UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

V SEMESTER

APPLIED ELECTRONICS and INSTRUMENTATION ENGINEERING

SCHEME -2013

V SEMESTER

APPLIED ELECTRONICS and INSTRUMENTATION ENGINEERING (A)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/ P				
13.501	Engineering Mathematics IV (AFRT) (Complex Analysis & Linear Algebra)	4	3	1	-	50	3	100	150
13.502	Engineering Management for Electronics Engineers (AT)	3	2	1	-	50	3	100	150
13.503	Microprocessors & Microcontrollers (AT)	4	3	1	-	50	3	100	150
13.504	Electrical Machines & Drives (A)	3	2	1	-	50	3	100	150
13.505	Power Electronics (A)	4	3	1	-	50	3	100	150
13.506	Elective I	3	2	1		50	3	100	150
13.507	Signal Processing Lab (A)	4	-	-	4	50	3	100	150
13.508	Control System Lab (A)	4	-	-	4	50	3	100	150
	Total	**29**	**15**	**6**	**8**	**400**		**800**	**1200**

13. 506 Elective I

13.506.1	Professional Communications (AT)
13.506.2	Fuzzy Systems & Applications (AT)
13.506.3	Artificial Neural Networks (AT)
13.506.4	Bioinformatics (AT)
13.506.5	Mechatronics (AT)
13.506.6	Analytical Instrumentation (A)
13.506.7	Fluid Dynamics & Instrumentation (A)

13.501 ENGINEERING MATHEMATICS – IV (AFRT)

(COMPLEX ANALYSIS AND LINEAR ALGEBRA)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To introduce the basic notion in complex analysis such as Analytic Functions, Harmonic functions and their applications in fluid mechanics and differentiations and integration of complex functions ,transformations and their applications in engineering fields*.
- *Many fundamental ideas of Linear Algebra are introduced as a part of this course. Linear transformations provide a dynamic and graphical view of matrix-vector multiplication. Orthogonality plays an important role in computer calculations.*

Module – I

Complex Differentiation: Limits, continuity and differentiation of complex functions. Analytic functions – Cauchy Riemann equations in Cartesian form (proof of necessary part only).Properties of analytic functions – harmonic functions. Milne Thomson method.

Conformal mapping: Conformality and properties of the transformations $w = \frac{1}{z}$, $w = z^2$, $w = z + \frac{1}{z}$, $w = \sin z$, $w = e^z$ - Bilinear transformations.

Module – II

Complex Integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – zeros and singularities – residues and residue theorem.

Evaluation of real definite integrals – $\int_0^{2\pi} f(sinx, cosx)dx$, $\int_{-\infty}^{\infty} f(x)dx$ (with no poles on the real axis). (Proof of theorems not required).

Module – III

Vector spaces and subspaces- Null spaces, Column spaces and linear transformations-Kernal and range of a linear transformation -Linearly independent sets-Bases –Bases for nulA and ColA-Co-ordinate systems -Dimension of vector space -Rank -Change of basis.

Module – IV

Inner product spaces -Length and orthogonality -Orthogonal sets-Orthogonal and orthonormal bases -Orthogonal projection -Gram-Schmidt process -Least square problem -Quadratic forms- Constrained optimization of quadratic forms -Singular value decomposition (proof of the theorem are not included).

References:

1. O'Neil P. V., Advanced Engineering Mathematics, Cengage Learning, 2011.
2. Kreyszig E., *Advanced Engineering Mathematics*, 9/e, Wiley India, 2013.
3. Grewal B. S., *Higher Engineering Mathematics*, 13/e, Khanna Publications, 2012.
4. Lay D. C., Linear Algebra with Applications, 3/e, Pearson Education, 2006.
5. Bronson R. and G. B. Costa, Linear Algebra-an introduction, Elsevier Academic Press, 2007.
6. Williams G., Linear Algebra with Applications, Jones and Bartlett Learning, 2012.
7. Strang G., Linear Algebra with Applications, Thomson Learning, 2006.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of this course, the students master the basic concepts of complex analysis and linear algebra which they can use later in their career.

13.502 ENGINEERING MANAGEMENT FOR ELECTRONICS ENGINEERS (AT)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objectives:

This paper prepares engineers to fulfil their managerial responsibilities, acquire useful business perspectives and takes on the much needed leadership roles to meet the new challenges.

