SYLLABUS & CURRICULUM

of

B.Tech.

APPLIED ELECTRONICS & INSTRUMENTATION ENGINEERING (3rd to 8th semesters)

UNIVERSITY OF CALICUT

(2014 admission)
### SCHEME OF SEMESTER III OF B.Tech AEI COURSE

<table>
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<tr>
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<th>Hours/Week</th>
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<th>Duration of End Semester Exam</th>
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**Note:** For EN 14 302 Computer Programming in C, the end semester examination will be held by the University as a theory paper.

### SCHEME OF SEMESTER IV OF B.Tech AEI COURSE

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# SCHEME OF SEMESTER VII OF B.Tech AEI COURSE

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## Elective I
1. AI14 704(A) Nanotechnology and Nanoelectronics
2. AI14 704(B) Mobile Communication
3. AI14 704(C) Nonlinear Control System
4. AI14 704(D) Digital Signal Processors
5. AI14 704(E) Computer Networks

## Elective II
1. AI14 705(A) Advanced Biomedical Instrumentation
2. AI14 705(B) Digital Image Processing
3. AI14 705(C) Speech Processing
4. AI14 705(D) Electronics Packaging
5. AI14 705(E) Piping Instrumentation
6. AI14 705(F) Operation Research

# SCHEME OF SEMESTER VIII OF B.Tech AEI COURSE

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## Elective III
1. AI14 804(A) Robotics & Automation
2. AI14 804(B) Soft Computing Techniques
3. AI14 804(C) Mechatronics
4. AI14 804(D) Telemetry & Remote Control
5. AI14 804(E) Numerical Methods

## Elective IV
1. AI14 805(A) Power Plant Instrumentation
2. AI14 805(B) Space Instrumentation
3. AI14 805(C) Instrumentation in Petrochemical Industries
4. AI14 805(D) Multirate Signal Processing
5. AI14 805(E) Wavelet Theory
EN14 301: ENGINEERING MATHEMATICS III
(Common for all branches)

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective
- To provide a quick overview of the concepts and results in complex analysis that may be useful in engineering.
- To introduce the concepts of linear algebra and Fourier transform which are wealths of ideas and results with wide area of application.

Module I: Functions of a Complex Variable (13 hours)

Module II: Functions of a Complex Variable (14 hours)

Module III: Linear Algebra (13 hours) – (Proofs not required)

Module IV: Fourier Transforms (14 hours)

Text Books

Module I:
Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
Sections: 12.3, 12.4, 12.5, 12.6, 12.7, 12.9

Module II:
Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
Sections: 13.1, 13.2, 13.3, 13.4, 14.4, 15.1, 15.2, 15.3, 15.4

Module III:
Bernad Kolman, David R Hill, Introductory Linear Algebra, An Applied First Course, Pearson Education.
Sections: 6.1, 6.2, 6.3, 6.4, 6.8, Appendix.B.1

Module IV:
Sections: 9.1, 9.3, 9.5
### Reference books


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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

### University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8 x 5 marks = 40

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

4 x 15 marks = 60

*Maximum Total Marks: 100*
EN14 302 Computer Programming in C
(Common for all branches)

Teaching scheme
3 hours lectures and 1hour lab per week

Objectives
- To impart the basic concepts of computer and information technology
- To develop skill in problem solving concepts through learning C programming in practical approach.

Module I (10 hours)

Module II (14 hours)

Module III (14 hours)

Module IV (14 hours)

Text Books

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

- 50% - Lab Practical Tests
- 20% - Assignments
- 20% - Main Record
- 10% - Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
Module I (13 hours)
Electron ballistics-Motion of electron in electric and magnetic fields-Electrostatic and magnetic deflection sensitivities-Principle of CRO, Multimeter-Measurement of voltage, current and resistance.

Electronic components-Resistors, Capacitors and Inductors-types, characteristics and colour coding of each. Relays and Transformers. Diodes-Principle-V-I characteristics-d-c model-diode current equation- Zener diode-clipping and clamping circuits.

Transistors- Physical structure-modes of operation-Transistor current components-characteristics-equivalent models-CE-CB-CC configurations. JFET and MOSFET-constructional details-operation and characteristics-MESFET. UJT- constructional details-operation and characteristics

Module II (13 hours)
Rectifiers and Power supplies-Half wave and Full wave rectifiers-Definition and derivation of rectifier specifications such as PIV, dc output voltage, ripple factor, efficiency, rectification factor-Rectifiers with filter-Inductive and capacitive filters-analysis-LC and pi filters

Simple Zener Regulator-working-analysis and design-series voltage regulator-analysis and design-short circuit protection

Module III (13 hours)
Transistor biasing-load line-Q point-effect of Q point location on signal swing-different biasing techniques-Bias stability-Stability factors-Calculation of S, S’, S” at least for voltage divider bias-

Amplifiers- analysis using h-parameter model-current gain, voltage gain, input and output impedance- Emitter follower-biasing problem-boot strapping-Darlington circuit- High frequency model of BJT and MOSFET- internal capacitances –f(beta and fT –Miller effect-gain bandwidth product

Multistage Amplifiers-Different types of coupling- RC, Transistor and Direct- Frequency response-Cascode Amplifier-Comparison

Module IV (13 hours)
Biasing of JFET and MOSFET-Modelling JFET and MOSFET - Analysis of FET and MOSFET-Amplifiers- current gain, voltage gain, input and output impedance –Source Follower-Single stage IC MOS amplifiers-active load- High frequency model of MOSFET- internal capacitances –f(beta and fT– Miller effect-gain bandwidth product
Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern
PART A: Analytical/problem solving SHORT questions
Candidates have to answer EIGHT questions out of TEN.
There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
AI14 304: Electrical Engineering

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
To introduce the fundamental concepts of DC machine, transformer, alternator, induction motor and indicating instruments.

Module I: DC machines (13 hours)
Types of DC machines - DC generators - emf equation - Open circuit and load characteristics of different types of DC generators - DC motors - Principle of operation - Types - Torque equation - Characteristics - Starters

Module II: Transformers (13 hours)
Principle of operation - emf equation - Phasor diagram - Equivalent circuit - OC and SC tests - Basic principles of auto transformer and three phase transformer

Module III: AC machines (13 hours)
Alternator - Rotating field - Frequency effect of distribution of winding - emf equation - Basic principles of synchronous motor - Losses and Efficiency - Torque equation - Starting methods - induction motor - Constructional features - Principle of operation of 3 phase induction motor - Vector diagram and equivalent circuits - Starting and speed control of squirrel cage and wound rotor induction motor

Module IV: Electrical measurements (13 hours)
Principle of Indicating instruments - moving coil, moving iron and dynamometer type instruments - Extension of range of voltmeter and ammeter - Measurement of 3 phase power by two wattmeter method - Principle and working of Induction type energy meter - DC slidewire, potentiometer - Wheatstone bridge - Kelvin's double bridge - AC bridges - Schering bridge, Maxwell's bridge

Text Book

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
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<td><strong>PART A: Analytical/problem solving SHORT questions</strong></td>
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<td>Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.</td>
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AI14 305: Digital Systems

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
- To introduce the concepts of digital logic systems.
- Topics covered are Boolean algebra, flip-flops, counters, shift registers, Digital IC technologies, and sequential networks.

Module I (13 hours)
Analog and digital representation, Review of number systems-representation-conversions, r’s and (r-1)’s complement representation. Binary codes - error detection and error correction. Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms-minterm and maxterm, Simplification of Boolean expressions-Karnaugh map (upto 4 variables), completely and incompletely specified functions, Quine Mccluskey method (upto 5 variables). Implementation of Boolean expressions using universal gates.

Module II (13 hours)
Combinational logic circuits- adders, subtractors, BCD adder, ripple carry look ahead adders,parity generator, decoders, encoders, multiplexers, demultiplexers, Realisation of boolean expressions-using decoders-using multiplexers. Memories - ROM - organisation, expansion. PROMs. RAMs - Basic structure, organization, Static and dynamic ROMs, PLDs, PLAs. Sequential circuits – latches, flip flops - SR, JK, D, T, and Master slave flip flops, edge triggering, asynchronous inputs.

Module III (14 hours)

Module IV (12 hours)

Text Books

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

60% - Tests (minimum 2)

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

10% - Attendance and Regularity in the class

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<td>There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.</td>
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</tbody>
</table>

| **PART B:** Analytical/Problem solving DESCRIPTIVE questions | 4 x 15 marks=60 marks |
| Two questions from each module with choice to answer one question. |

*Maximum Total Marks: 100*

**AI14 306: Electric Circuits & Network Theory**

Credits: 4
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To expose the students to basic concepts of electric circuits and methods of circuit analysis in time domain and frequency domain
- To introduce the fundamentals of filter circuits

Module I (14 hours)

Module II (13 hours)
Network functions—The concept of complex frequency—driving point and transfer functions—Impulse response—Poles and Zeros of network functions, their locations and effects on the time and frequency domain responses. Restriction of poles and zeros in the driving point and transfer function. Time domain behaviour from the pole–zero plot. Frequency response plots—Bode plot.

Module III (12 hours)

Module IV (13 hours)

Text Books
1. R. A. DeCarlo and P. Lin, Linear Circuit Analysis, Oxford University Press, New Delhi, 2001
2. D. R. Choudhary, Networks and Systems, New Age International, New Delhi, 2000

Reference Books
Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

<table>
<thead>
<tr>
<th>PART A: Analytical/problem solving SHORT questions</th>
<th>8x 5 marks=40 marks</th>
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<tr>
<td>Two questions from each module with choice to answer one question.</td>
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Maximum Total Marks: 100

AI14 307(P): Electronics Lab

Teaching scheme
3 hours practical per week

Credits: 2
University of Calicut

Objectives

- To train the students to obtain the characteristic curves of semiconductor devices like diode, transistor, FET, and UJT.
- To provide experience on design, testing, and analysis of electronic circuits-clipping and clamping circuits, RC filters, rectifiers, amplifier, voltage regulator, etc.
- To expose the students to simulation of electronic circuits using any software.
- The students may bring the simulation results before doing the experiment.

