SCHEME AND SYLLABI

FOR

THIRD TO EIGHTH SEMESTERS

OF

BACHELOR OF TECHNOLOGY

IN

APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING.

FROM 2009 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

University of Calicut
B. Tech. (Applied Electronics & Instrumentation Engg.)

Scheme & Syllabus – 3rd to 8th Semesters
(for 2009 admissions)

3rd Semester

Code	Subject	Hours/week			Marks		End-sem duration-hours	Credits
		L	T	P/D	Inte-rnal	End-sem		
EN09 301	Engineering Mathematics III	3	1	-	30	70	3	4
EN09 302	Humanities and Communication Skills	2	1	-	30	70	3	3
AI09 303	Electronic Circuits – I	4	1	-	30	70	3	5
AI09 304	Electrical Engineering	3	1	-	30	70	3	4
AI09 305	Digital Systems	3	1	-	30	70	3	4
AI09 306	Electric Circuits and Network Theory	3	1	-	30	70	3	4
AI09 307(P)	*Electronics Lab*	-	-	3	50	50	3	2
AI09 308(P)	*Electrical Engineering Lab*	-	-	3	50	50	3	2
	Total	**18**	**6**	**6**				**28**

4th Semester

Code	Subject	Hours/week			Marks		End-sem duration-hours	Credits
		L	T	P/D	Inte-rnal	End-sem		
EN09 401B	Engineering Mathematics IV	3	1	-	30	70	3	4
EN09 402	Environmental Science	2	1	-	30	70	3	3
AI09 403	Linear integrated circuits & Applications	4	1	-	30	70	3	5
AI09 404	Introduction to Microprocessors	3	1	-	30	70	3	4
AI09 405	Electronic Circuits – II	3	1	-	30	70	3	4
AI09 406	Electronic Instrumentation& Measurements	3	1	-	30	70	3	4
AI09 407(P)	*Analog Electronics Lab*	-	-	3	50	50	3	2
AI09 408(P)	*Digital Electronics Lab*	-	-	3	50	50	3	2
	Total	**18**	**6**	**6**				**28**

5th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Semester-end		
AI09 501	Advanced Microprocessors & Microcontrollers	4	1	-	30	70	3	5
AI09 502	Signals & Systems	3	1	-	30	70	3	4
AI09 503	Control Engineering	3	1	-	30	70	3	4
AI09 504	Computer Organization & Architecture	3	1	-	30	70	3	4
AI09 505	Power Electronics	3	1	-	30	70	3	4
AI09 506	Transducers	2	1	-	30	70	3	3
AI09 507(P)	*Power Electronics Lab*	-	-	3	50	50	3	2
AI09 508(P)	*Microprocessor & Microcontroller Lab*	-	-	3	50	50	3	2
	Total	**18**	**6**	**6**				**28**

6th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
AI09 601	Digital Signal Processing	4	1	-	30	70	3	5
AI09 602	Engineering Economics and Principles of Management	3	1	-	30	70	3	4
AI09 603	Biomedical Instrumentation	3	1	-	30	70	3	4
AI09 604	Advanced Control Theory	3	1	-	30	70	3	4
AI09 605	Industrial Instrumentation	2	1	-	30	70	3	3
AI09 Lxx	Elective I	3	1	-	30	70	3	4
AI09 607(P)	Instrumentation Lab	-	-	3	50	50	3	2
AI09 608(P)	*Mini Project*	-	-	3	50	50	3	2
	Total	**18**	**6**	**6**				**28**

Elective I

AI09 L01 Wireless Communication Systems
AI09 L02 Multimedia Communications
AI09 L03 Digital Design with VHDL
AI09 L04 Information Theory and Coding
AI09 L05 Embedded Systems.

7th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
AI09 701	Process Control Instrumentation	4	1	-	30	70	3	5
AI09 702	Advanced Instrumentation	3	1	-	30	70	3	4
AI09 703	Electronic Communication Systems	2	1	-	30	70	3	3
AI09 704	Analog and Digital Circuit Design	2	1	-	30	70	3	3
AI09 Lxx	Elective II	3	1	-	30	70	3	4
AI09 Lxx	Elective III	3	1	-	30	70	3	4
AI09 707(P)	System Simulation Lab	-	-	3	50	50	3	2
AI09 708(P)	*Process Control Instrumentation Lab*	-	-	3	50	50	3	2
AI09 709(P)	*Project*	-	-	1	100	-	-	1
	Total	**17**	**6**	**7**				**28**

8th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
AI09 801	Analytical and Opto-electronic Instrumentation	4	1	-	30	70	3	5
AI09 802	Data & Computer Communication	2	1	-	30	70	3	3
AI09 L06 to 22	Elective IV	3	1	-	30	70	3	4
AI09 L06 to 22	Elective V	3	1	-	30	70	3	4
AI09 805(P)	Seminar	-	-	3	100	-	-	2
AI09 806(P)	Project	-	-	11	100	-	-	7
AI09 807(P)	Viva Voce	-	-	-		100	-	3
	Total	**12**	**4**	**14**				**28**

List of Subjects for Electives II, III, IV, and V

AI09 L06 DSP Controllers
AI09 L07 Pattern Recognition
AI09 L08 VLSI Design
AI09 L09 Advanced Biomedical Instrumentation
AI09 L10 Robotics and Automation
AI09 L11 Computer Networks
AI09 L12 Soft Computing Techniques
AI09 L13 Speech Processing
AI09 L14 Advanced Signal Processing
AI09 L15 Artificial Intelligence and Expert Systems
AI09 L16 Nanotechnology and Nanoelectronics
AI09 L17 Power Plant Instrumentation & Control
AI09 L18 Software Engineering
AI09 L19 Adaptive Filter Theory
AI09 L20 Digital Image Processing
AI09 L21 Signal Compression
AI09 L22 Nonlinear Control Systems
AI09 L23 Micro Electromechanical Systems
AI09 L24 Mobile Communication
AI09 L25 Probability and Random Processes

Global Electives
IT09 L24 Management Information Systems
CH09 L23 Nanomaterial and Nanotechnology
EE09 L24 Mechatronics
BM09 L23 Operations Research
EC09 L023 Data Structures & Algorithms
EC09 L24 Electronic Packaging
CS09 L24 Computer Based Numerical Methods
CS09 L25 Pattern Recognition
CE09 L24 Remote Sensing and GIS
ME09 L25 Energy Engineering and Management

EN09 301: Engineering Mathematics III

(Common for all branches)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

This course provides a quick overview of the concepts and results in complex analysis that may be useful in engineering. Also it gives an introduction to 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)

Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples: Z^n, sinz, cosz, sinhz, coshz, $(z+{}^1/_z)$– Mobius Transformation.