Module – I

Management challenges to engineers, Functions of engineering management- Brief description of each function . System concept. Types of organization structures - Types of companies and their formation.

Engineers as managers and leaders, Ethics in engineering management, Web based enablers for engineering management, Globalization, Engineering management in the new millennium, Case studies..

Module – II

Personal Management – Objectives and functions – Recruitment, Selection, Training and Induction concepts and Techniques.

Financial Management, Functions of Financial Management, Capital, Sources of Finance- Shares Debentures.

Introduction to Marketing and its Environment- Marketing mix, Product Life Cycle.

Module – III

Cost concept - Break even analysis (simple problems). Depreciation - Methods of calculating depreciation.

Basic concepts quality, Quality Control, Control chart for variables and attributes, TQM, applications, Acceptance sampling, Quality circles.

Module – IV

Reliability, adequate performance of electronic circuits, working specifications, failure density curve, performance of electronic devices, probability indices, frequency indices, duration indices, expectation indices, MTTF MTBF, Reliability of system connected in series and parallel, failure rate calculations, maintainability, replacement.

References:

1. Chang C. M., *Engineering Management*, Pearson, 2012.
2. Gupta A. K., *Engineering Management*, S. Chand, 2010.

3. Chhalotra G. P., *Reliability Methods in Engineering and Its Applications, Khanna Publishers,* 2006.
4. Mahajan M., *Statistical Quality Control*, Dhanpat Rai, 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Question paper should contain minimum 20% Numerical Problems.*

Course Outcome:

After the completion of this course, students will be familiar with the managerial techniques and shall be confident to take up leadership roles and managerial challenges.

13. 03 MICROPROCESSORS AND MICROCONTROLLERS (AT)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To understand fundamental operating concepts of microprocessors and microcontrollers.*
- *To appreciate the advantages in using microprocessors and microcontrollers in engineering applications.*
- *To understand low level programming.*
- *To apply this knowledge to more advanced structures*

Module – I

Introduction to microprocessors, 8085 architecture, microprocessor initiated operations and bus organization, internal data operations, external initiated operations, registers, machine cycles and bus timings, memory interfacing, interfacing concepts for I/O devices. 8085 programming model, instruction classification, interrupts, assembly level programming..

Module – II

Introduction to microcontrollers, comparison: microcontrollers and microprocessors, 8051 architecture- memory organization, registers and I/O ports. Addressing modes, instruction sets, and assembly language programming, Introduction to C programming in 8051. Watchdog timer, Power down mode: idle/sleep mode concepts. Interrupts: comparison of interrupt with polling, Interrupt handling and programming. Timer operation: timer modes and assembly level programming.

Module – III

Serial port : modes of operation ,assembly level Programming ,Interfacing to RS232.

Interfacing : keyboard, stepper motor, ADC , DAC, RTC DS 12887 and LCD module interface

Applications - square wave and rectangular wave generation, frequency counter and temperature measurement. Introduction to software development tools: IDE, Cross compiler, cross assembler, builder, Linker, debugger.

Module – IV

Microcontroller RISC family-ARM processor fundamentals: Register Organisation, pipeline, core. ARM instruction sets: data processing, branch, load-store, interrupts & program status register instructions. Exceptions & interrupts: handling & priorities. PIC microcontrollers - introduction, architecture (block diagram explanation only).

References:

1. Gaonkar, *Microprocessor Architecture Programming and Applications with the 8085,* 5/e, Prentice Hall, 2002.
2. Mazidi M. A., *The 8051 Microcontroller and Embedded System*, 2/e, Pearson, 2009.
3. Das L. B., *Embedded systems an Integrated Approach*, Pearson, 2013.
4. Sloss A. N., D. Symes and C. Wright , *ARM system Developer's Guide: Designing and Optimizing System Software*, Elsevier, 2004.
5. PIC 16F877 Data book
6. ARM processor Data book.
7. Ayala K., *The 8051 Microcontroller,* Cengage, 3/e, 2004.
8. Seal D., *ARM Architecture Reference Manual,* Addison Wesley, 2/e, 2000.
9. Wolf W., *Computers as Components: Principles of Embedded Computing system design*, Elsevier, 2005.
10. Kamal R*., Microcontrollers architecture programming interfacing and system design*, Pearson,2/e,2012
11. Kaler R. S*., Text Book of Microprocessors and Microcontrollers*, IK International, 2011.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note:** Question paper should contain 25% Problems and Assembly level Programming. Assembly level Programming only for 8085 & 8051.*

Course Outcome:

After the course student will understand the principle of microprocessor and microcontroller working, programming concepts and applications.