2. Study of laboratory instruments like CRO, Multimeter, Function Generator, Power Supply, etc.
3. Introduction to any circuit simulation software, eg. PSPICE/EDSPICE/MULTISIM, etc.
4. Characteristics of diode (Si, Ge, Zener diode)
5. Characteristics of Transistor - Common Emitter configuration - Evaluation of h-parameters
6. Characteristics of Transistor - Common Base configuration - Evaluation of h-parameters
7. Characteristics of FET
8. UJT characteristics
9. RC LPF and HPF - Frequency response
10. Clipping and clamping circuits
11. Rectifiers - half wave, center tap full wave, bridge full wave - with and without filter - ripple factor and regulation & using Voltage Regulators: 78XX, 79XX family
12. Zener diode voltage regulator circuit
13. Series voltage regulator circuit with feedback
14. Common emitter amplifier with voltage divider bias circuit, and coupling and bypass capacitors - frequency response characteristics
15. FET/MOSFET - as an amplifier

Internal Continuous Assessment (Maximum Marks - 50)

<table>
<thead>
<tr>
<th>Percentage</th>
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<tbody>
<tr>
<td>60%</td>
<td>Laboratory practical and record</td>
</tr>
<tr>
<td>30%</td>
<td>Tests</td>
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<td>10%</td>
<td>Regularity in the class</td>
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Semester-End Examination (Maximum Marks - 50)

<table>
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<tr>
<th>Percentage</th>
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<tr>
<td>70%</td>
<td>Procedure, conducting experiment, results, tabulation, and inference</td>
</tr>
<tr>
<td>20%</td>
<td>Viva voce</td>
</tr>
<tr>
<td>10%</td>
<td>Fair record</td>
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</tbody>
</table>
AI14 308(P): Electrical Engineering Lab

Credits: 2

Teaching scheme
3 hours practical per week

Objectives
- To obtain the performance characteristics of dc and ac machines and transformers.
- To familiarize various electrical measurement methods

2. Plot open circuit characteristics of DC shunt generator for rated speed - Predetermine O.C.C for other speeds - Determine critical field resistance for different speeds
3. Load test on DC shunt generator - Plot external characteristics - Deduce internal characteristics
4. Load test on DC series motor - Plot the performance characteristics
5. OC and SC tests on single phase transformer - Determine equivalent circuit parameters - Predetermine efficiency and regulation at various loads and different power factors - verify for unity power factor with a load test
6. Load test on 3 phase cage induction motor - Plot performance curves
7. Resistance measurement using
   a. Wheatstone's bridge
   b. Kelvin's double bridge
8. Measurement of self inductance, mutual inductance and coupling coefficient of
   a. Transformer windings
   b. air cored coil
9. Power measurement in 3 phase circuit - Two wattmeter method
10. Extension of ranges of ammeter and voltmeter using shunt and series resistances
11. Calibration of Single phase energy meter by direct loading

Internal Continuous Assessment (Maximum Marks-50)
60% - Laboratory practical and record
30% - Test/s
10% - Regularity in the class

Semester-End Examination (Maximum Marks-50)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
**EN14 401B: Engineering Mathematics IV**  
(Common for IC, EC, EE, AI, BM, CS, and IT)

**Teaching scheme**  
3 hours lecture and 1 hour tutorial per week

**Objective**

- To inculcate the students an adequate understanding of the basic concepts of probability theory.
- To make them develop an interest in the area which may find useful to pursue their studies
- To stimulate the students understanding of the z-transform
- To make the student get acquainted with the basics of PDE

**Module I (12 hours)**  

**Module II (14 hours)**  

**Module III (13 hours)**  

**Module IV (13 hours)**  
Introduction – Solutions of equations of the form $F(p,q) = 0$; $F(x,p,q) = 0$; $F(y,p,q) = 0$; $F(z,p,q) = 0$; $F1(x,q) = F2(y,q)$; Clairaut’s form, $z = px + qv + F(p,q)$; Lagrange’s form, $Pp + Qq = R$ – Classification of Linear PDE’s – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables.

**Text Books**

**Module I:**  
Richard A Johnson, CB Gupta, *Miller and Freund’s Probability and statistics for Engineers*, 7e, Pearson Education - Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7

**Module II:**  
Sections: 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7.

**Module III:**  
Sections: 4.1, 4.4, 4.5

**Module IV:**  
Sections: 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9  
Sections: 11.2, 11.3, 9.8 Ex.3, 11.5
University of Calicut

Reference books


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| There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions. |

| **PART B: Analytical/Problem solving DESCRIPTIVE questions** 4 x 15 marks=60 marks |
| Two questions from each module with choice to answer one question. |

*Maximum Total Marks: 100*
EN14 402 Environmental Science
(Common for all branches)

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To understand the problems of pollution, loss of forest, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues
- To create awareness among the students to address these issues and conserve the environment in a better way.

Module I (13 hours)
The Multidisciplinary nature of environmental science. Definition-scope and importance-need for public awareness. Natural resources. Renewable and non-renewable resources: Natural resources and associated problems-forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their defects on forests and tribal people- water resources: Use and over utilization of surface and ground water, floods, drought , conflicts over water, dams-benefits and problems.- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.- Food resources: World food problems, changes caused by agriculture over grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.-Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources, Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Module II (14 hours)
Ecosystems-Concept of an ecosystem-structure and function of an ecosystem – producers, consumers, decomposers-energy flow in the ecosystem-Ecological succession- Food chains, food webs and Ecological pyramids-Introduction, types, characteristics features, structure and function of the following ecosystem-Forest ecosystem- Grassland ecosystem –Desert ecosystem-Aquatic ecosystem(ponds, streams, lakes, rivers, oceans , estuaries).

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 prevention of pollution. Pollution case studies-Disaster management: floods , earth quake, cyclone and landslides-Environmental impact assessment

Module IV (12 hours)
Environment and sustainable development-Sustainable use of natural resources-Conversion of renewable energy resources into other forms-case studies-Problems related to energy and Energy auditing-Water conservation, rain water harvesting, water shed management-case studies-Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust-Waste land reclamation Consumerism and waste products-Reduce, reuse and recycling of products-Value education.
Text Books:
1. Daniels & Krishnaswamy, Environmental studies, Wiley India Pvt Ltd, 2009

References:
1. Raghavan Nambiar, K Text book of Environmental Studies, Scitech Publishers (India) Pvt Ltd
2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

Note: Field work can be Visit to a local area to document environmental assets-river/forest/grass land/mountain or Visit to local polluted site-urban/rural/industrial/agricultural etc. or Study of common plants, insects, birds etc. or Study of simple ecosystems-pond, river, hill slopes etc. or mini project work on renewable energy and other natural resources, management of wastes etc.

University Examination Pattern

PART A: Analytical/problem solving SHORT questions  8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To expose the students to the principles of integrated circuit fabrication
- To provide in depth understanding of the fundamentals of Op-Amp and various circuits using Op-Amp.

Module I (12 hours)
Integrated circuit-fabrication, monolithic IC technology, basic planar processes, fabrication of a typical circuit, active and passive components of ICs- fabrication of BJTs and FETs-CMOS technology, thin and thick film technology, technology trends.
Differential amplifier – The BJT differential pair – small signal and large signal operation of differential amplifier, CMRR, input resistance, voltage gain, non-ideal characteristics of differential amplifier, current sources, active load, MOS differential amplifier, BiCMOS amplifier, GaAs amplifier

Module II (14 hours)

Module III (14 hours)
Op-Amp with negative feedback-non Inverting and inverting amplifiers- I/P resistance with feedback, O/P resistance, band width, voltage follower, concept of virtual ground, I to V converter, differential amplifier with one Op-Amp, instrumentation amplifier, AC amplifiers with single supply voltage, summing, scaling and averaging amps, V to I converter with floating load, V to I converter with grounded load. Integrator, differentiator, comparator, zero crossing detector, timing mark generator, sample and hold circuit, Precision Diode, Precision rectifier, average detector, peak detector, logarithmic and antilog amplifiers, analog Multiplier.

Module IV (12 hours)
Phase locked loops – operation of first and second order PLLs – Lock and Capture range – LM565 PLL – Application of PLL as AM/FM/FSK detectors, frequency translator, phase shifter, tracking filter, signal synchronizer and frequency synthesizer. Voltage controlled oscillator – Functional diagram & operation of IC 566 – Applications of 566

Text Books
4. B. Somanathan Nair, Linear Integrated Circuits, Wiley India, New Delhi

Reference Books
1. S. Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata Mc-Grav Hill, New Delhi, 2002
2. D. A. Bell, Operational Amplifiers and Linear Circuits, 4th ed., Prentice Hall of India, New Delhi, 1990

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
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**Maximum Total Marks: 100**
AI14 404: Introduction to Microprocessors

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- This course aims to equip the students with the basic knowledge of architecture, programming, and interfacing of the microprocessor 8085. A brief study of the microprocessor 8086 and interfacing chips also is intended.

Module I (13 Hours)

Module II (12 Hours)
Concepts of Microprocessors, microcomputers and assembly language, Microprocessor architecture, Memory organization, Memory mapped I/O and I/O mapped I/O modes. I/O interfaces. The 8085 MPU: Buses and signals, instruction format, Flags, Interrupts, Addressing modes, DMA Programming with 8085: Basic Instructions, Logic operations, Branch operations, Data transfer, 16-bit operations. Counter and Timing delays, stacks and subroutines. Code Conversion, BCD arithmetic.

Module III (14 Hours)
Intel 8086 processor, Architecture, Concept of memory segmentation, Addressing modes, Instruction set, Assembly language programming, Assemblers with an example MASM/TASM/NASM, Interrupts, Timing diagrams, Minimum and Maximum mode, Concepts of pipelining and parallelism Simple programming with 8086.

Module IV (13 hours)
Interfacing, Address decoding, interfacing chips: Programmable Peripheral Interface (8255), Programmable Timer (8253/54), Programmable Interrupt Controller (8259), Programmable keyboard/display controller (8279), DMA and DMA controller (8237/57), ADC & DAC, Serial I/O and Data communication.

Text Books
University of Calicut

Reference Books
1. P. K. Ghosh and P. R. Sridhar. 0000 to 8085 Introduction to Microprocessors for Engineers and Scientists, 2nd ed., Prentice Hall of India, New Delhi, 1995

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class.

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
AI14 405: Electronic Circuits – II

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To provide a comprehensive understanding of the following areas of analog electronics and pulse circuits
  - Power amplifiers
  - Feedback amplifiers
  - Wave shaping circuits
  - Time base generators
  - Timer IC 555 and its applications

Module I (13 hours)
Linear wave shaping-high pass and low pass circuits-analysis-steady state output for step, pulse, square wave and ramp inputs. Response of second order systems to these signals

Transistor as a switch-Minority carrier storage in the base-switching speed- application-Logic inverter- MOSFET analog switch-MOS logic inverter-CMOS logic inverter Sweep circuits using BJT-Bootstrap sweep circuit-UJT sweep circuit Multivibrators- Bistable multivibrator-Triggering circuit- Commutating capacitors- Monostable and astable multivibrators-Schmitt trigger circuit

Module II (12 hours)
Voltage time base generators – General features of time base signal – Miller and Bootstrap time base generators – Current time base generators - transistor circuits. Astable, monostable, bistable multivibrators, triangular wave generator, saw tooth wave generator. Timer IC 555–Block diagram–Astable and Monostable circuits using IC 555.

Module III (14 hours)

Module IV (13 hours)
Power amplifiers – Class A large signal amplifiers – harmonic distortion – Transformer coupled Class A power amplifier – efficiency, Push pull amplifiers – Class B push pull amplifier, class B push pull circuit with complimentary symmetry, Class AB amplifier, Biasing the class AB circuit, Class C amplifiers, Tuned BJT amplifiers – Synchronous and stagger tuning.
Text Books


Reference Books

2. A. Anad Kumar, *Pulse and Digital Circuits*, Prentice Hall of India, New Delhi, 2004

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks = 40 marks

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

4 x 15 marks = 60 marks

Maximum Total Marks: 100
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
· To impart knowledge in the area of measurement principles
· To provide in depth understanding of operation, performance, and applications of important measuring instruments used in electronics laboratories.

