinoWicz E, "*Physical Measurements and its Analysis"*, Addison Wesley
5. Sawheny .A.K.,"*A course in Mechanical Measurements"*, Dhanpat Rai


**Sessional work assessment**

| | |
|---|---|
| Laboratory practical & record | = 35 |
| Test | = 15 |
| Total marks | =50 |

## 2K6AEI 608(P) : MICROPROCESSOR & MICROCONTROLLER LAB

3 hours practical per week

**List of experiments**

1. 8068 kit familiarization and basic experiments
2. Addition and Subtraction of Binary and unpacked BCD numbers
3. Double precision multiplication
4. Sorting algorithms
5. Searching algorithms
6. Interfacing with A/D converters
7. Interfacing with D/A converters
8. PWM motor control circuits
9. Serial communication between two kits
10. General purpose clock design
11. Interfacing with PCs
12. Data acquisition System using 8051 microcontroller
13. Stepper motor control using 8051 microcontroller

**Text books**


1.A.K Ray, K.M. Bhurchandi, Advanced Microprocessors and peripherals, 2nd Edition, TMH

2.Ajay V Deshmukh, Microcontrollers theory and applications, TMH

3.Hall D.V., Microprocessors & Interfacing, McGraw Hill

4.Brey B.B., The Intel Microproessors - Architecture, Programming & Interfacing, Prentice Hall

5.Liu Y .C. & Gibsen G.A., Microcomputer System: The 8086/8088 Family, Prentice Hall of India

6.Hintz K.J. & Tabak D., MicrocontrollersArchitecture, Implementation & Programming, McGraw Hill

7.Myke Predko, Programming and Customising the 8051 Microcontroller,Tata Mc Graw Hill


**Sessional work assessment**

| | |
|---|---|
| Laboratory practical & record | = 35 |
| Test | = 15 |
| Total marks | =50 |