13.504 ELECTRICAL MACHINES & DRIVES (A)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

This course provides students an insight on principles, construction and application of DC Machines, Transformers and Synchronous machines. Special Machines and drives will also be covered under this course.

Module – I

D.C. MACHINES: Types and characteristics - shunt, series and compound generators - Principle of operation of D.C. motor - Back E.M.F - Torque equation - characteristics of shunt, series and compound motors - Losses and efficiency calculations - Applications of D.C. Motors - Motor starters - speed control of D.C. motors.

Module – II

TRANSFORMERS: Principle, constructional details of shell and core type transformer - EMF equation. Equivalent circuit - regulation and efficiency calculations - Auto transformer - Principle of operation - phasor diagram - three phase transformer connections. Potential Transformer, Current Transformer - Application.

Module – III

SYNCHRONOUS MACHINES: Construction and principle of operation of alternators - EMF equation Synchronizing Methods (Dark Lamp and Bright Lamp Method) - determination of regulation by synchronous impedance method - Theory of operation of synchronous motor.

INDUCTION MACHINES: Construction and principle of operation - types of induction motor - Torque equation - Torque slip characteristics - Maximum toque - Effect of rotor resistances - starting and speed control.

Module – IV

SPECIAL MACHINES: Types of single phase motor - Double field revolving theory - Shaded pole motor - Universal motor - Stepper motor.

DRIVES: DC Motor Drives - Introduction to Motor drives, Criteria for selecting drive component. Equivalent circuit of DC Motor drive, Block diagram and transfer function.

References:

1. Nagrath I. J. and D. P. Kothari, *Electric Machines*, 2/e, Tata McGraw Hill, 2004.
2. Sen P. C., *Principles of Electric Machines and Power Electronics*, 2/e, John Wiley & Sons, 2008.

3. Krishnan R., *Electric Motor drives – Modeling, Analysis and Control*, PHI, 2008.
4. Bimbhra P. S., *Electrical Machinery*, Khanna Publishers, 2009.
5. Gupta B. R., and Vandana Singhal, *Fundamentals of Electrical Machines*, New Age International Publishers, 2001.
6. Say M. G., Alternating Current Machines, 5/e, Pitman, 1983.
7. Wildi and T. Wildi, *Electrical Machines, Drives and Power Systems*, 6/e, Pearson Education, 2007.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note:** Question paper should contain minimum 25% Problems.*

Course Outcome:

After the completion of this course, students will be familiarized with DC Machines, Transformers, Synchronous and Special machines. Construction and applications of electrical machines and drives will also be familiarized as a part of this course.

13.505 POWER ELECTRONICS (A)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

This course provides students an insight on concepts of Power Electronics. The various applications of Power electronics such as rectifiers, regulators and inverters are also introduced as a part of this course

(Handled by faculty of Dept. of Electronics and Communication)

Module – I

Concept of Power Electronics - Power semiconductor switches: Power diodes-structure, static and dynamic characteristics, Power diode types. Power transistors - Power BJT, Power MOSFET, GTO and IGBT. Steady state and switching characteristics of BJT, Power MOSFET and IGBT.

Module – II

SCR - Structure-VI characteristics - Two Transistor analogy - Snubber Circuits - Single phase half wave and full wave controlled rectifier circuits with R, RL and RLE load. Three phase half wave and full wave controlled rectifiers. Resistance and Resistance Capacitance Firing Circuits for SCR.

Module – III

Switched mode regulators - Buck, Boost, Buck-Boost and Cuk DC-DC converters - Analysis of waveforms and derivation of expression for output voltage, voltage and current ripple under continuous conduction mode. Overview of SMPSN- Isolated converters - Flyback, Forward, Push Pull, Half Bridge and Full Bridge Converters - waveforms and governing equations.

Module – IV

Switched mode inverters- Principles of PWM switching schemes for square wave and sine wave output. Single phase inverters - half bridge, full bridge and push pull. UPS - on line and off line. Battery charging circuits. Three phase inverters - Six step and current controlled inverters. PWM and Space vector modulation in three phase inverters.