Module I (14 hours)

Module II (13 hrs)
Potentiometers: General Principle- Direct Current Potentiometer- AC potentiometer- Application of DC and AC potentiometers
Bridges: Wheatstone’s bridge – Kelvin’s Double Bridge - Carry Foster Slide Wire Bridge - Bridge Current Limitations - Maxwell’s bridge- Schering bridge- Anderson’s bridge and Wein’s bridge (Analysis included for all bridges)

Module III (12 hrs)
Analog to digital converters-Tracking, successive approximation, charge distribution, flash, subranging, and integrating type ADCs. Digital to analog converters-weighted resistor, weighted capacitor, potentiometric, and R-2R ladder type DACs. Bipolar DACs, Master-slave DACs. Performance specifications of ADCs and DACs.

Module IV (13 hours)

Text Books:
1. D. A. Bell, *Electronic Instrumentation and Measurements*, Prentice Hall of India, New
Delhi, 2003

2. S. Franco, *Design with Operational Amplifiers and Analog Integrated Circuits*, Tata Mc-Graw Hill, New Delhi, 2003 (for ADCs and DACs only)

Reference Books


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

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Attendance and Regularity in the class

### University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 407(P): Analog Electronics Lab

Credits: 2

Teaching scheme
3 hours practical per week

Objectives
- To provide hands-on experience on design, testing, and analysis of various transistor circuits
- To provide hands-on experience on design, testing, and analysis of Op-Amp circuits
- To provide training on simulation of transistor and Op-Amp circuits using any suitable software
- The students may bring the simulation results before doing the experiment (Oscillators, Schmitt trigger circuit, astable multivibrator, etc., and Op-Amp Circuits (Basic circuits), Rectifier, using any software like PSPICE, EDSPICE, MULTISIM, etc)

Transistor Circuits
1. Power Amplifier circuits-class A and class AB
2. Schmitt trigger circuit
3. Phase shift/Wien bridge/Hartley Oscillator
4. Transistor switch and sweep circuits
5. Bootstrap sweep circuit.
6. Astable, Monostable/Bistable multivibrator circuits
7. Differential Amplifier

Op-Amp Circuits
8. Measurement of important Op-Amp parameters such as CMRR, slew rate, open loop gain, input and output impedances, GBW product.
9. Op-Amp (use IC 741) basic circuits -- voltage follower, inverting and non-inverting amplifier, integrator and differentiator circuits-frequency response
10. Instrumentation amplifier using Op-Amps-gain and CMRR
11. Analog to digital and Digital to analog converter circuits
12. Design of PLL for given lock and capture ranges, frequency multiplication
13. Precision rectifier, Sample and hold circuit
14. Voltage to Current and Current to Voltage Converter

Internal Continuous Assessment (Maximum Marks-50)
60% - Laboratory practical and record
30% - Test/s
10% - Regularity in the class

Semester-End Examination (Maximum Marks-50)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
AI14 408(P): Digital Electronics Lab  
Credits: 2

Teaching scheme
3 hours practical per week

Objectives
- To provide hands-on experience on design, testing, and analysis of various digital circuits
- To provide training on simulation of digital circuits using any suitable software
- The students may bring the simulation results before doing the experiment.

(Any twelve experiments)
1. Characteristics of TTL and CMOS gates.
2. Realization of logic circuits using TTL/CMOS (NAND / NOR) gates.
3. Arithmetic logic circuits like Half adder, Full adder, Half subtractor, Full subtractor
4. 4-bit adder/subtractor
5. BCD adder-7483 circuits.
6. Astable and Monostable multivibrators using TTL/CMOS gates
8. Realisation of Shift Registers- ring counter, Johnson counter
9. Counter Circuits-Up/down Counter-asynchronous & synchronous
10. Counter ICs
11. Astable, Monostable/Bistable multivibrator circuits using 555 IC.
12. Arbitrary Sequence generator
13. BCD to Decimal and BCD to 7-segment decoder & display
14. Multiplexers and Demultiplexers-Realisation of combinational circuits
15. Simulation of Digital circuits- combinational and sequential circuits- using any software package
   a. Adder/Subtractor circuits
   b. JK Master Slave flip-flops using gates
   c. Shift register
   d. UP/DOWN Counter
   e. Arbitrary Sequence Generator
16. Introduction to VHDL: 2 simple examples

Internal Continuous Assessment (Maximum Marks-50)
- 60% - Laboratory practical and record
- 30% - Test/s
- 10% - Regularity in the class

Semester-End Examination (Maximum Marks-50)
- 70% - Procedure, conducting experiment, results, tabulation, and inference
- 20% - Viva voce
- 10% - Fair record
AI14 501: Advanced Microprocessors & Microcontroller

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To expose the students to the features of advanced microprocessors like 80386 and Pentium processors
- To introduce the architecture, programming, and interfacing of the microcontroller 8051

Module I (14 hours)

Module II (13 hours)
Descriptors, selectors, description tables and TSS– Real and protected mode – Memory paging – Branch prediction logic –Superscalar architecture, concept of Cache Memories, Simple introduction to multi core processing.

Module III (12 Hours)
8051 Microcontroller: Overview of 8051 family, architecture of 8051, Program counter, ROM space in8051, data types and directives, flags and PSW register, register bank and stack, Addressing modes. Instruction set-.Arithmetic instructions JUMP, LOOP, CALL instructions, time delay generations

Module IV (13 Hours)
Assembly Language programming in 8051 (some simple programs): programs using arithmetic and logic instructions, single bit instructions and programs, Timer/counter programming, 8051 serial communication programming, programming timer interrupts. Interfacing with 8255 PPI, Stepper motor, keyboard, DAC, external memory.

Text Books
3. Ramani Kalpathi and Ganesh Raja, Microcontrollers and Applications

Reference Books
3. K. J. Ayala, The 8051 Microcontroller Architecture, Programming And applications, Penram
Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 502: Signals and Systems

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Objectives

- To impart the basic concepts of continuous and discrete signals and systems
- To develop understanding about frequency domain approaches used for analysis of continuous and discrete time signals and systems.
- To establish the importance of z-transform and its properties for analyzing discrete time signals and systems.

Module I (12 hours)

Introduction to signals and systems – classification of signals – basic operations on signals- elementary signals - concept of system-properties of systems-stability, invertibility, time invariance, linearity, causality, memory, time domain description-convolution-impulse response- representation of LTI systems- differential equation and difference equation representation of LTI systems

Module II (13 hours)

Fourier representation of continuous time signals- Fourier transform-existence of the Fourier integral-FT theorems-energy spectral density and power spectral density-frequency response of LTI systems- correlation theory of deterministic signals-condition for distortionless transmission through an LTI system- transmission of a rectangular pulse through an ideal low pass filter-Hilbert transform-sampling and reconstruction

Module III (13 hours)

Fourier representation of discrete time signals- discrete Fourier series and discrete Fourier transform-Laplace Transform analysis of systems-relation between the transfer function and differential equation- causality and stability-inverse system- determining the frequency response from poles and zeroes

Module IV (14 hours)

Z-transform-definition- properties of the region of convergence- properties of the Z-transform-analysis of LTI systems-relating the transfer function and difference equation-stability and causality-inverse systems-determining the frequency response from poles and zeroes

Text Books


Reference Books

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

- **60% - Tests** *(minimum 2)*
- **30% - Assignments** *(minimum 2)* such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10% - Attendance and Regularity in the class**

**University Examination Pattern**

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<tr>
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<th>8x 5 marks=40 marks</th>
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<th>4 x 15 marks=60 marks</th>
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*Maximum Total Marks: 100*
AI14 503: Control Engineering

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
To make the students familiarized with the modelling of linear time invariant systems and their responses in time and frequency domain. State space techniques are also discussed.

Module I (12 Hours)
System Analysis: Systems, subsystems, and stochastic and deterministic systems - Principles of automatic control - Open loop and closed loop systems - Principles of superposition and homogeneity Transfer Function Approach: Mathematical models of physical systems and transfer function approach - Impulse response and transfer function - Determination of transfer functions for simple electrical, mechanical, electromechanical, hydraulic and pneumatic systems - Analogous systems - Multiple-input-multiple-output systems: Block diagram algebra - block diagram reduction - Signal flow graphs - Mason's gain formula.

Module II (14 hours)

Module III (13 hours)
Frequency Domain Analysis: Frequency response representation - Frequency domain specifications - Correlation between time and frequency response - Polar plots - Logarithmic plots - Bode plots - All pass, minimum-phase and non minimum-phase systems - Transportation lag - Stability in frequency domain - Nyquist stability criterion - Stability from polar and bode plot - Gain margin and phase margin - Relative stability - M-N circles - Nichols chart.

Module IV (13 Hours)
**Text Books**


**Reference Books**


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

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 504: Biomedical Instrumentation

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
• This course gives a brief introduction to human physiology and presents various instrumentation systems for measurement and analysis of physiological parameters.

Module I (12 Hours)
Development of Biomedical Instrumentation, biometrics, Man-instrument system-components-block diagram, Physiological systems of the body (brief discussion), Problems encountered in biomedical measurements.

Sources of bioelectric potentials – resting and action potentials –propagation of action potentials- bioelectric potentials- examples (ECG, EEG, EMG, ERG, EOG, EGG, etc.)

Biopotential electrodes–theory-microelectrodes- skin surface electrodes- needle electrodes-biochemical transducers- transducers for biomedical applications.

Module II (14 Hours)
Heart and cardiovascular system (brief discussion), electro-conduction system of the heart. Electrocardiography- Electrodes and leads-Einthoven triangle, ECG readout devices, ECG machine-block diagram.

Measurement of Blood Pressure –direct and indirect measurements – oscillometric measurement, ultrasonic method, Measurement of blood flow and cardiac output, Plethysmography– photoelectric, impedance, and capacitance plethysmographs, Measurement of heart sounds-phonocardiography

Module III (13 Hours)
Electroencephalogram- anatomy of nervous system (brief discussion) - neuronal communication EEG measurement. Muscle response - Electromyogram (EMG) - Nerve Conduction velocity measurements - Electromyogram measurements.

Physiology of respiratory system (brief discussion), Respiratory parameters-spirometer, pneumograph, body plethysmographs, gas exchange and distribution, Respiratory therapy equipment.

Cardiac pacemakers – internal and external pacemakers, defibrillator, artificial heart valves, heart lung machine

Module IV (13 Hours)
X-rays- principle of generation, uses of X-rays -diagnostic still picture, fluoroscopy, angiography, tomograms, Endoscopy, Diathermy. Basic principle of computed tomography, magnetic resonance imaging system and nuclear medicine system-radiation therapy.