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

Definition of Line integral in the complex plane – Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted) – Independence of path – Cauchy's integral formula – Derivatives of analytic functions (Proof not required) – Taylor series – Laurent series – Singularities and Zeros – Residues – Residue Integration method – Residues and Residue theorem – Evaluation of real integrals.

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

Vector spaces – Definition, Examples – Subspaces – Linear Span – Linear Independence – Linear Dependence – Basis – Dimension – Ordered Basis – Coordinate Vectors – Transition Matrix – Orthogonal and Orthonormal Sets – Orthogonal and Orthonormal Basis – Gram-Schmidt orthogonolisation process – Inner product spaces –Examples.

Module IV: Fourier Transforms (14 hours)

Fourier Integral theorem (Proof not required) – Fourier Sine and Cosine integral representations – Fourier Transforms – Fourier Sine and Cosine Transforms – Properties of Fourier Transforms.

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:

Bernaed Kolman, David R Hill, *Introductory Linear Algebra, An Applied First Course,* Pearson

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)*	*5 x 2 marks=10 marks*
	All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	
PART B:	*Analytical/Problem solving questions*	*4 x 5 marks=20 marks*
	Candidates have to answer four questions out of six. There should be at least one question from each module and not more	

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

Reference books

1. H S Kasana, *Complex Variables, Theory and Applications*, 2e, Prentice Hall of India.
2. John M Howie, *Complex Analysis*, Springer International Edition.
3. Shahnaz bathul, *Text book of Engineering Mathematics, Special functions and Complex Variables*, Prentice Hall of India.
4. Gerald Dennis Mahan, *Applied mathematics*, Springer International Edition.
5. David Towers, *Guide to Linear Algebra*, MacMillan Mathematical Guides.
6. Howard Anton, Chris Rorres, *Elementary Linear Algebra, Applications Version, 9e*, John Wiley and Sons.
7. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, 3e, Pearson Education.
8. H Parthasarathy, *Engineering Mathematics, A Project & Problem based approach*, Ane Books India.
9. B V Ramana, *Higher Engineering Mathematics*, McGrawHill.
10. Sarveswara Rao Koneru, *Engineering Mathematics*, Universities Press.
11. J K Sharma, *Business Mathematics, Theory and Applications*, Ane Books India.
12. John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
13. M Chandra Mohan, Vargheese Philip, *Engineering Mathematics-Vol. I, II, III & IV.*, Sanguine Technical Publishers.
14. N Bali, M Goyal, C Watkins, *Advanced Engineering Mathematics, A Computer Approach, 7e*, Infinity Science Press, Fire Wall Media.
15. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
16. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II.*, Prentice Hall of India.
17. Lary C Andrews, Bhimsen K Shivamoggi, *Integral Transforms for Engineers*, Prentice Hall of India.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

EN09 302: Humanities and Communication Skills

(Common to all branches)

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

Objectives

- *To identify the most critical issues that confronted particular periods and locations in history;*
- *To identify stages in the development of science and technology;*
- *to understand the purpose and process of communication;*
- *to produce documents reflecting different types of communication such as technical descriptions, proposals ,and reports;*
- *To develop a positive attitude and self-confidence in the workplace; and*
- *To develop appropriate social and business ethics.*

Module I (8 hours)

Humanities, Science and Technology: Importance of humanities to technology, education and society- Impact of science and technology on the development of modern civilization.

Contributions of ancient civilization: Chinese, Indian, Egyptian and Greek. Cultural, Industrial, Transportation and Communication revolutions. Advances in modern India: Achievements in information, communication and space technologies.

Module II (9 hours)

Concept of communication: The speaker/writer and the listener/reader, medium of communication, barriers to communication, accuracy, brevity, clarity and appropriateness

Reading comprehension: Reading at various speeds, different kinds of text for different purposes, reading between lines.

Listening comprehension: Comprehending material delivered at fast speed and spoken material, intelligent listening in interviews

Speaking: Achieving desired clarity and fluency, manipulating paralinguistic features of speaking, task oriented, interpersonal, informal and semi formal speaking, making a short classroom presentation.

Group discussion: Use of persuasive strategies, being polite and firm, handling questions and taking in criticisms on self, turn-taking strategies and effective intervention, use of body language.

Module III (10 hours)

Written Communication : Note making and taking, summarizing, notes and memos, developing notes into text, organization of ideas, cohesion and coherence, paragraph writing, ordering information in space and time, description and argument, comparison and contrast, narrating events chronologically. Writing a rough draft, editing, proof reading, final draft and styling text.

Technical report writing: Synopsis writing, formats for reports. Introductory report, Progress report, Incident report, Feasibility report, Marketing report, Field report and Laboratory test report

Project report: Reference work, General objective, specific objective, introduction, body, illustrations using graphs, tables, charts, diagrams and flow charts. Conclusion and references

Preparation of leaflets, brochure and C.V.

Module IV (9 hours)

Human relations and Professional ethics: Art of dealing with people, empathy and sympathy, hearing and listening. Tension and stress, Methods to handle stress Responsibilities and rights of engineers- collegiality and loyalty – Respect for authority – Confidentiality – conflicts of interest – Professional rights, Rights of information, Social responsibility

Senses of ethics – variety of moral issues – Moral dilemma – Moral autonomy – Attributes of an ethical personality – right action – self interest

Reference Books

1. Meenakshi Raman and Sangeeta Sharma, *Technical Communication- Principles and Practice* Oxford University press, 2006
2. Jayashree Suresh and B S Raghavan, *Professional Ethics*, S Chand and Company Ltd, 2005
3. Subrayappa, *History of Science in India*, National Academy of Science, India
4. R C Bhatia, *Business Communication*, Ane Books Pvt. Ltd, 2009
5. Sunita Mishra and C Muralikrishna, *Communicatin Skils for Engineers*, Pearson Education, 2007.
6. Jovan van Emden and Lucinda Becker, *Effective Communication for Arts and Humanities Students*, Palgrave macmillam, 2009
7. W C Dampier, *History of Science*, Cambridge University Press
8. Vesilind, *Engineering, Ethics and the Environment*, Cambridge University Press
9. Larson E, *History of Inventions*, Thompson Press India Ltd.
10. Bernal J.D, *Science in History*, Penguin Books Ltd
11. Encyclopedia Britannica, *History of Science, History of Technology*
12. Brownoski J, *Science and Human Values*, Harper and Row
13. Schrodinger, *Nature and Greeks and Science and Humanism*, Cambridge University Press