References:

1. Umanand L., *Power Electronics Essentials and Applications*, Wiley India, 2009.
2. Mohan N.and T. M. Undeland, *Power Electronics: Converters, Applications and Design,* John Wiley, 2007.
3. Rashid M. H., *Power Electronics: Circuits, Devices and Applications*, 3/e, Pearson/Prentice Hall, 2004.

4. Asghar M. S. J., *Power Electronics*, PHI, 2004.
5. Jacob J. M., *Power Electronics Principle and Application*, Cenagae, 2010.
6. Agrawal J. P., *Power Electronic Systems: Theory and Design*, Pearson 2001.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Question paper should* contain *60% Numerical problems, Analysis and derivations.*

Course Outcome:

After successful completion of the course, students will be familiar with the concepts of power electronics and the theory and design of different power electronic devices.

13.506.1 PROFESSIONAL COMMUNICATION (AT)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

- *To understand the concepts and acquire necessary communication skills*
- *To shape personalities and to deal with global business and life situations*
- *To study the topics relating to technology, legal and ethical aspects of business, employment interview*

Module – I

Introduction to communication, meaning and definition, features, significance, forms of communication, channels, models-Shannon's, Shannon- Weaver, transactional, limitations, barriers to communication, oral communication, significance, types, business presentation, features, types, steps, visual aids in communication, listening, written communication, merits and demerits, reports, significance, types, components of a report, report writing process.

Module – II

Proposals, types of proposals, external and internal proposal, qualities of a good proposal, steps in proposals, technical documents, thesis, features, scientific article and research paper, dissertation, business letters, types, components, forms, layout, government letters, components, memorandum, components, format of a memo, guidelines, nonverbal communication, features, functions, nonverbal leakage, stimuli, mass media communication, significance, categories, public relations management, tools of public relations, press conference, press release.

Module – III

Meetings, types, virtual mode of meeting, notice, agenda, conduct of meetings, chairpersons role, members role, minutes of meeting, cross cultural and global communication, characteristics, Hofstede's model, barriers, effective global communication, communication and information technology, impact of ICT, E-business, E- business related operations, E-mail, videoconferencing, writing employment messages, adapting to workplace change, writing resumes, writing job application letters.

Module – IV

Employment interviews, role of communication in the interview process, types of interviews, characteristics, qualities of a interviewer, success in interview process.

Legal issues in professional communication, ethics in business communication, significance, ethics related issues, corporate communication, business etiquettes,

significance, etiquette rules, verbal and nonverbal etiquette, visits, gifts, E-mail etiquette, meeting etiquette, dining etiquette.

Practical (**No University Examination)**

Practice in speech making process, developing communicative ability, techniques for speaking fluently, using body language, developing fluency and confidence, short speeches, group discussions and role-plays, listening activities, effective presentation strategies, writing user manuals for electronic equipment

References:-

1. SubbaRao P., B. Anita Kumar, C.H. Bindu**,** *Business Communication,* Cengage, 2012.
2. KavithaTyagi and Padma Mishra*, Professional Communication,* PHI, 2011.
3. KavithaTyagi and Padma Mishra*, advanced Technical Communication,* PHI, 2011.
4. Tyagi, *Advanced Technical Communication*, PHI, 2013.
5. Bert Decker, *The Art of Communicating*, Crisp Publication, 2004.
6. Meenakshi Raman and Sangeeta Sharma, *Technical Communication,* Oxford University Press, 3/e, 2004.
7. Anderson P., *Technical Communication*, Cengage, 8/e, 2014.
8. Rajendra Pal, *Essentials of Business Communication*, Sultan Chand, 11/e, 2009.
9. Madhukar, *Business Communications*, VIKAS, 2/e, 2013.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the course ,the student will be able to understand the topics relating to technology and ethical aspects of business, employment messages, employment interview, basic concepts of communication skills, mass media communication etc.

13.506.2 FUZZY SYSTEMS AND APPLICATIONS (AT)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To understand the concepts and terminologies of fuzzy systems.*
- *To study the concepts of crisp sets, fuzzy sets and fuzzy networks.*
- *To study various applications of fuzzy systems.*

Module – I

Introduction to fuzzy sets and systems-crispness, vagueness, uncertainty and fuzziness. Basics of fuzzy sets, membership functions, support of a fuzzy set height, normalized fuzzy set, alpha cuts.