Ultrasonic imaging system- introduction and basic principle.


Introduction to expert system and hospital management, Introduction to telemedicine.
Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern
PART A: Analytical/problem solving SHORT questions
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
Teaching scheme

3 hours lecture and 1 hour tutorial per week

Objective

- This course aims at introducing various power semiconductor devices and converters used in industrial applications.

Module I (13 hours)
Power semiconductor devices: Power diodes-types, power transistors, thyristor family, SCRs, Triac, GTOs, power MOSFETs, IGBTs, MCTs-static and dynamic characteristics, protection circuits, series and parallel connections, turn-on characteristics, turn off characteristics

Module II (12 hours)
Controlled rectifiers- single phase and three phase converters-power factor improvements-design of converter circuits-AC voltage controllers-single phase and three phase-cycloconverters-single phase and three phase, design of AC voltage controller circuits.

Module III (13 hours)
DC choppers – principle of step down and step up operations – step down chopper with RL load, Classes of chopper, MOSFET/IGBT choppers.
DC to AC converters: Thyristor inverters, McMurray-McMurray Bedford inverter, current source inverter, voltage control waveform control, inverters using devices other than thyristors, vector control of induction motors.

Module IV (14 hours)
DC and AC power supplies: Switched mode, resonant, bi-directional and multistage conversions, buck, boost, buck boost regulators. UPS-block diagram, types.
Drive requirements and design of simple drive circuits for power BJT, MOSFET and IGBT. Advanced control of power electronic circuits using microprocessors, microcontrollers, isolation amplifier circuits, synchronization circuits.

Text Books


Reference Books

2. P. S. Bimbhra, Power Electronics, Khanna Publishers, New Delhi, 2002
### Internal Continuous Assessment (Maximum Marks-50)

- **60% - Tests (minimum 2)**
- **30% - Assignments (minimum 2)** such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10% - Attendance and Regularity in the class**

### University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

- Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

- **8x 5 marks=40 marks**

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

- Two questions from each module with choice to answer one question.

- **4 x 15 marks=60 marks**

*Maximum Total Marks: 100*

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**AI14 506: Transducers**

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
- This course introduces the various types of transducers and their working principle.

Module I (14 hours)

Module II (12 hours)

Module III (13 hours)

Module IV (13 hours)
Smart sensors-block diagram, Recent trends in sensor technology – Semiconductor sensors–Film sensors-MEMS-Nanosensors.
Sensors and their applications- Automotive sensors, Home Appliance sensors, Environmental monitoring sensor
Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks = 40 marks

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

4 x 15 marks = 60 marks

Maximum Total Marks: 100

AI14 507(P): Power Electronics Lab
Teaching scheme
3 hours practical per week

Objectives
- To make the students familiar with the characteristics of power semiconductor devices
- To provide experience on design, testing, and analysis of few power electronic circuits
- To expose the students to simulation of power electronic circuits

(Any 12 experiments)
1. SCR characteristics
2. Triac and Diac characteristics
3. Phase controlled rectifier-resistance triggering
4. Phase controlled rectifier- UJT triggering
5. Chopper circuits
6. MOSFET characteristics
7. Cycloconvertors
8. Simple DC to AC inverter circuit
9. Driven DC to AC inverter using MOSFET & IC
10. IGBT characteristics
11. Inverter circuit using IGBT
12. Lamp control using TRIAC
13. Digital triggering circuit for phase controlled rectifiers
15. DC motor speed control – Using digital logic circuits/microprocessor/PC
16. AC motor speed control – Using digital logic circuits/microprocessor/PC
17. Simulation of power electronic converter and inverter circuits using software like MATLAB, PSPICE

Internal Continuous Assessment (Maximum Marks-50)
60% - Laboratory practical and record
30% - Test/s
10% - Regularity in the class

Semester-End Examination (Maximum Marks-50)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
University of Calicut

**A114 508(P): Microprocessors & Microcontroller Lab**

**Credits:** 2

**Teaching scheme**
3 hours tutorial per week

**Objectives**
To acquaint the students with the following skills
- Assembly language programming based on the microprocessors 8085
- Assembly language programming based on the microcontroller 8051
- Interfacing programs based on 8051
- Embedded C programming exposure on platforms like 8051, PIC, Arduino, Raspberry Pi (Any 15 experiments covering all the six sections)

I. **Assembly language programming based on 8085 Kit** *(The students may bring the simulated programs before doing the experiment using tools like GNUsim8085, etc)*
   1. Programs based on Arithmetic and Logic instructions
   2. Array- Largest of arrays
   3. 8 bit Multiplication
   4. Programs involving subroutines, stacks

II. **Assembly language programming based on 8086 Kit** *(The students may bring the simulated programs before doing the experiment using tools like TASM/MASM, etc)*
   5. Addition / Subtraction of 64 bit Numbers.
   6. Sorting of an array
   7. Programs with lookup table
   8. Square root of a 32 bit number, Average of n numbers

III. **Interfacing programs based on 8085/8086 Kit**
   9. ADC & DAC
   10. Stepper motor (forward & backward motion)
   11. Hex key pad
   12. Seven segment display
   13. 8251 USART

IV. **Assembly language programming based on 8051 Kit**
   5. Addition / Subtraction of 64 bit Nos.
   6. Sorting of an array
   7. Programs with lookup table
   8. Square root of a 32 bit no, Average of n numbers

V. **Interfacing programs based on 8051 Kit**
   9. ADC & DAC
   10. Stepper motor (forward & backward motion)
   11. Hex key pad
   12. Seven segment display
   13. 8251 USART

VI. **Embedded C programming of Microcontrollers 8051, PIC, Arduino,**
   14. Addition / Subtraction of 64 bit Nos.
   15. Sorting of an array
   16. Programs with lookup table
   17. Square root of a 32 bit no, Average of n numbers

### Internal Continuous Assessment *(Maximum Marks-50)*
- 60% - Laboratory practical and record
- 30% - Test/s
- 10% - Regularity in the class

### Semester-End Examination *(Maximum Marks-50)*
- 70% - Procedure, conducting experiment, results, tabulation, and inference
- 20% - Viva voce
- 10% - Fair record
Objective

The prime objective of the Engineering Economics course is to make students familiar with the economic way of thinking. This course provides the students with the foundations of economic theory, tools and techniques for use in the process of efficient economic decision-making in their engineering and managerial profession.

Module I (14 Hrs)


Module II (12 Hrs)


Investment criteria: Pay Back Period, Net Present Value, Internal Rate of Return, Benefit-cost ratio.

Text Books


Reference Books

**Internal Continuous Assessment (Maximum Marks-25)**

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Attendance and Regularity in the class

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**University Examination Pattern for Section 1**

**PART A: Analytical/problem solving SHORT questions**

4x 5 marks = 20 marks

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

2 x 15 marks = 30 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 50*

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**University Examination Pattern – for Section 1**

*Note: Section 1 and Section 2 are to be answered in separate answer books*

Maximum 50 marks each for Section 1 and Section 2

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**Section 2: Principles of Management**

**Teaching scheme Credits:** 2 1 hour lecture and 1 hour tutorial per week

**Objective**

- To provide knowledge on principles of management, decision making techniques, accounting principles and basic management streams

**Module I (13 hours)**

Principles of management – Evolution of management theory and functions of management

Organizational structure – Principle and types. Decision making – Strategic, tactical & operational decisions, decision making under certainty, risk & uncertainty and multistage decisions & decision tree

Human resource management – Basic concepts of job analysis, job evaluation, merit rating, wages, incentives, recruitment, training and industrial relations

**Module II (13 hours)**

Reference Books

8. Weist and Levy, *A Management guide to PERT and CPM*, Prantice Hall of India

Internal Continuous Assessment *(Maximum Marks-25)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern for Section 1

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 50*

University Examination Pattern – for Section 2

Note: Section 1 and Section 2 are to be answered in separate answer books

Maximum 50 marks each for Section 1 and Section 2

**AI14 602: Digital Signal Processing**
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To cover the following topics of digital signal processing.
  - Discrete Fourier transform and fast Fourier transform
  - Techniques of IIR and FIR digital filter design and various filter structures
  - Finite word length effects in DSP
- Brief ideas about computer architectures for signal processing with emphasis on TMS320 series processor.

Module 1 (14 hours)
Review of Discrete Fourier Series and Discrete-Time Fourier Transform - Frequency domain sampling and reconstruction of discrete time signals - The Discrete Fourier Transform - DFT as a linear transformation - relationship to other transforms - properties of DFT - frequency analysis of signals using DFT - Linear filtering methods based on DFT - convolution using overlap add and overlap save methods - Efficient computations of the DFT - Fast Fourier Transform algorithms – decimation in time, decimation in frequency-in place computation-direct computation, divide-and-conquer approach, radix-2, radix-4 and split radix algorithms - implementation of FFT algorithms - Applications of FFT

Module II (12 hours)
Structures for realization of discrete time systems - structures for FIR and IIR systems - signal flow graphs, direct-form, cascade-form, parallel form, frequency sampling, lattice and transposed structures representation of numbers and errors due to rounding and truncation - Quantization of filter coefficients - round off effects in digital filters - limit cycle oscillations, scaling for overflow prevention.

Module III (14 hours)

Module IV (12 hours)
Computer architectures for signal processing - Harvard architecture, pipelining, multiplier-accumulator, special instructions for DSP, replication, on chip storage, extended parallelism- general purpose DSP Processors - implementation of DSP algorithms for various operations - special purpose DSP hardware - hardware digital filters and FFT processors - case study and overview of TMS320C6x series processor.
University of Calicut

Text Books

Reference Books
6. R. Chassaing, DSP applications using C and the TMS 320C6x DSK, Wiley, 2002

Internal Continuous Assessment (Maximum Marks-50)

<table>
<thead>
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University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks = 40 marks

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

4x 15 marks = 60 marks

*Maximum Total Marks: 100*
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
- This course introduces the basic techniques used for transferring information in electronic communication systems.
- Various schemes of analog and digital modulation, and broadband communication systems are also covered.

Module I (13hrs)
Electromagnetic spectrum-Elements of a Communication System-Classification of communications-Transmission Lines, (Brief description only)-basic types, characteristic impedance, SWR, Antennas (brief description only)- antennas operation, basic antenna types-RF wave propagation (brief description only)-modulation-AM principle, generation-SSB techniques-principle, generation-angle modulation-theory and generation of PM and FM-Comparison of AM, PM, FM

Module II (13hrs)
Super heterodyne receivers- Receiver parameters - AM receivers- IF and its selection, automatic gain control, AM demodulator circuits, SSB receivers, demodulation of SSB, receiver types, FM receiver-FM demodulators, FM noise suppression, Pulse modulation, Principle of PAM, PWM & PPM modulation and demodulation

Module III (13hrs)
Digital communication-baseband transmission and reception-digital carrier system-PCM, Delta modulation, DPCM, generation and demodulation, Signal to noise ratio, Digital modulation schemes-ASK, FSK, PSK, DPSK, M-arysignaling schemes – multiplexing – TDM, FDM, WDM

Module IV (13hrs)
(Block diagram approach only)
Microwave communication – transmitter-receiver - repeater, Satellite communication-Optical fibre link, satellite system, Cellular radio system-Telemetry –functional block, standards,landline telemetry, electrical telemetry-analog and digital techniques in telecontrol

Text Books

Reference Books

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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

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*Maximum Total Marks: 100*
AI14 604: Advanced Control Theory

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
This course is designed to introduce some of the advanced topics in control theory. State variable design, analysis of discrete-time control systems, controller principles and tuning, robust control systems, and basics of Lyapunov stability analysis are covered.