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 303: Electronic Circuits - I

Teaching scheme **Credits:** 5
4 hours lecture and 1 hour tutorial per week

Objective

- *To provide a comprehensive understanding of electronic circuits based on transistors/ MOSFETs*

Module I (20 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 (17 hours)
Rectifiers and Power supplies-Half wave and Fullwave rectifiers-Definition and derivation of rectifier specifications such as PIV, dc output voltage, ripple factor, efficieny, 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 (18 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 –fbeta and fT –Miller effect-gain bandwidth product
Multistage Amplifiers-Different types of coupling- RC, Transistor and Direct- Frequency response-Cascode Amplifier-Comparison

Module IV (17 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 f_T – Miller effect-gain bandwidth product

Text Books

1. A. C. Sedra and K. C. Smith, *Microelectronic Circuits*, 5th ed., Oxford University Press, New Delhi, 2004.
2. J. Millman and C. Halkias, *Integrated Electronics: Analog and Digital Circuits and Systems*, Tata McGraw Hill, New Delhi, 1991.
3. R.D. Sudhakar Samuel, Electronic Circuits , Sanguine Publishers, Bangalore,2008

Reference Books

1. D. A. Bell, *Electron Devices and Circuits*, 4th ed., Prentice Hall of India, New Delhi, 2004.
2. J. Millman and A. Grabel, *Microelectronics*, Tata McGraw-Hill, New Delhi, 1999
3. R. T. Howe and C. G. Sodini, *Microelectronics: An Integrated Approach*, Pearson Education, Delhi, 2004
4. R. L. Boylestad and L. Nashelsky, *Electronic Devices and Circuits*, 8th ed., Pearson Education, Delhi, 2002.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 304: Electrical Engineering

Teaching scheme **Credits:** 4

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 (15 hours)

Alternator - Rotating field - Frequency effect of distribution of winding - emf equation – Bsic 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 - Wheat stone bridge - Kelvin's double bridge - AC bridges - Schering bridge, Maxwell's bridge

Text Book

E. Hughes, *Electrical & Electronic Technology*, 8th ed., Pearson Education, Delhi, 2002.

Reference Books

1. H. Cotton, *Advanced Electrical Technology*, Sir Isaac Pitman and Sons, London, 1974
2. E. W. Golding and F. G. Widdis, *Electrical Measurements and Measuring Instruments*, 5th ed., A H Wheeler & Company, Calcutta, 1993

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

AI09 305: Digital Systems

Teaching scheme **Credits:** 4

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 (16 hours)

Shift registers, Universal shift register, applications. Binary counters – Synchronous and asynchronous-up/down counters, mod-N counter, Counters for random sequence. Multivibrators – astable and monostable multivibrators using gates. Integrated circuit technologies – Characteristics and parameters. TTL Circuit-totem pole output-open collector-tristate gates-Schottky TTL, ECL, NMOS and PMOS logic, CMOS logic, BiCMOS and Gallium-Arsenide digital circuits.

Module IV (12 hours)

Synchronous sequential networks: structure and operation, analysis-transition equations, state tables and state diagrams, Modelling- Moore machine and Mealy machine- serial binary adder, sequence recogniser, state table reduction, state assignment. Asynchronous sequential circuit – basic structure, equivalence and minimization, minimization of completely specified machines

Text Books

1. D. D. Givone, *Digital Principles and Design*, Tata Mc-Graw Hill, New Delhi, 2003.
2. M. M. Mano, *Digital Design*, 3rd ed., Pearson Education, Delhi, 2003
3. R.D. Sudhakar Samuel, Logic Design, Sanguine Technical Publishers, Bangalore, 2008

Reference Books

1. J. F. Wakerly, *Digital Design Principles and Practices*, 3rd ed., Pearson Education, Delhi, 2001
2. T. L. Floyd, *Digital Fundamentals*, 8th ed., Pearson Education, Delhi, 2003
3. W. H. Gothmann, *Digital Electronics: An Introduction to Theory and Practice*, 2nd ed., Prentice Hall of India, New Delhi, 1998
4. R. J. Tocci, *Digital systems Principles and Applications*, 6th ed., Prentice Hall of India, New Delhi, 1998

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

AI09 306: Electric Circuits & Network Theory

Teaching scheme **Credits:** 4
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 (15 hours)
Review of Network theorems. Signal representation – Impulse, step, pulse and ramp functions. Laplace Transform-properties-solution of differential equation (review). Circuit analysis applications of Laplace Transform-Notions of impedance and admittance-Nodal and loop analysis in the s-domain. Use of Laplace Transform in the transient analysis of RC and LC networks with impulse, step, exponential, pulse and sinusoidal inputs. Initial and final value theorems, step input for RLC circuits.

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 (13 hours)
Parameters of two-port network – impedance, admittance, transmission and hybrid – Conversion formulae. Attenuators – propagation constant, types of attenuators – T, π and Bridged T. Analysis of interconnected two
port networks-parallel, series, and cascade connections of 2 port networks –simple problems. Characteristic impedance and propagation constant.

Module IV (13 hours)
Filters- Introduction and basic terminology – types of filtering- L.P filter basics- Butterworth LP filter transfer characteristics- Basic passive realization of Butterworth transfer functions. Frequency transformations- transformations to high pass, band pass and band elimination. Chebyshev filters-characteristics- poles of the Chebyshev function.