Type- 2 fuzzy sets. Operation on fuzzy set-complement, intersection, union, Demorgan's Law Equality & subset hood. Law of excluded middle and contradiction, concentration, dilation, contrast intensification.

Module – II

Extension Principle and its application. Fuzzy relation- operations, projection, max-min , min-max composition, cylindrical extension. Reflexivity, symmetry and transitivity of fuzzy relations. Fuzzy prepositions, fuzzy connectives, linguistic variables, hedges, Approximate reasoning or fuzzy inference, Fuzzy rule based system. Fuzzification and defuzzification using centroid, centre of sums.

Module – III

Applications-Fuzzy logic controllers, Types of FLC- Types of Fuzzy rule formats. Block diagram of fuzzy logic controller. Multi input multi output control system. FLC with different case studies. PID controller. Air Conditioner controller using Fuzzy logic.

Module – IV

Introduction to Neural Fuzzy Controller- Neural Fuzzy controller with hybrid structure, Parameter learning for Neural fuzzy controllers – Neural Fuzzy controller with Fuzzy singleton Rules. Introduction to ANFIS- Structure of an ANFIS – Neural Fuzzy controller with TSK fuzzy rules.

References:

1. Ross T. J., *Fuzzy Logic with Engineering Applications*, Wiley, 3/e, 2010.
2. Lin C. T. and C.S. G. Lee, *Neural Fuzzy Systems*, Prentice Hall, 1996.
3. Ibrahim A. M., *Introduction to Applied Fuzzy Electronics*, PHI, 2013.
4. Rajasekaran and Pai, *Neural Networks Fuzzy Logic and Genetic Algorithms*, PHI, 2003.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the course the student will be able to know the concepts of fuzzy system and applications.

13.506.3 ARTIFICIAL NEURAL NETWORKS (AT)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To learn concepts of Artificial neural networks.*
- *To learn various architecture of ANN*
- *To study the methods of operating informations in ANN.*

Module – I

Introduction to Neural Networks - Applications - Typical architecture of Artificial Neural Networks - Common activation function, Mc. Culloh Pitts Neuron – Architecture, logic implementatons. Supervised and Unsupervised learning- Learning Algorithms .Linear Separability -Pattern Classification – Hebb Net, Perceptrons, ADALINE networks (Architecture, Algorithm and simple Applications).

Module – II

Pattern Association- training algorithms- Hetro Associative Network, Auto Associative Network, Hopfield Network, BAM Network. Self organizing Maps - Learning Vector Quantization (Architecture, Algorithm and Applications.

Module – III

Counter Propagation Network (Architecture, Algorithm and Applications). Conjugate Gradient Learning- Back Propagation algorithm-Multilayer feed forward network (Architecture, Algorithm and applications).

Module – IV

Adaptive Resonance Theory- ART 1 and ART 2. Cover's theorem- Radial Basis Function Networks. Boltzmann machine (Architecture, Algorithms and Applications). Introduction to Probabilistic neural network.

References:

1. Fausett L., *Fundamentals of Neural Networks,* Pearson Education. 2004.
2. Haykin S., *Neural Networks,* PHI, 3/e, 2012.
3. Freeman J. A. and D. M. Skapura, *Neural Networks - Algorithms, Applications and Programming Techniques,* Pearson Education, 2008.
4. Bose N. K. and P. Liang, *Neural Network Fundamentals with Graphs, Algorithms and Applications,* McGraw Hill, 1996.
5. Hagan M. T., H. B. Demuth and M. Beale*, Neural Network Design,* Vikas Thomson Learning, 1996.

6. Sivanandham, Sumathi, Deepa, *Introduction to Neural Networks using MATLAB,* TMH, 2005.
7. Bishop C. M., *Neural Networks for Pattern Recognition,* Oxford University Press, 1995.
8. Yegnanarayana*, Artificial Neural Networks*, PHI, 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note:** Question paper should contain minimum 70% Problems and Algorithm.*

Course Outcome:

After successful completion of the course, students will be familiar with the concept of ANN and will be able to apply the right algorithm to solve practical problems.