Module I (13 hours)
State Variable Analysis: Concepts of state, state variables, state vector and state space - State model of continuous time systems - Transformation of state variable - Derivation of transfer function from state model - invariance property - state diagram - State variable from transfer function - bush or companion form - controllable canonical form - observable canonical form - Jordan canonical form - Diagonalization - State transition matrix - computation of state transition matrix by Laplace transform, Cayley-Hamilton theorem - Controllability and observability of a system. (Proof not required)

Module II (13 hours)
MIMO systems - controllability - Observability - Effect of pole-zero cancellation, Practical examples - controllable and uncontrollable systems - observable and unobservable systems. Optimal control system - definition - design using state variable feedback and error squared performance indices. Shaping the dynamic response - need for pole placement, Pole placement by state feedback, Ackermann's formula, State feedback control for inverted pendulum system, linear observers need - structure of an observer, design of observer.

Module III (12 hours)
Discrete time systems - analogies with continuous-time systems, Z-transforms (review), mathematical models for LTI discrete-time systems. State model of linear discrete-time systems, state models from linear difference equations/system functions, derivation of system function from state model, solution of state equations - state transition matrix, controllability and observability conditions. Linear continuous-time systems with sampled inputs - closed loop feedback sampled-data systems - Stability analysis in the z-plane - Jury’s stability test.

Module IV (14 hours)
Robust control systems - system sensitivity, analysis of robustness, systems with uncertain parameters, Design of robust control systems - design considerations. Robust PID controlled systems - design procedure. Internal model design, robust internal model control system. Lyapunov Stability analysis (basics only) - Direct method of Lyapunov, Stability in the sense of Lyapunov, asymptotic stability, graphical representation of stability, asymptotic stability, and instability, Lyapunov stability analysis of LTI systems.
### Text Books

### Reference Books

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### University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks = 40 marks

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

4 x 15 marks = 60 marks

*Maximum Total Marks: 100*
Teaching scheme

3 hours lecture and 1 hour tutorial per week

Objective

This course describes the various techniques used to measure temperature, pressure, flow, and level.

Module I (12 hours)

Module II (13 hours)

Module III (14 hours)

Module IV (13 hours)
Text Books
4. Tai-Ran Hsu, *MEMS and Microsystems Design, Manufacture and nano scale Engineering*

Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

8 x 5 marks = 40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

4 x 15 marks = 60 marks
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 606: Embedded Systems

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To impart knowledge on the concepts of embedded systems
- To provide knowledge on the microcontrollers 8051 and 80196, and a peripheral interface controller and thus enable students to design embedded systems

Pre-requisites:
The students should have basic knowledge about microcontroller.

Module I (12 hours)

Module II (12 hours)

Module III (14 hours)

Module IV (14 hours)

Text Books

Reference Books
3. Intel Data Book Vol. 1, *Embedded Microcontrollers and Processors*
6. PIC Data Manual, Microchip, 2002
Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
Teaching scheme
3 hours tutorial per week

Objectives
- To provide experience on design, testing, and analysis of few electronic circuits used in instrumentation systems
- To acquaint the students with the measurement of various industry parameters using prototype instrumentation systems
  (18 Experiments covering all the sections)

Instrumentation Lab
1. Study of dead weight tester and calibration of pressure gauge
2. Measurement using LVDT
3. Measurement using
4. strain gauge
5. pressure transducer
6. Measurements using Photocell/LDR
7. Temperature measurement using RTD
8. Temperature measurement using thermocouple.
9. Measurement of distance using ultrasonic method
10. Measurement of PH and viscosity

Virtual Instrumentation
11. Measurement of level using LABVIEW
12. Flow measurement using LABVIEW
13. Development of VI for measurement of torque/speed/displacement/light

Control Lab
14. Analog PID control
15. Process Control Simulator
16. Stability Analysis of Linear System
17. Relay Control System
18. Lead-Lag Network Simulator
19. Light intensity control system

Control system simulation
20. Study of first order and second order system responses—measurement of system parameters
21. Check the stability of a system. Report whether the system is stable, unstable, or marginally stable. Given the transfer function of the system.
22. Digital Simulation of linear System
23. State variable analysis—controllability, observability
24. Design of state feedback
25. Design of state observer
26. Simulation of Mass Spring Dashpot system, DC Motor Control
Internal Continuous Assessment (*Maximum Marks-50*)
60% - Laboratory practical and record
30% - Test/s
10% - Regularity in the class

<table>
<thead>
<tr>
<th>Semester-End Examination (<em>Maximum Marks-50</em>)</th>
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<tbody>
<tr>
<td>70% - Procedure, conducting experiment, results, tabulation, and inference</td>
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<td>20% - Viva voce</td>
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<tr>
<td>10% - Fair record</td>
</tr>
</tbody>
</table>
AI14 608(P): Mini Project

Credits: 2

Teaching scheme
3 hours practical per week

Objectives

- To estimate the ability of the student in transforming the theoretical knowledge studied so far into a model.
- For enabling the students to gain experience in organisation and implementation of a small project and thus acquire the necessary confidence to carry out main project in the final year.

In this practical course, each group consisting of three/four members is expected to design and develop a moderately complex system with practical applications; this should be a working model. The basic concepts of product design may be taken into consideration while designing the project.

Internal continuous assessment will be carried out by the Guide. End Semester evaluation of individual student will be carried out by a committee consisting of minimum three faculty members. Students have to submit a report on the mini project and demonstrate the mini project before the evaluation committee.

<table>
<thead>
<tr>
<th>Internal Continuous Assessment by the Guide (Maximum marks - 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40% - Design and development</td>
</tr>
<tr>
<td>30% - Final result and Demonstration</td>
</tr>
<tr>
<td>20% - Report</td>
</tr>
<tr>
<td>10% - Regularity in the class</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester End Examination (Maximum Marks-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% - Demonstration and Presentation of mini project</td>
</tr>
<tr>
<td>30% - Viva voce</td>
</tr>
<tr>
<td>10% - Final Report</td>
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</table>
AI14 701: Process Control Instrumentation

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
- To introduce the principles of various control and instrumentation components and strategies applied in a process control system.

Module I (14 hours)

Module II (13 hours)

Module III (13 hours)
Control valves – construction, characteristics, different types –ball, gate, butterfly, and other types, Valve sizing, cavitation and flashing, control valve noise and methods of its reduction. Advanced Control Strategies- Cascade control-Feed forward control-Ratio Control-Internal model control-Selective control schemes- Split-range control -Adaptive control -Inferential control.

Module IV (12 hours)
Text Books


Reference Books


Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A**: Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B**: Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

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**AI14 702: Optoelectronic Instrumentation**
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
- This course introduces the basics of optoelectronic instrumentation.
- Various topics included in this course are instrumentation applications of optics, lasers, and optical fibres

Module I (14 hours)

Module II (12 hours)

Module III (13 hours)
Holography, Construction of holograms, holographic interferometry, applications of holography, distance measurements, information storage, optical methods. Fibre optics-light guidance through fibres, multimode and single mode fibres, step index and graded index fibres, properties of optical fibres, fibre fabrication, fabrication of perform, fibre drawing process

Module IV (13 hours)
Measurement of fibre characteristics-attenuation, dispersion and refractive index profile measurements, optical time domain reflectometer, fibre optic joining- couplers, splicers and connectors, losses in optical fibres, application of optical fibres, fibre optic sensors-measurement of temperature, liquid level, and fluid flow, microbend sensors, optical fibre communication recent trends and developments-optical telemetry.
Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern
PART A: Analytical/problem solving SHORT questions 8 x 5 marks = 40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks = 60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
AI14 703: Analog and Digital MOS Circuits

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To provide basic knowledge in the design of analog circuits and digital circuits using MOS devices

Module I (13 hours)
Basic MOS device physics, MOS I/V characteristics, device capacitance, small signal model. Single stage MOS amplifiers -CS, CD, CG and cascode amplifiers, gain and frequency response, class B and class AB amplifiers. Differential Amplifiers, MOS load Current source, Current mirror, cascode load.

Module II (13 hours)
MOS Operational Amplifiers, one stage-cascode and folded cascode, two stage op-amp, Common mode feedback, Input range limitation, frequency compensation and slew rate in two stage Op-amps. CMOS Switch, sample and hold circuit, switched capacitor Integrator, Summing amplifiers.

Module III (14 hours)
Digital MOS model - series and parallel connections, overview of pseudo NMOS and CMOS logic circuits, basic CMOS inverter, principle of operation, voltage levels, delay time definitions, power dissipation, CMOS design application - ring oscillator, super buffer, MOS static logic circuits - NAND, NOR, AOI, OAI, adder, latch, transmission gates, pass transistor logic, Bi CMOS logic circuits - principle of operation, advantages

Module IV (12 hours)
Dynamic MOS logic circuits – precharge/evaluate logic, domino logic, cascading and charge sharing, simple logic function realization using Domino logic, Domino logic types - NORA, TSPC, CVSL, Concept of adiabatic logic, digital system timing - clock skew, setup and hold time, metastability and synchronizer

Text Books

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

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Component</th>
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<tbody>
<tr>
<td>60%</td>
<td>Tests (minimum 2)</td>
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**University Examination Pattern**

<table>
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<tr>
<th>Part</th>
<th>Type of Questions</th>
<th>Marks</th>
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<tbody>
<tr>
<td>PART A</td>
<td>Analytical/problem solving SHORT questions</td>
<td>8 x 5 marks = 40 marks</td>
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<td>Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.</td>
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<tr>
<td>PART B</td>
<td>Analytical/Problem solving DESCRIPTIVE questions</td>
<td>4 x 15 marks = 60 marks</td>
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<td></td>
<td>Two questions from each module with choice to answer one question.</td>
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*Maximum Total Marks: 100*
AI14 704(A): Nanotechnology and Nanoelectronics

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
To provide an introduction to Nanotechnology

Pre-requisites:
The students should have basic knowledge about simple chemical reactions

Module I (13 hours) Foundations in nanoscience
Nanoscience and technology – quantum structures – nanoclusters – carbon nanostructures – nanotubes and nanowires - nanofibers

Module II (14 hours) Synthesis of nanomaterials

Module III (13 hours) Characterization of nanomaterials
Structures of nanomaterials – x ray diffraction and absorption – spectroscopy – luminescence – microscopy – standards for Nanometerology

Module IV (12 hours) Applications of Nanotechnology

Text Books

Reference Book

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**  
8 x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 704(B): Mobile Communication

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
To introduce the concepts of Mobile Communication Cellular environment

Pre-requisites:
It is desirable to have basic knowledge about wireless communications but is not essential.