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
3. D. Ganesh Rao - K. Channa Venkatesh, Network Theory, Sanguine Technical Publishers, Bangalore,2008

Reference Books

1. W. H. Hayt Jr, J. E. Kemmerly, and S. M. Durbin, *Engineering Circuit Analysis*, Tata McGraw-Hill, New Delhi, 2002
2. W. K. Chen, *Passive and Active Filters-Theory and Implementations*, John Wiley & Sons, New York, 1986

.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

Note: *More than 75% of the questions shall be analytical/problem oriented types.*

AI09 307(P): Electronics Lab

Teaching scheme **Credits:** 2
3 hours practical per week

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 electronics circuits-clipping and clamping circuits, RC filters, rectifiers, amplifier, voltage regulator, etc.*
- *To expose the students to simulation of electronics circuits using any software.*

1. Study of laboratory instruments like CRO, Multimeter, Function Generator, Power Supply, etc.
2. Characteristics of diode
3. Zener diode- Characteristics, as a voltage regulator
4. Characteristics of Transistor-Common emitter configuration-Evaluation of h-parameters
5. Characteristics of FET
6. Clipping and clamping circuits
7. UJT characteristics
8. Rectifiers-half wave, full wave, bridge-with and without filter- ripple factor and regulation
9. Common emitter amplifier with four resistor bias circuit, and coupling and bypass capacitors-frequency response characteristics
10. Series voltage regulator circuit with feedback
11. FET/MOSFET- as an amplifier-
12. a) Introduction to any circuit simulation software, eg. PSPICE/EDSPICE/MULTISIM, etc.
    b) Simulation of following experiments
        i)diode characteristics
        ii)transistor/MOSFET characteristics
        iii)rectifier circuits
        iv)clipping and clamping circuits
        v)common emitter amplifier

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

AI09 308(P): Electrical Engineering Lab

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

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

1. 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
2. Load test on DC shunt generator - Plot external characteristics - Deduce internal characteristics
3. Load test on DC series motor - Plot the performance characteristics
4. 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
5. Load test on 3 phase cage induction motor - Plot performance curves
6. Resistance measurement using a) Wheatstone's bridge b) Kelvin's double bridge
7. Measurement of self inductance, mutual inductance and coupling coefficient of a) Transformer windings b) air cored coil
8. Power measurement in 3 phase circuit - Two wattmeter method
9. Extension of ranges of ammeter and voltmeter using shunt and series resistances
10. 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

EN09 401B: Engineering Mathematics IV

(Common for IC, EC, EE, AI, BM, CS, and IT)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

Objective of this course is 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. Also it is intended to stimulate the students understanding of the Z-transform. A study of some important partial differential equations is also included to make the student get acquainted with the basics of PDE.

Module I: Probability Distributions (13 hours)

Random variables – Mean and Variance of probability distributions – Binomial Distribution – Poisson Distribution – Poisson approximation to Binomial distribution – Hyper Geometric Distribution – Geometric Distribution – Probability densities – Normal Distribution – Uniform Distribution – Gamma Distribution.

Module II: Z Transforms (14 hours)

Introduction – The Z transform – Z transform and Region of Convergence (ROC) of finite duration sequences – Properties of ROC – Properties of Z-Transforms: Linearity, Time Shifting, Multiplication by exponential sequence, Time reversal, Multiplication by *n*, Convolution, Time Expansion, Conjugation, Initial Value Theorem, Final Value Theorem – Methods to find inverse transforms – long division method – partial fraction method – residue method – Solutions of difference equations using Z Transforms.

Module III: Series Solutions of Differential Equations (14 hours)

Power series method for solving ordinary differential equations – Legendre's equation – Legendre polynomials – Rodrigue's formula – Generating functions – Relation between Legendre polynomials – Orthogonality property of Legendre polynomials (Proof not required) – Frobenius method for solving ordinary differential equations – Bessel's equation – Bessel functions – Generating functions – Relation between Bessel functions – Orthogonality property of Bessel functions (Proof not required).

Module IV: Partial Differential Equations (13 hours)

Introduction – Solutions of equations of the form $F(p,q) = 0$; $F(x,p,q) = 0$; $F(y,p,q) = 0$; $F(z,p,q) = 0$; $F_1(x,q) = F_2(y,q)$; Clairaut's form, $z = px + qv + F(p,q)$; Legrange'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 – D'Alembert's solution of one dimensional wave equation.

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:
P Ramesh Babu, R Ananda Natarajan, *Signals and* Systems, 2e, Scitech Publications.
Sections: 10.1, 10.2, 10.3, 10.4, 10.5.1, 10.5.2, 10.5.3, 10.5.4, 10.5.5, 10.5.6, 10.5.7, 10.5.8, 10.5.12, 10.5.13, 10.6, 10.10

Module III:
Erwin Kreysig, *Advanced Engineering Mathematics, 8e*, John Wiley and Sons, Inc.
Sections: 4.1, 4.3, 4.4, 4.5

Module IV:
N Bali, M Goyal, C Watkins, *Advanced Engineering Mathematics, A Computer Approach, 7e*, Infinity Science Press, Fire Wall Media.
Sections: 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9
Erwin Kreysig, *Advanced Engineering Mathematics, 8e*, John Wiley and Sons, Inc.
Sections: 11.2, 11.3, 11.4, 9.8 Ex.3, 11.5

Reference books

1. William Hines, Douglas Montgomery, avid Goldman, Connie Borror, *Probability and Statistics in Engineering*, 4e, John Wiley and Sons, Inc.
2. Sheldon M Ross, *Introduction to Probability and Statistics for Engineers and Scientists*, 3e, Elsevier, Academic Press.
3. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, 3e, Pearson Education.
4. H Parthasarathy, *Engineering Mathematics, A Project & Problem based approach*, Ane Books India.
5. B V Ramana, *Higher Engineering Mathematics*, McGrawHill.
6. Sarveswara Rao Koneru, *Engineering Mathematics*, Universities Press.
7. J K Sharma, *Business Mathematics, Theory and Applications*, Ane Books India.
8. John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
9. M Chandra Mohan, Vargheese Philip, *Engineering Mathematics-Vol. I, II, III & IV.*, Sanguine Technical Publishers.
10. Wylie C.R and L.C. Barret, *Advanced Engineering Mathematics*, McGraw Hill.
11. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
12. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II*., Prentice Hall of India.
13. Michael D Greenberg, *Advanced Engineering Mathematics*, Pearson Education.
14. Lary C Andrews, Bhimsen K Shivamoggi, *Integral Transforms for Engineers*, Prentice Hall of India.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

EN09 402: Environmental Science

(Common for all branches)

Teaching scheme **Credits:** 3

2 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 and create awareness among the students to address these issues and conserve the environment in a better way.*

Module I (8 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 land slides, soil erosion and desertification.