13.506.4 BIOINFORMATICS (AT)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To familarise terminology used in bioinformatics*
- *To give an understanding of bioinformatics and algorithms, data bases and matrices, alignment and comparison, sequences, and algorithms to analyse data*
- *To study the applications of bioinformatics*

Module – I

The cell as basic unit of life-Prokaryotic cell and Eukaryotic cell - Central Dogma: DNA-RNA-Protein, Introduction to DNA and Protein sequencing, Human Genome Project, SNP, Bioinformatics databases- Nucleotide sequence databases, Primary nucleotide sequence databases-EMBL, Gene Bank, DDBJ; Secondary nucleotide sequence databases Protein sequence databases- Swiss Prot. Protein Data Bank.

Module – II

Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues. Scoring matrices- PAM and BLOSUM matrices, Pairwise sequence alignments: Needleman & Wuncsh, Smith & Waterman algorithms for pairwise alignments. BLAST and FASTA. Multiple sequence alignments (MSA)- CLUSTALW. Basic concepts of phylogeny- Phylogenetic analysis algorithms - Maximum Parsimony, UPGMA and Neighbour-Joining. Evaluation of phylogenetic trees-reliability and significance; Boot strapping; Jackknifing.

Module – III

Computational approaches for bio-sequence analysis - Mapping bio-sequences to digital signals – various approaches – indicator sequences – distance signals – use of clustering to reduce symbols in amino acid sequences – use of cross correlation to locate desired patterns in nucleotide sequences- Chaos Game Representation of Genomes- analysis of bio-sequence signals: case study of spectral analysis for exon location.

Module – IV

Systems Biology: System Concept- Properties of Biological systems, Self organization, emergence, chaos in dynamical systems, linear stability, bifurcation analysis, limit cycles, attractors, stochastic and deterministic processes, continuous and discrete systems, modularity and abstraction, feedback, control analysis, Mathematical modeling; Biological Networks- Signaling pathway, GRN, PPIN, Flux Balance Analysis, Systems biology v/s synthetic biology.

References:

1. Claverie J. M. And C. Notredame, *Bioinformatics - A Beginners Guide*, Wiley-Dreamtech India Pvt, 2003.
2. Alon U., *An Introduction to Systems Biology Design Principles of Biological Circuits*, Chapman & Hall/CRC, 2006.
3. Zvelebil M. J. and J. O. Baum, *Understanding Bioinformatics*, Garland Science, 2008.
4. Bergeron B.P., *Bioinformatics Computing,* Pearson Education, 2003.
5. Mount D.W., *Bioinformatics: Sequence & Genome Analysis*, Cold Spring Harbor Press, New York, 2004.
6. Semple C., R. A. Caplan and M. Steel, *Phylogenetics,* Oxford University Press, 2003.
7. Orengo C. A., D. T. Jones and J. M. Thornton*, Bioinformatics- Genes, Proteins and Computers,* Taylor & Francis 2003.
8. Singh R. and R. Sharma, *Bioinformatics*, Universities Press, 2010.
9. Resources at web sites of NCBI, EBI, SANGER, PDB etc.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note:** Question paper should contain minimum 40% to 60% quantitative questions.*

Course Outcome:

After successful completion of the course, student will be able to understand the basic principles bioinformatics, algorithms and application.

13.506.5 MECHATRONICS (AT)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

This course provides students an introduction to mechatronics and provides an insight on systems, system devices, Direct Numerical Control and Computer aided planning.

Module – I

Introduction to mechatronics - What is mechatronics - design process – systems - measurement systems - control systems - programmable logic controllers - examples of mechatronic systems - fundamentals of numerical control - advantages of NC systems - classification of NC systems - point to point and contouring systems - NC and CNC - incremental and absolute systems - open loop and closed loop systems - features of NC machine tools - fundamentals of machining.

Module – II

System devices - system drives - hydraulic systems - DC motors - stepping motors - AC motors -feedback devices - encoders - pulse digitizers - resolvers - tachometers - counting devices - flip flops - counters - decoders - digital to analog converters - interpolation - linear interpolator - circular interpolators Complete interpolator - Control Loops for CNC - CNC software interpolator.