Module I (13 hours) Introduction to Cellular Mobile Systems
A basic cellular system, performance criteria, uniqueness of mobile environment, operation of cellular systems, planning a cellular system, analog and digital cellular systems
Elements of Cellular radio system design – concept of frequency reuse channels – co – channel interference reduction factor – desired C/I from a normal case in an omni directional antenna system – cell splitting

Module II (14 hours) Cell coverage for Signal and Traffic
General introduction - mobile point to point mode – radio propagation characteristics: models for path loss – shadowing and multipath fading – propagation over water or flat open area – foliage loss – propagation in near distance – long distance propagation – cell site – antenna heights and signal coverage cells – mobile to mobile propagation

Module III (12 hours) Frequency management, Channel assignment and handoff
Frequency management – fixed channel assignment – non fixed channel assignment – traffic and channel assignment – why handoff - types of handoff and their characteristics – handoff analysis

Module IV (13 hours) Multiple access techniques

Text Books

Reference Books
1. Dr Kamilo Feher, Wireless and Digital Communications, PHI
2. R.Blake , Wireless Communication Technology, Thomas Delmar, 2003
### Internal Continuous Assessment (Maximum Marks-50)

- **60%** - Tests (minimum 2)
- **30%** - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10%** - Attendance and Regularity in the class

### University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 704(C): Nonlinear Control System

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
This course introduces the following areas of nonlinear control systems
- Types of common physical nonlinearities and their analysis
- Stability of nonlinear control systems
- Feedback linearisation

Pre-requisites:
The students should have knowledge about linear control theory.

Module I (14 hours)

Module II (12 hours)
Describing function method-basic concepts, derivation of describing functions-dead zone and saturation, relay with dead-zone and hysteresis, backlash, Stability of nonlinear systems-analysis by describing function-using Nyquist stability criterion-limit cycles-Reliability of describing function analysis

Module III (14 hours)
Stability of nonlinear systems-Lyapunov theory (review)- autonomous and non-autonomous systems-equilibrium points, Stability in the sense of Lyapunov, asymptotic stability and exponential stability, Linearization and local stability, Lyapunov’s direct method, positive definite functions and Lyapunov functions, Lyapunov theorem for local stability and global stability,
Analysis based on Lyapunov’s direct method-LTI systems-Krasovskii’s method, Variable gradient method for constructing Lyapunov functions-simple examples, Popov’s stability criterion. Stability of non-autonomous systems (basic concepts only)- Lyapunov’s direct method –simple problems

Module IV (12 hours)
Feedback Linearization-discussion of basic concepts using simple examples-controlling the fluid level in a tank, two-link robot, input state linearization- input-output linearization- mathematical tools-Lie derivative and Lie brackets- properties of Lie brackets, Frobenius theorem- simple example problems.
Text Books

Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Attendance and Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
AI14 704(D): Digital Signal Processors

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To provide in depth understanding of the architecture of TMS320C6x family of processors
- To train students in writing programming examples using C/assembly language for TMS320C64x processor
- To give an introduction to DSP development systems

Pre-requisites:
The students should have knowledge about digital signal processing.

Module I (13 hours)
Architecture of TMS 320C6x-functional units-VLIW and VelociTI - fetch and execute-pipelining-registers-addressing modes instruction sets-timers-interrupts-serial ports-DMA-memory

Module II (12 hours)
Fixed and floating point formats-code improvement-constraints- -simple programming examples using C/assembly, Code optimization-procedure-software pipelining.

Module III (14 hours)

Module IV (13 hours)

Text Book
1. R. Chassaing, DSP applications using C and the TMS 320C6x DSK, Wiley, 2002

Reference Books
2. N. Kehtarnavaz, Real-Time Digital Signal Processing: Based on the TMS320C6000, Elsevier, 2004
3. S. A. Tretter, Communication System Design using DSP algorithms: with Laboratory
6. TMS320C6000 CPU and Instruction Set Reference Guide, spru189f
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| **PART B: Analytical/Problem solving DESCRIPTIVE questions** 4 x 15 marks = 60 marks |
| Two questions from each module with choice to answer one question. |

**Maximum Total Marks: 100**
AI14 704(E): Computer Networks

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
This course presents the fundamental concepts involved in computer networks

Pre-requisites:
No pre-requisites.

Module I (13 hours)

Module II (12 hours)

Module III (13 hours)

Module IV (14 hours)

Text Book

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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
Objective of this course is to introduce some of the advanced topics in biomedical instrumentation

Pre-requisites:
The students should have basic knowledge about biomedical instrumentation.

Module I (13 hours)
Nuclear Medical Imaging System–Radio isotopes in Medical diagnosis–Physics of radioactivity -
radiation detectors–Pulse height analyser–uptake monitoring equipment–radio isotope rectilinear
scanner–The Gamma camera–ECT–SPECT–PET
Magnetic Resonance Imaging System–Principles of NMR Imaging System–Image reconstruction
techniques–Basic NMR components–Biological effects of NMR Imaging

Module II (13 hours)
Physiotherapy and electrotherapy equipment–High frequency heat therapy–Short wave
diathermy–Microwave diathermy–Ultrasonic therapy. Principles of surgical diathermy-
Surgical diathermy machine–Electrodes used–Safety aspects

Haemodialysis – Function of the kidneys–Artificial kidney–Dialysers–Membranes for haemodialysis–
Haemodialysis machine–Portable Kidney machine

Module III (12 hours)
Principle of Lithotripsy–Anaesthesia machine–Ventilators–Types–Classification–Pressure-Volume
flow diagrams–Modern Ventilators–Automated drug delivery systems–Infusion pumps–Components
of drugs infusion systems–Implantable infusion systems–Examples of typical infusion pumps–Infant
Incubators–Surgical Instruments.

Module IV (14 hours)
Applications of signal processing: Signal Averaging, Data reduction techniques: Turning point
algorithm, AZTEC algorithm, Fan algorithm, Huffman coding. ECG QRS Detection–Power
spectrum of ECG – filtering techniques, Differentiation Techniques, Template matching
techniques, QRS detection algorithm. ECG Analysis System–ECG interpretation- ST segment
analysers, portable arrhythmia monitor, arrhythmia analysis.

Text Books
1. J. G. Webster, Medical Instrumentation Application and Design, 3rd ed., John
Wiley & Sons, N.Y., 1998
Hill, New Delhi, 2003
3. W. J. Tompkins, Biomedical Signal Processing, Prentice Hall of India, New Delhi,
1995

Reference Books
1. M. Akay, Detection and Estimation Methods for Biomedical Signals, Academic
Press, 1997
2. D. C. Reddy, Biomedical Signal Processing: Principles and Techniques, Tata
McGraw-Hill, New Delhi, 2004
**Internal Continuous Assessment (Maximum Marks-50)**

60% - Tests (minimum 2)

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

10% - Attendance and Regularity in the class

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**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
**Teaching scheme**
3 hours lecture and 1 hour tutorial per week

**Objectives**
- To provide elementary knowledge about digital image processing
- To discuss various image transforms used in digital image processing
- To explain the algorithms adopted for image enhancement and image restoration
- To bring out the concepts of image compression and image reconstruction

**Pre-requisites:**
The students should have basic knowledge about digital signal processing.

**Module I (14 hours)**
*Introduction* - digital image representation - fundamental steps in image processing - elements of digital image processing systems, digital image fundamentals - elements of visual perception - a simple image model - sampling and quantization - basic relationship between pixels - image geometry - image transforms - Fourier transform - discrete Fourier transform - Properties of 2D-fourier transform (DFT) - FFT algorithm - other separable image transforms.

**Module II (12 hours)**
*Image enhancement* - point processing - spatial filtering - frequency domain - color image processing
*Image restoration* - degradation model - diagonalization of circulant and block circulant matrices, deconvolution, inverse filtering - Wiener filtering - least mean square filter

**Module III (12 hours)**
*Image compression* - image compression models - elements of information theory - basic ideas of variable length coding, predictive coding, transform coding - error-free compression - lossy compression - image compression standards

**Module IV (14 hours)**
*Image reconstruction from projections* - basics of projection - parallel beam and fan beam projection - ART - method of generating projections - Fourier slice theorem - filtered back projection algorithms - testing back projection algorithms.

**Text Book**

**Reference Books**

**Internal Continuous Assessment (Maximum Marks-50)**
University of Calicut

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 705(C): Speech Processing

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To develop an understanding of the relationship of vocal tract shapes and physical acoustics to the acoustic speech signal
- To give a comprehensive understanding of the algorithms used for processing of speech signals in various applications.

Pre-requisites:
The students should have basic knowledge about digital signal processing.

Module I (12 hours)

Module II (13 hours)

Module III (14 hours)

Module IV (13 hours)
Text Books


Reference Books


Internal Continuous Assessment (Maximum Marks-50)

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Attendance and Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks = 40 marks

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

4 x 15 marks = 60 marks

*Maximum Total Marks: 100*

AI14 705(D): Electronics Packaging
University of Calicut

**Teaching scheme**
3 hours lecture and 1 hour tutorial per week

**Objectives**

Introduction to packaging technologies, technology drivers, electrical performance, thermal management, materials, optoelectronics, RF integration, reliability, system issues, assembly, and testing.

**Pre-requisites:**
No pre-requisites

**Module I (14 hours)**

Electrical Design - Interconnect Capacitance, Resistance and Inductance fundamentals - Transmission Lines (basic concepts) - Clock Distribution - Noise Sources - power Distribution – signal distribution-EMI - Digital and RF Issues

**Module II (13 hours)**
Thermal Management - Heat-transfer fundamentals - Thermal conductivity and resistance - Conduction, convection and radiation – Cooling requirements

Reliability - Basic concepts - Environmental interactions - Thermal mismatch and fatigue – failures - thermo mechanically induced – electrically induces – chemically induced-

**Module III (12 hours)**
Single chip packaging – functions, types, materials processes, properties, characteristics, trends Multi chip packaging – types, design, comparison, trends

IC assembly – purpose, requirements, technologies – wire bonding, TAB, flip chip

Wafer level packaging - technologies, reliability, wafer level burn – in and test

**Module IV (13 hours)**
Passives – discrete, integrated, embedded – encapsulation and sealing – fundamentals, requirements, materials, processes

PWB – fundamentals, standards, limitations – microvia boards – PWB assembly – SMT - Through hole assembly – design challenges

Testing - Need for testing – Electrical testing – design for test

**Text Books**

**Reference Books**
1. Blackwell (Ed), The electronic packaging handbook, CRC Press

**Internal Continuous Assessment (Maximum Marks-50)**
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**  
8 x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
Objective

This course introduces the students to the piping and instrumentation diagram/drawing

Pre-requisites:
The students should have basic knowledge about industrial instrumentation.