Module II (8 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)

Biodiversity and its consideration

Introduction- Definition: genetic, species and ecosystem diversity-Biogeographical; classification of India –value of biodiversity: consumptive use, productive use, social ethical , aesthetic and option values Biodiversity at Global, national , and local level-India at mega –diversity nation- Hot spot of biodiversity-Threats to biodiversity: habitat loss, poaching of wild life, man , wild life conflicts – Endangered and endemic species of India-Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Module III (10 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 (10 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. Clark,R.S.Marine pollution,Clanderson Press Oxford.
2. Mhaskar A. K. Matter Hazrdous, Techno-science Publications.
3. Miller T. G. Jr., Environmental Science, Wadsworth Publishing Co.
4. Townsend C., Harper J, Michael Begon, Essential of Ecology, Blackwell Science
5. Trivedi R. K., Goel P. K., Introduction to Air Pollution, Techno-Science Publications.

Reference Books.

1. Raghavan Nambiar,K Text book of Environmental Studies, Nalpat Publishers, Kochi
2. Bharucha Erach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, Email: mapin@icenet.net
3. Cunningham, W.P., Cooper, T.H., Gorhani, E & Hepworth, M.T. 2001Environmental encyclopedia Jaico publ. House Mumbai 1196p
4. Down to Earth, Centre for Science and Environment
5. Hawkins, R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
6. Mckinney, M.L. & School, R.M. 1996. Environmental Science system & Solutions, Web enhanced edition, 639p.
7. Odum, E.P. 1971. Fundamentals of Ecology. W.B.Saunders Co. USA, 574p
8. Rao, M.N. & Datta, A.K 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd., 345p
9. Survey of the Environment, The Hindu Magazine
10. Wagner.K.D. 1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as Report of field work, literature survey, seminar etc.
10% - 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: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 403: Linear Integrated Circuits and Applications

Teaching scheme **Credits: 5**

4 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 (18 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 (18 hours)

Introduction to Operational amplifier: block diagram representation, analysis of a typical Op-Amp circuit, constant current bias, current mirror, the ideal Op-Amp, equivalent circuit of an Op-Amp, ideal voltage transfer curve, offset error voltages and currents, CMRR, PSRR. frequency Response of an Op-Amp (brief discussion): compensating networks, high frequency Op-Amp equivalent, open loop and closed loop frequency response, slew rate, causes of slew rate, effect of slew rate in applications. 741 Op-amp-Simplified internal circuit.

Module III (20 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 (16 hours)

Oscillators: principles, types, frequency stability, phase shift oscillator, Wien bridge oscillator.

Astable, monostable, bistable multivibrators, triangular wave generator, saw tooth wave generator.

Active Filters: first order Butterworth low pass, high pass, band pass and band stop filters, second Order Butterworth low pass, high pass, band pass and band stop filters, all pass filter, universal active filters, switched capacitor filter-theory of operation, switched capacitor integrator.

Text Books

1. R. Gayakwad, *Op-Amps and Linear Integrated Circuits*, 4th ed., Pearson Education, Delhi, 2000
2. R. Coughlin and F. Driscoll, *Operational Amplifiers and Linear Integrated Circuits*, 6th ed., Pearson Education, Delhi, 2003
3. D. R. Choudhury and S. Jain, *Linear Integrated Circuits*, New Age International, New Delhi, 2002
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-Graw 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-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 404: Introduction to Microprocessors

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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)

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

Module II (14 Hours)

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

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

1. R. S. Gaonkar, *Microprocessor Architecture Programming and Application with 8085*, 5th ed., Penram International Publishers, Bombay, 2000
2. D. V. Hall, *Microprocessors and Interfacing: Programming and Hardware*, 2nd ed., Tata McGraw Hill, 1999
3. B. Brey, *The Intel Microprocessors, 8086/8088, 80186, 80286, 80386 and 80486 architecture, Programming and interfacing*, 6th ed., Prentice Hall of India, New Delhi, 2003

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
2. Y. C. Liu and G. A. Gibsen, *Microcomputer system: The 8086/8088 family*, 2nd ed., Prentice Hall of India, New Delhi, 1986
3. A. P. Mathur, *Introduction of Microprocessors*, Tata McGraw-Hill, New Delhi, 1989.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

AI09 405: Electronic Circuits - II

Teaching scheme **Credits:** 4

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 (14 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 (13 hours)

Voltage time base generators – General features of time base signal – Miller and Bootstrap time base generators – Current time base generators - transistor circuits. Timer IC 555–Block diagram–Astable and Monostable circuits using IC 555, PLL–basic principle–applications.

Module III (14 hours)

Feedback amplifiers – principles of feedback in amplifiers, advantages of negative feedback, voltage series, current series, voltage shunt and current shunt feedback circuits–analysis.

Oscillators–criteria for oscillation–RC phase shift and Wien bridge oscillator, Hartley, Colpitts and crystal oscillator-frequency stability.

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

1. J. Millman and C. Halkias, *Integrated Electronics: Analog and Digital Circuits and Systems*, Tata McGraw Hill, New Delhi, 1991.
2. J. Millman and H. Taub, *Pulse, Digital, and Switching Waveforms*, McGraw-Hill, New York, 1965
3. V.B. Mahadevaswamy, Sanguine Technical Publishers, Bangalore, 2008

Reference Books

1. D. A. Bell, *Solid State Pulse Circuits*, 4th ed., Prentice Hall of India, New Delhi, 1999
2. A. Anad Kumar, *Pulse and Digital Circuits*, Prentice Hall of India, New Delhi, 2004
3. A. C. Sedra and K. C. Smith : *Microelectronic Circuits*, 4th ed., Oxford University Press, New Delhi, 2004.
4. D. A. Bell, *Electron Devices and Circuits*, 3rd ed., Prentice Hall of India, New Delhi, 1999.
5. R. L. Boylestad and L. Nashelsky, *Electronic Devices and Circuit Theory*, 8th ed., Prentice Hall of India, New Delhi, 2002.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 406: Electronic Instrumentation & Measurements

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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 (15 hours)

Generalized configurations of Instruments – Functional element, Analog and Digital modes, Null and deflection methods, Methods of correction. Static characteristics of instruments- Calibration, accuracy, precision, bias, sensitivity, linearity, threshold, resolution, hysterisis and dead space. Measurement errors-various types. Measurement standards and calibration. Uncertainty analysis-estimation of precision uncertainty, probability distributions, Theories based on population and sample, t-test comparison, goodness of fit, propagation of uncertainty, examples of uncertainty analysis, Chi-squared distribution, graphical presentation of data-line fitting, method of least squares, curve fitting.