Module – III

Direct Numerical Control (DNC)-Distributive Numerical Control- DNC configurations-connecting NC/CNC machines to DNC systems-DNC system hardware components- DNC software- DNC selection criteria-Computer Integrated Manufacturing (CIM) Introduction-Automated Storage and Retrieval Systems.

Module – IV

Computer Aided Process Planning - Material Requirement Planning - Computer Aided Inspection - Machine Vision NC part programming - manual programming - concepts - tape formats - tab sequential - fixed block word address and variable block formats - part programming examples - point to point programming and simple contour programming - computer aided programming - concepts - APT programming - part programming examples.

References:

1. Koren Y., *Computer Control of Manufacturing Systems,* McGraw Hill, 1983.
2. HMT, *Mechatronics*, TMH, 2000.

3. Groover M. P., M. Weiss, R. N. Nagel and N. G. Odrey, *Industrial Robots - Technology, Programming and Applications*, McGraw Hill, 1986.
4. Groover M. P. and E. W. Zimmers, *CAD/CAM: Computer Aided Design and Manufacturing*, Prentice Hall, 1984.
5. Koren Y. and B. Yuri, *Numerical Control of Machine Tools*, Khanna Publishers, 1984.
6. Bolton W., *Mechatronics: A Multidisciplinary Approach,* 4/e, Pearson Education, 2008.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of this course, students will be familiarized with mechatronics concepts, design process, systems, system devices and Direct Numerical Control systems. Students will also be equipped with good knowledge on Computer aided programing.

13.506.6 ANALYTICAL INSTRUMENTATION (A)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

This course provides students an insight on principles of electromagnetic radiation, construction and application of related instruments. The course also render a vivid understanding about special devices and their applications.

Module – I

Electromagnetic radiation – Beer-Lambert law – Colorimeters – UV-Visible spectrophotometers– Single and double beam instruments – Sources and detectors – IR Spectrophotometers – Types – Attenuated total reflectance flame photometers.

Module – II

Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers –Flame emission photometers – Fluorescence spectrophotometer. Different techniques – Gas chromatography – Detectors – Liquid chromatographs – Applications – High-pressure liquid chromatographs – Applications.

Module – III

Gas analyzers – types, Oxygen analyser, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation, Water pollution monitoring, Principle of pH measurement, pH meters, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes.

Module – IV

NMR – Basic principles – NMR spectrometer - Applications. Electron spin Resonance spectroscopy– Basic principles, Instrumentation and applications. Fundamentals of radio chemical methods, Radiation detectors, Gamma camera, Mass spectrometers – Different types –Applications. Biosensors, Chemically sensitive semiconductor devices.

References:

1. Khandpur R. S., *Handbook of Analytical Instruments*, Tata McGraw Hill, 2003.
2. Jain R. K., *Mechanical and Industrial Measurements*, Khanna Publishers, New Delhi, 1999.
3. Braun R. D., *Introduction to Instrumental Analysis*, McGraw Hill, Singapore, 1987.
4. Liptak, B.G, *Process Measurement and Analysis*, Chilton Book Company, 1995.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of this course, students will become familiar with the principles of electromagnetic radiation, construction and application of related instruments. Some selected special devices and their applications will also be familiarized as a part of this course.

13.506.7 FLUID DYNAMICS & INSTRUMENTATION (A)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

This course provides students an insight on principles of fluid dynamics. Various measuring devices and their applications are also introduced as a part of this course

Module – I

Properties of fluids- density, specific gravity, viscosity, compressibility, vapor pressure - Capillarity and surface tension- Newton's law of Viscosity – Fluid pressure and its measurement -various types of manometers and pressure gauges– Types of Flow– Reynolds number – Continuity equation - Bernoulli's Equations.

Module – II

Euler's Equation of Motion – Practical applications of Bernoulli's – Orifice plate – Venturi tube –Pitot tube – Laminar flow - Reynold's experiment – Navier Stokes equations of motion – Flow through pipes – Loss of energy in pipes – major energy losses – Minor energy losses..

Module – III

Velocity measurements - Hot-Wire anemometer – Hot-film anemometry – Laser Doppler anemometer (LDA)- Flow measurement by drag effect - rotameter- turbine meter-vortex shedding, Magnetic flowmeter- Flow visualisation methods – shadowgraph, schlieren, interferometer- Introduction and Classification of Turbines and pumps- impulse turbines – construction and working.