Module I (13 Hrs)

Module II (14 Hrs)
P & I D objectives, guide rules, Symbols, Line numbering, Line schedule, P & I D development, typical stages of P & I D. P & I D for rotating equipment and static pressure vessels, Process vessels, absorber

Module III (14 Hrs)
Control System for Heater, Heat exchangers, reactors, dryers, Distillation column and Evaporators.

Module IV (13 Hrs)
Applications of P & I D in design stage - Construction stage - Commissioning stage - Operating stage - Revamping stage - Applications of P & I D in HAZOPS and Risk analysis.

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
### University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**  
8 x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 705(F): Operations Research

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
Objective of this introductory course on operations research is to give the students the essential tools of operations research. This will enable them to model and make scientifically based decisions in economic and production environments.

Pre-requisites:
No pre-requisites

Module 1 (13 hours)
Introduction to operation research: OR model, solving the OR model, simulation models, art of modeling, phases of OR study. Linear programming: Formulation (Identification of decision variables, constructing objective functions and constraints, assumption), Graphical LP solution,

Module II (14 hours)
Simplex Method: Standard LP form, basic solution,, the M-method, the two-phase method, degeneracy, alternative optimal solution, unbounded solution, infeasible solution. Sensitivity analysis and dual problem : Definition of the dual problem, the relationship between the optimal primal and dual solution, economic interpretation of duality, the dual Simplex method, primal dual computations, sensitivity analysis

Module III (12 hours)
Transportation Model: Definition of the transportation model, determination of a starting solution, the transportation algorithm, definition of the assignment problem, the Hungarian method. Network models: Network definition, minimal spanning tree algorithm, shortest route problem, shortest route algorithm, maximal flow model, enumeration of cuts, maximal flow algorithm, CPM, PERT

Module IV (13 hours)
Queuing systems: Elements of a queuing model, role of exponential distribution, birth and death models, steady state measures of performance, single server models Game theory: Formulation of two person zero sum games, solution of simple games, mixed strategy games(using graphical method and Lp), saddle point condition.

Text Books

Reference Book

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 706(P): Embedded System and Signal processing lab

Credits: 2

Teaching scheme
3 hours practical per week

Objectives
- To provide experience to students in computer simulation of systems with emphasis on digital signal processing, digital signal processor and digital system design

(14 experiments covering all the sections)

Section I: Embedded C programming of Microcontrollers 8051, PIC, Arduino
1. Serial Communication using Microcontroller
2. Interfacing of analog sensors like temperature sensor etc.
3. LCD interfacing
4. DC motor interfacing using H bridge

Section II: Digital Signal Processing
1. Generation of test signals
2. Response of discrete-time systems for test inputs
3. Obtaining DTFT and DFT
4. Design of IIR filters-Butterworth and Chebyshev
5. Design of FIR filter
6. Representation of Digital filters (Type I, Type II, Parallel form, Cascade, etc)
7. Convolution using overlap add/overlap save method

Section III: D S Processor
8. Assembly-level/High-level language program for the following operations on discrete-time signals
   a) addition, b) subtraction c) shifting d) multiplication, and e) convolution
9. Assembly-level/High-level language program for convolution using overlap add/overlap save method
10. Assembly-level/High-level language program for FFT Computation
11. Interfacing of on chip peripherals with a DSP kit
12. Implementation of FIR filter
13. Implementation of IIR filter

Section IV: Digital System Design
14. VHDL Code: Analysing & Simulation of basic digital circuits: Adder
15. VHDL Code: Analysing & Simulation of basic digital circuits: Multiplexer
16. Simulation of State machine model, Binary to Excess-3 converter
17. Synthesis: using FPGA/CPLD (Example: Xilinx, Altera, etc) (2 Experiments)

Internal Continuous Assessment (Maximum Marks-50)
- 60% - Laboratory practical and record
- 30% - Test/s
- 10% - Regularity in the class

Semester-End Examination (Maximum Marks-50)
- 70% - Procedure, conducting experiment, results, tabulation, and inference
- 20% - Viva voce
- 10% - Fair record
AI14 707(P): Process Control Instrumentation Lab

Credits: 2

Teaching scheme
3 hours practical per week

Objectives
- To provide experience on control of various industrial processes using different control paradigms
- To provide experience in development of virtual instrumentation systems for industry applications
- To introduce a few novel control strategies based on artificial neural networks, fuzzy logic, digital control algorithm, etc.

(Any Thirteen experiments)

1. ON-OFF controller with and without neutral zone-level control, flow control
2. Temperature control using P, PI, PD, and PID controllers–Study of output response
4. Liquid level control using P, PI, PD, and PID controllers–Study of output response
5. Pressure control using P, PI, PD, and PID controllers–Study of output response
6. Controller tuning for various processes – using Ziegler-Nichols rule
7. Controller tuning for various processes – using Cohen and Coon rule
8. Controller Tuning – Simulation
9. Block diagram simulation of a complex control system
10. Study of PLC-ladder diagram implementation for simple processes
11. PLC Control of water level control system
12. PLC Simulator-Simulation of complex control systems
13. Study of feed-forward, cascade, and ratio controls
14. Data Logger
15. PC based control of robotic actions
16. Simulation of Artificial Neural Networks – use any software
17. Fuzzy Logic Controller–use any software
18. Simulation of Heat Exchanger Temperature Control
19. Interface of DCS with PLC/SCADA using protocol/fieldbus

Internal Continuous Assessment (Maximum Marks-50)
60% - Laboratory practical and record
30% - Test/s
10% - Regularity in the class

Semester-End Examination (Maximum Marks-50)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
University of Calicut

AI14 708(P) : Project

Teaching scheme
4 hours practical per week

Credits:4

Objectives
- To judge the capacity of the students in converting the theoretical knowledge into practical systems/investigative analysis.

Project work is for duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. Project evaluation committee consisting of the guide and three/four faculty members specialised in the above field shall perform the screening and evaluation of the projects.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent. Literature survey and 40% of the work has to be completed in the seventh semester.

Students should execute the project work using the facilities of the institute. However, external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

Each student has to submit an interim report of the project at the end of the 7th semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7th semester.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>20% - Technical relevance of the project</td>
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<tr>
<td>40% - Literature survey and data collection</td>
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<td>20% - Progress of the project and presentation</td>
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<td>10% - Report</td>
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<td>10% - Regularity in the class</td>
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</table>
AI14 801: Industrial Automation

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
To introduce the principles of various industrial control systems used in industrial processes

Module I (12 hours)

Module II (14 hours)

Module III (13 hours)

Module IV (13 hours)
DCS- overview, Software configuration, DCS communication, Supervisory computer tasks, DCS integration with PLC and computers, Features and advantages of DCS. Computer aided process control case studies- Electric oven temperature control, electric power generation plant.

Text Books

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

- **60%** - Tests (minimum 2)
- **30%** - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10%** - Attendance and Regularity in the class

**University Examination Pattern**

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<thead>
<tr>
<th>Part</th>
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<th>Marks</th>
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<td>A</td>
<td>Analytical/problem solving SHORT questions</td>
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<td>B</td>
<td>Analytical/Problem solving DESCRIPTIVE questions</td>
<td>4 x 15 marks = 60 marks</td>
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<td>Two questions from each module with choice to answer one question.</td>
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*Maximum Total Marks: 100*
Teaching scheme

3 hours lecture and 1 hour tutorial per week

Objectives

- This course is intended for exposing the students to some of the advanced topics in instrumentation. Topics covered are humidity and moisture measurement, smart sensors, EMI in instrumentation systems, virtual instrumentation, common instrument interfaces, and measurement of time, frequency, voltage, etc. using digital techniques.

Module I (11 hours)


Module II (15 hours)

Time measurement using digital techniques–Small time interval measurement–Periodic time– Time interval between two events defined by voltage levels–time constant–Phase measurement– Capacitance measurement–Quality factor of a ringing circuit Frequency measurement using digital techniques –Ratio of two frequencies–High frequency–Power system frequency deviation–Low frequency–Time reciprocating circuit–Peak frequency.

Module III (14 hours)


Module IV (12 hours)


Text Books


Reference Books

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions,
quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

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Maximum Total Marks: 100
University of Calicut

**AI14 803: Analytical Instrumentation**

**Credits:** 4

**Teaching scheme**
3 hours lecture and 1 hour tutorial per week

**Objective**
- *This course introduces the basics of analytical and optoelectronic instrumentation.*

**Module I (13 hours)**
Spectral analysiselectromagnetic radiation and its interaction with matter- - radiation sources, wavelength selection, filters, monochromators, prisms, grating, detectors, readout modules, ultraviolet spectrophotometer, single beam and double beam photometers, filter photometers-visible and near IR photometers, use of microprocessors in photometry

**Module II (12 hours)**
Infrared spectrophotometer-sources- detectors-FTIR-flame emission and atomic absorption spectrometry, Radiation sources-wavelength choice-cells and detectors-atomic emission spectrometry-plasma excitation-thermal analysis- principles and instrumentation. Differential thermal analysis-thermo gravimetric analysis

**Module III (12 hours)**
Raman spectrometry-principles and instrumentation, X-ray techniques, diffraction of X-rays- - r a y spectrometer- principles and instrumentation- X-ray absorption fluorescence spectrometry-principles and instrumentation-Magnetic resonance techniques-nuclear magnetic resonance-measurement techniques-ESR spectrometer

**Module IV (15 hours)**
Mass spectrometry-principle- magnetic deflection type, time of flight, quadrapole types. Chromatography-general principles- classification- gas chromatography- various types- liquid chromatography, high performance liquid chromatography, gas-liquid chromatography, chromatographic detectors.
Gas Analysers thermal conductivity type thermal analyser Oxygen analyser CO monitor dust and smo ke measurement industrial analysers.

**Text Books**

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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

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| **PART B: Analytical/Problem solving DESCRIPTIVE questions** | 4 x 15 marks = 60 marks |
| Two questions from each module with choice to answer one question. |

*Maximum Total Marks: 100*
University of Calicut

AI14 804(A): Robotics & Automation

Credit: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
- The course introduces the students to industrial robotics and automation

Pre-requisites:
- The students should have basic knowledge about linear algebra.

Module I (10 hours)

Module II (13 hours)

Module III (15 hours)
Introduction to Robotics-Robotics System-Classification of Robots-Robot Characteristics-Kinematics for manipulator-Frames and Transformations-Forward and inverse Kinematics- Derivation of forward and Inverse kinematic equations for various types of Robots -DH representation-Applications of Robots.

Module IV (14 hours)
Differential motions and velocities- Jacobian- Differential motions of a frame- Inverse Jacobian-Introduction to dynamic analysis-Lagrangian formulation-a short overview- Trajectory planning-Joint space and Cartesian space- Basics of trajectory planning- third order polynomial trajectory planning.