Module II (13 hours)

Dynamic characteristics – Modelling, digital stimulation methods, response to first and second order instruments for standard test signals-frequency response. Dead time elements. Response of an Instrument to periodic and transient inputs. Determination of measurement system parameters. Units, dimensions and standards. Digital instruments-basic blocks.

Signal generators – low frequency signal generators, function generator, pulse, RF signals, sweep generators, Frequency synthesizer, arbitrary waveform generator.

Module III (13 hours)

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)

Cathode ray oscilloscope (review), Special purpose oscilloscopes-delayed time-base, analog storage, sampling oscilloscopes. Digital storage oscilloscopes-DSO applications. Graphic Recording Instruments: strip chart recorder, X-Y recorder, Plotter, liquid crystal display (LCD). Waveform analysing instruments: Distortion meter, Spectrum analyser, Digital spectrum analyser, Q meter, Watt-hour meter, Power-factor meter, Instrument transformers, Thermocouple instruments, Peak response voltmeter, True RMS meter

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)
3. J. J. Carr, *Elements of Electronic Instrumentation and Measurements*, 3rd ed., Pearson Education, Delhi, 2003
4. T. G. Beckwith, R. D. Marangoni, and J. H. Lienhard, *Mechanical Measurements*, 5th ed., Pearson Education, Delhi, 1993

Reference Books

1. E. O. Doebelin, *Measurement Systems: Application and Design*, 4th ed., McGraw-Hill, New York, 1990
2. A. D. Helfrick and W. D. Cooper, *Modern Electronic Instrumentation and Measurement Techniques*, Pearson Education, Delhi, 1992
3. J. P. Bentley, *Measurement Systems*, Pearson Education, Delhi, 2003
4. R. A. Witte, *Electronic Test Instruments: Analog and Digital Measurements*, 2nd ed., Pearson Education, Delhi, 2003

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 407(P): Analog Electronics Lab

Teaching scheme **Credits:** 2
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*

Transistor Circuits

1. Power Amplifier circuits-class A and class AB
2. Schmitt trigger circuit
3. Phase shift/Wien bridge/Hartley Oscillator
4. Tuned amplifiers-frequency response.
5. RC LPF and HPF-Frequency response
6. Transistor switch and sweep circuits
7. Bootstrap sweep circuit.
8. Astable, Monostable/Bistable multivibrator circuits
9. Differential Amplifier

Op-Amp Circuits

10. Measurement of important Op-Amp parameters such as CMRR, slew rate, open loop gain, input and output impedances, GBW product.
11. Op-Amp (use IC 741) basic circuits –voltage follower, inverting and non-inverting amplifier, integrator and differentiator circuits-frequency response
12. Wien bridge oscillator with amplitude stabilization
13. Astable and monostable multivibrators
14. Second order LPF/ HPF
15. Precision rectifier, Sample and hold circuit

Simulation of Circuits

16. Simulation of few transistor circuits (Oscillators, Schmitt trigger circuit, astable multivibrator, etc.), and Op-Amp Circuits (Basic circuits, Astable and monostable multivibrators, LPF/HPF, Rectifier, etc.) using any software like PSPICE, EDSPICE, MULTISIM, etc.

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

AI09 408(P): Digital Electronics Lab

(Common with BM09-408(P)

Teaching scheme **Credits:** 2

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*

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
7. Realization of RS, T, D, JK and JK Master Slave flip-flops using gates.
8. Realisation of Shift Registers- ring counter, Johnson counter
9. Counter Circuits-Up/down Counter-asynchronous & synchronous
10. Counter ICs
11. Monostable multivibrator IC-74123
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

(Any twelve 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

AI09 501: Advanced Microprocessors & Microcontroller

Teaching scheme **Credits:** 5

4 hours lecture and 1 hour tutorial per week

Objectives

- *To expose the students to the features of advanced microprocessors like 8086, 80386, and Pentium processors*
- *To introduce the architecture, programming, and interfacing of the microcontroller 8051*

Module I (18 hours)

Intel 8086, format:, Assembler directives and operators, Assembly process, Linking and relocation, stacks, procedures, interrupt routines, macros. 8086 hardware design - Bus structure, bus buffering and latching, system bus timing with diagram, Minimum and maximum mode configurations of 8086, Multi processor configuration, 8087 co-processor architecture and configuration, Memory (RAM and ROM) interfacing, memory address decoding.

Module II (18 hours)

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

.

Module III (18 Hours)

8051 Microcontroller: Overview of 8051 family, architecture of 8051, Program counter, ROM space in 8051, 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 (18 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 8255PPI, Stepper motor, keyboard, DAC, external memory

Text Books

1. D. V. Hall, *Microprocessors and Interfacing: Programming and Hardware*, 2nd ed., Tata McGraw Hill, 1999.
2. M. A. Mazidi and J. G. Mazidi, *The 8051 Microcontroller and Embedded Systems*, Pearson Education, Delhi, 2004
3. Ramani Kalpathi and Ganesh Raja, Microcontrollers and Applications

Reference Books

1. Y. C. Liu and G. A. Gibson, *Microcomputer system: The 8086/8088 family*, 2nd ed., Prentice Hall of India, New Delhi, 1986
2. B. Brey, *The Intel Microprocessors, 8086/8088, 80186, 80286, 80386 and 80486 architecture, Programming and interfacing*, 6th ed., Prentice Hall of India, New Delhi, 2003
3. K. J. Ayala, *The 8051 Microcontroller Architecture, Programming And applications*, Penram

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

AI09 502: Signals and Systems

Teaching scheme **Credits:** 4

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 analysing 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 (15 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

1. S. Haykin and B. V. Veen, *Signals and Systems*, John Wiley & Sons, N. Y., 2002
2. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, *Signals & Systems*, 2nd ed., Prentice Hall of India, New Delhi, 1997

Reference Books

1. C. L. Philips, J. M. Parr, E. A Riskin, *Signals, Systems and Transforms*, 3rd ed., Pearson Education, Delhi, 2002
2. R. E. Zeimer, W. H. Tranter, and D. R. Fannin, *Signals and Systems: Continuous and Discrete*, 4th ed., Pearson Education, Delhi, 1998
3. M. J. Roberts, *Signals and Systems: Analysis using Transform methods and MATLAB*, Tata McGraw Hill, New Delhi, 2003

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

Note: *More than 75% of the questions shall be analytical/problem oriented types.*

AI09 503: Control Engineering

Objective Teaching scheme **Credits:** 4
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 1 (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)
Time Domain Analysis: Standard test signals -Response of systems to standard test signals -Step response of second order systems -Time domain specifications (of second order system) -Steady state response -Steady state error -Static and dynamic error coefficients -Zero input and zero state response -Stability of linear systems -absolute stability -relative stability -Hurwitz and Routh stability criterion -Root locus method -construction of root locus -root contours -root sensitivity to gain k -effect of poles and zeros and their locations on the root locus.