Module – IV

Introduction and fundamentals of CFD – solution procedure – grid generation and grid independence – Boundary conditions – Laminar CFD calculation – Turbulant CFD calculation – CFD with heat transfer – Compressible flow CFD calculation – Open Channel flow CFD calculation.

References:

1. Rajput R. K., *Fluid Mechanics and Hydraulic Machineries*, S. Chand & Company Ltd., 2013
2. Holman J. P., *Experimental Methods for Engineers*, 7/e, Tata McGraw Hill, 2012.
3. Cengel Y. A. and J. M. Cimbala, *Fluid mechanics Fundamentals and Applications* Tata McGraw Hill, 2012.
4. Beckwith T. G., *Mechanical Measurements*, 5/e, Pearson Education, 2001.

5. Patranabis D., *Principles of Industrial Instrumentation*, Tata McGraw Hill, 1999.
6. Jain R. K., *Mechanical and Industrial Measurements*, Khanna Publishers, 1999.
7. Eckman D. P.,*Industrial Instrumentation*, Wiley Eastern, 1990.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of this course, students will be familiarized with the principles of fluid dynamics. Various measuring devices and their applications will also be familiarized as a part of this course.

13.507 SIGNAL PROCESSING LAB (A)

Teaching Scheme: 0(L) - 0(T) - 4(P) **Credits**: 4

Course Objective :

The main objectives of this course are

- *Develop programming skills on Digital Signal Processors*
- *Simulation of circuits using VHDL*

PART – A

Experiments

1. Sine wave generation (Display on CRO)
2. Generation of arbitrary wave forms. (Standard test signals, ECG etc.)
3. Real Time FIR Filter implementation (Low-pass, High-pass and Band-pass)
4. Real Time IIR Filter Implementation (Low-pass, High-pass and Band-pass)
5. Sampling a given Analog signal and study of aliasing.

PART – B

Experiments on MATLAB or LABWIEW

1. Generation Basic signals (sinusoidal, square, triangular, impulse etc.)
2. Mathematical operation on signals (Time shifting, Time scaling, Multiplication, Addition etc.)
3. Convolution: Linear Convolution, Circular Convolution, Linear Convolution using Circular Convolution.
4. Random Sequence Generation: Uniform, Rayleigh and Normal Distributions
5. Discrete Fourier Transform: (Unfolding the spectrum, Frequency Unwrapping)
6. Linear convolution using DFT (Overlap-add and Overlap-Save methods).
7. Design & implementation of IIR filters from analog specifications. (Butterworth and Chebyshev Filters)
8. Design & implementation of FIR filters. (Window method and Frequency sampling Method)
9. Generation of AM, FM & PWM waveforms and study of their spectrum.
10. Study of Sampling rate conversion by a rational factor

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions for each batch should be based on the list of experiments prescribed, equally from Part A and Part B.

25% - Circuit Design (Logical design and flow diagram for software experiments)

15% - Implementation (Usage of Kits and trouble shooting, Coding for Software experiments)

35% - Result (Including debugging of Program for software experiments)

25% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

After completion the course student will be able to design circuits using VHDL and MATLAB/LABVIEW.

13.508 CONTROL SYSTEM LAB (A)

Teaching Scheme: 0(L) - 0(T) - 4(P) **Credits**: 4

Course Objective :

- *To give a practical exposure to Control systems*
- *To familiarize the modelling of control systems and to simulate their responses in time and frequency domain.*

List of Experiments:

Part A:

1. Transient response analysis of a second order system
2. Frequency response analysis of a second order system
3. Design of compensation networks (Lead, Lag and Lead –lag)
4. P, PI and PID Controller design and implementation
5. Data acquisition system
6. Microcontroller based servo system- position control, speed control
7. Root locus analysis & Design
8. State Observer design
9. Design of state feedback Pole placement.

Part B:

1. Real time control of inverted pendulum
2. Real time control of gyroscope.
3. Ball beam system
4. Magnetic levitation system

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions should be based on the list of experiments prescribed in Part A. (Experiment No. 1 – 6: Circuit implementation and & Simulations using LABVIEW and MATLAB; Experiment No. 7 – 9: Simulations only)

20% - Circuit and Design

20% - Performance

35% - Result

25% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

After completion the course student will be able to understand the working of various control systems and will be able to design/simulate the same for practical models.