Text Books

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

60% - Tests (minimum 2)

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

10% - Attendance and Regularity in the class

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**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
To acquaint the students with important soft computing methodologies-neural networks, fuzzy logic, genetic algorithms, and genetic programming.

Pre-requisites:
The students should have basic knowledge about numerical methods.

Module I (12 hours)
Artificial intelligence systems– Neural networks, fuzzy logic, genetic algorithms. Artificial neural networks: Biological neural networks, model of an artificial neuron, Activation functions, architectures, characteristics-learning methods, brief history of ANN research-Early ANN architectures (basics only)- McCulloch & Pitts model, Perceptron, ADALINE, MADALINE

Module II (14 hours)
Backpropagation networks: architecture, multilayer perceptron, backpropagation learning-input layer, hidden layer, output layer computations, calculation of error, training of ANN, BP algorithm, momentum and learning rate, Selection of various parameters in BP networks. Variations in standard BP algorithms- Adaptive learning rate BP, resilient BP, Levenberg-Marquardt, and conjugate gradient BP algorithms (basic principle only)- Applications of ANN

Module III (12 hours)

Module IV (14 hours)
Genetic algorithms – basic concepts, encoding, fitness function, reproduction-Roulette wheel, Boltzmann, tournament, rank, and steady state selections, Elitism. Inheritance operators, Crossover different types, Mutation, Bit-wise operators, Generational cycle, Convergence of GA, Applications of GA – case studies. Introduction to genetic programming- basic concepts.

Text Books

Reference Books
5. B. Yegnanarayana, Artificial Neural Networks. Prentice Hall of India, New Delhi, 1999

Internal Continuous Assessment (Maximum Marks-50)
University of Calicut

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

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**PART B:** Analytical/Problem solving DESCRIPTIVE questions | 4 × 15 marks = 60 marks |
| Two questions from each module with choice to answer one question. |

*Maximum Total Marks: 100*
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives:
To provide knowledge on the fundamentals of mechatronics, Numerical control machine tools, part programming and robotics.

Pre-requisites:
No pre-requisites

Module I (14 hours)
Introduction to Mechatronics.- Mechatronics in manufacturing- Mechatronics in products-Scope of Mechatronics. 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-Design consideration of NC machine tools-Methods of improving machine accuracy and productivity-Special tool holders

Module II (12 hours)

Module III (12 hours)

Module IV (14 hours)

References
3. Fu K.S , Gonzales et al, Robotics-Control, sensing, vision and intelligence, McGrawHill,
Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

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

10% - Attendance and Regularity in the class

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University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks = 40 marks

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

4 x 15 marks = 60 marks

Maximum Total Marks: 100
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
- *This course deals with fundamentals of telemetry, data transferred over other media such as a telephone or computer network, optical link or other wired communications like phase line carriers.*

Pre-requisites:
The students should have basic knowledge about communication systems.

Module I (13 hours)
Purpose of telemetry, basic scheme, voltage, current and frequency telemetry, line length limitations, Concepts of Information transfer, bits, symbols, codes-source, line, channel, BCD, ABCII, BAUDOT, AMI, CMI, Manchester, HDBM, Block, Differential, Hamming, Conduction

Module II (13 hours)
Modulation codes: PAM, PFM, PTM, PCM, Bit error rate, Inter symbol, noise, parity checking Review of modulation and multiplexing: FM-AM, FM-FM, PAM-AM, PAM-FM, PCM-AM, etc. Quantization and conversion methods, error in quantization, bandwidth consideration

Module III (13 hours)
FDM systems, IRIG standards in FDM systems in FDM telemetry, SCO’s, Mux and Demux circuits, Detectors and Demodulators, Pulse averaging, Quadrature FM and PLL, Mixers TDM systems (architecture)- TDM- PAM, PAM- PM, TDM- PCM systems, synchronization, PCM generation, differential PCM, PCM reception and detection.

Module IV (13 hours)
Modems, Digital modulation and Shift-keying, FSK, PSK, DPSK, QPSK, QAM, Modem Protocols Satellite telemetry, TT and C services, subsystems, The earth station. Fiber optic Telemetry- The fiber as transmission medium, Interconnections, Repeaters, Sources, Detectors, WDM Remote control: concept and example from a typical industry.

Text Books:

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
AI14 804(E): Numerical Methods

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To impart the basic concepts of mathematical modelling of problems in science and engineering and to know procedures for solving different kinds of problems.
- To understand the various numerical techniques which provide solutions to non-linear equations, partial differential equations etc that describe the mathematical models of problems.

Pre-requisites:
No pre-requisites

Module I (13 hours)

Module II (13 hours)

Module III (13 hours)

Module IV (13 hours)
Statistical Computations - frequency Chart - method of least square curve fitting procedures - fitting a straight line - curve fitting by sum of exponential - data fitting with cubic splines - approximation of functions. Regression Analysis - linear and nonlinear regression - multiple regression - statistical quality control methods.

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
University of Calicut

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

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*Maximum Total Marks: 100*
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To provide an overview of power generation methods
- To give an understanding about the instrumentation systems in a power plant
- To discuss about the various control loops and their operation in a power plant

Pre-requisites:
The students should have basic knowledge about process control instrumentation.

Module I (12 hours)
Overview of Power Generation: Brief survey of methods of power generation – hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation. Thermal power plants – building blocks – overview, types of boilers, turbine generators, condensers, variable speed pumps and fans, material handling system.

Module II (13 hours)

Module III (13 hours)

Module IV (14 hours)

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
AI14 805(B): Space Instrumentation

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective:
To provide an understanding of the instrumentation in Space application

Pre-requisites:
The students should have basic knowledge about sensors and control system.

Module I (12 Hrs)
Introduction to telemetry systems – Aerospace transducers – Signal conditioning and multiplexing methods – Analog and digital telemetry – Command Link and Remote control system – Application of telemetry in flight systems

Module II (13 Hrs)

Module III (14 Hrs)

Module IV (13 Hrs)
Flight control systems – Block diagrams – methods of control – Application of digital and Adaptive control systems – Autopilot

Reference Books
2. Richard F. J., Space communication techniques.
5. Williams, Aircraft Instruments.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
**University Examination Pattern**

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</table>

*Maximum Total Marks: 100*
AI14 805(C): Instrumentation in Petrochemical Industries

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective:
- To provide an understanding of the instrumentation in petrochemical industries

Pre-requisites:
The students should have basic knowledge about process control system.

Module I (12 Hrs)

Module II (13 Hrs)

Module III (13 Hrs)
Process control in refinery and petrochemical industry – Control of distillation column – catalytic cracking unit – catalytic reformer – pyrolysis unit – Automatic control of polyethylene production – Control of vinyl chloride and PVC production – Optimal control of cracking units and reformers.

Module IV (12 Hrs)
Chemical from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Cyclic petrochemicals – Other Products

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
### University Examination Pattern

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Maximum Total Marks: 100
AI14 805(D): Multirate Signal Processing

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- This course aims to introduce the following topics of advanced signal processing
  - Multirate system fundamentals and multirate filter banks
  - Wavelet transform and its applications

Pre-requisites:
The students should have basic knowledge about linear algebra and digital signal processing.

Module I (13 hours)
Multirate system fundamentals–Basic multirate operation – up-sampling and down sampling: Time domain and frequency domain analysis– Identities of multirate operations– Interpolator and decimator design– Rate conversion– Polyphase representation.

Module II (14 hours)

Module III (13 hours)
Wavelets–Fundamentals of signal decomposition - brief overview of Fourier transform and short time Fourier transform - time frequency resolution - Continuous wavelet transform - different wavelets– DWT - wavelet decomposition - approximation of vectors in nested linear vector spaces - example of MRA - orthogonal wavelet decomposition based on the Haar wavelet - digital filter implementation of the Haar wavelet decomposition (Mallat’s algorithm)

Module IV (12 hours)
Wavelet applications–Image compression - EZW algorithm - Audio compression - signal denoising techniques– different types–edge detection. Lossless compression

Text Books
1. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Pearson Education, Delhi, 2004
2. K. P. Soman and K. I. Ramachandran, Insight into Wavelets, Prentice Hall of India, New Delhi, 2004

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

60% - Tests (minimum 2)

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

10% - Attendance and Regularity in the class

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**University Examination Pattern**

**PART A**: Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B**: Analytical/Problem solving DESCRIPTIVE questions  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
This course aims to introduce the concept of wavelet transform and its applications

Pre-requisites:
The students should have basic knowledge about linear algebra and digital signal processing.

Module I (13 hours)
Generalized Fourier theory, Fourier transforms, Short time (windowed) Fourier transform, Time frequency analysis - uncertainty relation, Fundamental notions of the theory of sampling, Wavelets: The basic functions, Admissibility conditions, Continuous wavelet transform (CWT), Inverse CWT-Resolution of identity.

Module II (14 hours)
The multiresolution analysis (MRA) of L2 space-time and frequency resolution- Construction of an MRA from scaling functions - Discrete wavelet transform (DWT) - sub band coding-approximation and detail space- Relation to filter banks-The dilation equation and the wavelet equation, Compactly supported orthonormal wavelet bases – Necessary and sufficient conditions for orthonormality-vanishing moments.

Module III (13 hours)
Fast wavelet transform algorithms- Mallat Algorithm- wavelet reconstruction in L2(R)- Families of wavelets- Haar scaling and wavelet functions- Daubechies' family of wavelets-Biorthogonality and biorthogonal basis, Biorthogonal system of wavelets - construction, vanishing moments

Module IV (12 hours)
Wavelet packets, The Lifting scheme. Wavelet applications in signal processing: Speech, audio and image compression, signal denoising and feature extraction.

Text Book

Reference:

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

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**AI14 806 (P): Seminar**

**Teaching scheme**  
3 hours practical per week

**Credits: 2**

**Objectives**

To assess the ability of the student to study and present a seminar on a topic of current relevance in the field of instrumentation, electronics or allied areas

It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report, based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members will evaluate the seminar.

**Internal Continuous Assessment (Max. Marks : 100)**

- 20% - Relevance of the topic and literature survey
- 50% - Presentation and discussion
- 20% - Report
- 10% - Regularity in the class and Participation in the seminar
AI14 807 (P): Project

Teaching scheme
7 hours practical per week

Credits: 4

Objectives

To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model or a system.

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least an Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation.

Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the guide, and three/four faculty members specialised in the relevant field.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment (Maximum Marks - 100)

40% - Design and development/Simulation and analysis
30% - Presentation & demonstration of results
20% - Report
10% - Regularity in the class
Objectives

To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. Course, mini project, seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level.

For final viva-voce, candidates should produce certified reports of mini project, seminar, and project. If he/she has undergone industrial training/industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce.

Allotment of marks for viva-voce shall be as given below.

Assessment in Viva-voce (Maximum marks – 100)

- 40% - Subjects
- 30% - Project and Mini Project
- 20% - Seminar
- 10% - Industrial training/industrial visit/educational tour or Paper presented at National-level