Module III (14 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 (14 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)

Text Books

1. I. J. Nagrath and M. Gopal, *Control Systems Engineering*, New Age International Publishers, New Delhi, 1997
2. K. Ogata, *Modern Control Engineering*, 4th ed., Pearson Education, Delhi, 2002
3. B. C. Kuo, *Automatic Control Systems*, 7th ed., Prentice Hall of India, New Delhi, 1995
4. R. C. Dorf and R. H. Bishop, *Modern Control Systems*, 10th ed., Pearson Education, Delhi, 2004

Reference Books

1. G. J. Thaler, *Automatic Control Systems*, Jaico Publishing House, Mumbai, 2005
2. M. Gopal, *Digital Control and State Variable Methods*, 2nd ed., Tata McGraw Hill, New Delhi, 2003

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

Note: One of the assignments shall be simulation of control systems using any technical computing software

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

Note: *More than 75% of the questions shall be analytical/problem oriented types.*

AI09 504: Computer Organisation and Architecture

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

Objective

- *To provide in depth knowledge on organisation and architecture of the computer hardware, data path design, computer peripherals, and parallel processing.*

Module 1 (14 hours)
Basic Structure of Computer Hardware & Software – Functional units, Basic Operational Concepts, Bus Structures, Software, Performance, Historical Perspective. Addressing Methods and Machine program sequencing – Memory Locations, Addresses encoding of Information, Main Memory Operations, Instructions & Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input Output Operations, Stacks and Queues, Subroutines. The Processing Unit – Fundamental Concepts – Fetching a word from memory, Storing a word in memory, Register Transfers, Performing an arithmetic or logic operation, Register Gating and Timing of Data Transfers. Execution of a complete Instruction, Hardwired Control, Performance Considerations, Microprogrammed Control.

Module II (14 hours)
Input Output Organization–Accessing I/O Devices, Interrupts, Direct Memory Access, I/O Hardware, Standard I/O Interfaces. The Memory – Basic concepts, Semiconductor RAM memories, Read Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements.
Arithmetic–Number Representations, Addition of Positive Numbers, Design of Fast Adders, Signed Addition and Subtraction, Arithmetic and branching Conditions, Multiplication of Positive numbers, Signed – Operand Multiplication, Fast Multiplication, Integer Division, Floating Point Numbers and Operations.

Module III (14 hours)
Pipelining–Basic Concepts, Instruction Queue, Branching, Data Dependency, Influence of Pipelining on Instruction Set Design, Multiple Execution Units, Performance Considerations.
Computer peripherals–I/O Devices–Video Terminals, Communication with remote terminal, Video Displays, Flat panel Displays, Graphic Input Devices and Printers. On-Line Storage–Magnetic-Disk Systems, Magnetic – Tape Systems CD- ROM Systems. System Performance Considerations–Disk Access Considerations, Communication Line Considerations.

Module IV (12 hours)
Introduction to parallel processing–Pipelining – An Overlapped parallelism–Parallelism in unipolar systems, Parallel Computer structures, Architectural classification schemes. Principles of pipelining & Vector processing–Principles of Linear pipelining, Classification of pipeline processors, General pipelines and reservation tables, interleaved memory Organizations, Instruction and Arithmetic pipelines, Principles of designing pipelined processors, Vector processing Requirements. Structures for array processors: SIMD Array processor, SIMD Interconnection networks. Parallel Processing Applications

Text Books

1. V. C. Hamacher, Z. G. Vranesic, and S. G. Zaky, *Computer Organization*, 4th ed., McGraw-Hill, New York, 1996
2. K. Hwang and F. A. Briggs, *Computer Architecture and Parallel Processing*, McGraw-Hill, N.Y., 1984.

Reference Books

1. Y. C. Liu and G. A. Gibson, *Microcomputer system: The 8086/8088 family*, 2nd ed., Prentice Hall of India, New Delhi, 1986

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 505: Power Electronics

Teaching scheme **Credits:** 4
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-cyclo converters-single phase and three phase, design of AC voltage controller circuits.

Module III (15 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, synchronisation circuits.

Text Books

1. M. H. Rashid, *Power Electronics: Circuits, Devices and Applications*, 3rd ed., Pearson Education, Delhi, 2002
2. N. Mohan, T. M. Underland, and W. P. Robbins, *Power Electronics: Converter, Applications and Design*, John Wiley & Sons, New York, 1995

Reference Books

1. G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K. Sinha, *Thyristorised Power Controllers*, New Age International Publishers, New Delhi, 1996
2. P. S. Bimbhra, *Power Electronics*, Khanna Publishers, New Delhi, 2002

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

AI09 506: Transducers

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

Objective

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

Module I (10 hours)
Definition of transducers–classification-based on transduction principle, measurand, material and technology-Analog and digital transducers, Active and passive transducers, Primary and secondary transducers. Resistive Transducers–Potentiometers, Resistance thermometers, Hot-wire anemometer, Resistive magnetic flux transducer, Resistive optical radiation transducer, Thermistors, Strain gauge-types-gauge factor.

Module II (8 hours)
Mechanical input elements – springs, membranes, thin plates, diaphragms, capsules, bellows, Bourdon tubes. Damping devices. Inductance Transducers-transformer type, LVDT-characteristics, electromagnetic and magnetostrictive transducers. Capacitive, Piezoelectric, Thermoelectric, Photoelectric, Hall effect, and Ionization transducers. Digital Transducers.

Module III (8 hours)
Measurement of displacement, velocity, and acceleration. Measurement of force and torque, Analytical balance, Weighing systems, Load cells-different types. Mechanical, hydraulic, electric, and transmission type torque dynamometers.

