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)**

<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Credits</th>
<th>Weekly load, hours</th>
<th>CA Marks</th>
<th>Exam Duration Hrs</th>
<th>UE Max Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.501</td>
<td>Engineering Mathematics IV (AFRT) (Complex Analysis &amp; Linear Algebra)</td>
<td>4</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.502</td>
<td>Engineering Management for Electronics Engineers (AT)</td>
<td>3</td>
<td>2 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.503</td>
<td>Microprocessors &amp; Microcontrollers (AT)</td>
<td>4</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.504</td>
<td>Electrical Machines &amp; Drives (A)</td>
<td>3</td>
<td>2 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.505</td>
<td>Power Electronics (A)</td>
<td>4</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.506</td>
<td>Elective I</td>
<td>3</td>
<td>2 1</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.507</td>
<td>Signal Processing Lab (A)</td>
<td>4</td>
<td>- - 4</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.508</td>
<td>Control System Lab (A)</td>
<td>4</td>
<td>- - 4</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>29</strong></td>
<td><strong>15 6 8</strong></td>
<td><strong>400</strong></td>
<td><strong>800</strong></td>
<td><strong>1200</strong></td>
<td></td>
</tr>
</tbody>
</table>

### 13. 506 Elective I

<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.506.1</td>
<td>Professional Communications (AT)</td>
</tr>
<tr>
<td>13.506.2</td>
<td>Fuzzy Systems &amp; Applications (AT)</td>
</tr>
<tr>
<td>13.506.3</td>
<td>Artificial Neural Networks (AT)</td>
</tr>
<tr>
<td>13.506.4</td>
<td>Bioinformatics (AT)</td>
</tr>
<tr>
<td>13.506.5</td>
<td>Mechatronics (AT)</td>
</tr>
<tr>
<td>13.506.6</td>
<td>Analytical Instrumentation (A)</td>
</tr>
<tr>
<td>13.506.7</td>
<td>Fluid Dynamics &amp; Instrumentation (A)</td>
</tr>
</tbody>
</table>
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


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 – \( \int_0^{2\pi} f(\sin x, \cos x)\,dx \), \( \int_{-\infty}^{\infty} f(x)\,dx \) (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:


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


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


References:


**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


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:

5. PIC 16F877 Data book
6. ARM processor Data book.

**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.*
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


Module – II


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.


References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, 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


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:


**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.
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:-**


**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


Module – II


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


References:

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

Module – II

Module – III

Module – IV

References:


**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 familiarise 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 & Wunsch, 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


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:


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


Module – III


Module – IV


References:


**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


Module – II


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


References:

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


Module – III


Module – IV


References:


**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 LABVIEW

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 Chebychev 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

**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.