Module IV (10 hours)
Measurement of strain, Vibration measurement–vibration characteristics–vibration sensing devices–Bonded Strain gauge, Piezoelectric, Servo, and digital accelerometers.
Shock Measurements. Measurement of Viscosity– Saybolt's viscometer – rotameter type viscometer – consistency meter. Measurement of pH– basic principle– electrodes– pH measuring circuit – digital pH meter.

Text Books

1. D. V. S. Murty, *Transducers and Instrumentation*, Prentice Hall of India, New Delhi, 1995
2. H. K. P. Neubert, *Instrument Transducers: An Introduction to their Performance and Design*, 2nd ed., Oxford University Press, New Delhi, 2003
3. C. S. Rangan, G. R. Sarma, and V. S. V. Mani, *Instrumentation: Devices and Systems*, 2nd ed., Tata Mc-Graw Hill, New Delhi, 1997

Reference Books

1. D. Patranabis, *Sensors and Transducers*, 2nd ed., Prentice Hall of India, New Delhi, 2003
2. E. O. Doebelin, *Measurement Systems: Application and Design*, 4th ed., McGraw-Hill, New York, 1990

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

AI09 507(P): Power Electronics Lab

Teaching scheme **Credits:** 2
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. Simple DC to AC inverter circuit
8. Driven DC to AC inverter using MOSFET & IC
9. IGBT characteristics
10. Inverter circuit using IGBT
11. Digital triggering circuit for phase controlled rectifiers
12. Application of ICS: PWM IC TL 494, optocoupler IC -MCT2E
13. DC motor speed control – Using digital logic circuits/microprocessor/PC
14. AC motor speed control – Using digital logic circuits/microprocessor/PC
15. Simulation of power electronic converter and inverter circuits using software like MATLAB, PSPICE

Internal work 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 and tabulation form, Conducting experiment, results and inference
20% - Viva voce
10% - Fair record

AI09 508(P): Microprocessors & Microcontroller Lab

Teaching scheme **Credits:** 2
3 hours tutorial per week

Objectives
To acquaint the students with the following skills

- *Assembly language programming based on the microprocessors 8085 and 8086*
- *Assembly language programming based on the microcontroller 8051*
- *Interfacing programs based on 8085/8086 and 8051*
- *ALPs using TASM/NASM*

(Any 15 experiments covering all the six sections)

I. Assembly language programming based on 8085 Kit

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

5. Addition / Subtraction of 64 bit Numbers.
6. Sorting of an array
7. Program s 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

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

V. Interfacing programs based on 8051 Kit

18. ADC & DAC
19. Stepper motor (forward & backward motion)
20. Hex key pad
21. Seven segment display
22. 8251 USART

VI. ALPs using TASM/NASM

23. Simple programs listed above with usage of all assembler directives

24. Downloading the assembled programs to 8086 kit

Internal work 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 and tabulation form, Conducting experiment, results and inference
20% - Viva voce
10% - Fair record

AI09 601: Digital Signal Processing

Teaching scheme **Credits: 5**

4 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 (20 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 11 (16 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 (20 hours)

Design of digital filters - general considerations - causality and its implications, characteristics of practical frequency selective filters - design of FIR filters - symmetric and anti-symmetric, linear phase-design of IIR filters from analog filters – Design of LPF, HPF, Band pass and band stop filters-Butterworth and Chebyshev filters – properties – design equations - using impulse invariance, bilinear transformation, matched-z transformation, characteristics of standard filters and their designs - Frequency transformations in the analog and digital domains.

Module IV (16 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 TMS320 series processor.

Text Books

1. J. G. Proakis and D. G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, 3rd ed., Pearson Education, Delhi, 1996
2. E. C. Ifeachor, B. W. Jervis, *Digital Signal Processing: A Practical Approach*, 2nd ed., Pearson Education, Delhi, 2002

Reference Books

1. V. Oppenheim, and R. W. Schafer, *Discrete-time Signal Processing*, 2nd ed., Pearson Education, Delhi, 1999
2. S. K. Mitra, *Digital Signal Processing: A Computer Based Approach*, 2nd ed., Tata Mc-Graw Hill, 2001
3. B. Venkataramani and M. Bhaskar, *Digital Signal Processors*, Tata McGraw Hill, New Delhi, 2002
4. R. Chassaing, *Digital Signal Processing with C and the TMS320C30*, Wiley, NY, 1992

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

Note: One of the assignments shall be simulation of DSP systems using any technical computing software

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

Note: *More than 75% of the questions shall be analytical/problem oriented types.*

AI 09 602: Engineering Economics and Principles of Management

(Common for AI, EE, BM, and IC)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Section 1: Engineering Economics

Objective

Impart fundamental economic principles that can assist engineers to make more efficient and economical decisions.

Module1 (14 Hrs)

Economic reasoning, Circular Flow in an economy, Law of supply and demand, Economic efficiency. Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Private and Social cost, Opportunity cost. Functions of Money and commercial Banking. Inflation and deflation: concepts and regulatory measures. Economic Policy Reforms in India since 1991: Industrial policy, Foreign Trade policy, Monetary and fiscal policy, Impact on industry.

Module II (13 Hrs)

Value Analysis – Function, aims, procedure.–Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor. Methods of project analysis (pay back, ARR, NPV, IRR and Benefit -Cost ratio) Break-even analysis-, Process planning.

Text books

1. Panneer Selvam, R, Engineering economics, Prentice Hall of India, New Delhi, 2002.
2. Wheeler R (Ed) Engineering economic analysis, Oxford University Press, 2004.

Internal Continuous Assessment *(Maximum Marks-15)*

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% - Regularity in the class

University Examination Pattern – for Section 1
Note: Section 1 and Section 2 are to be answered in separate answer books

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*2 x 2 marks=4 marks* *1 x 1 mark = 1 mark*
PART B:	*Analytical/Problem solving questions* Candidates have to answer two questions out of three. There should be at least one question from each module and not more than two questions from any module.	*2 x 5 marks=10 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*2 x 10 marks=20 marks*

Maximum Total Marks: 35

Section 2: Principles of Management

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 (14 hours)
Financial management – Time value of money and comparison of alternative methods. Costing – Elements & components of cost, allocation of overheads, preparation of cost sheet, break even analysis. Basics of accounting – Principles of accounting, basic concepts of journal, ledger, trade, profit &loss account and balance sheet. Marketing management – Basic concepts of marketing environment, marketing mix, advertising and sales promotion. Project management – Phases, organisation, planning, estimating, planning using PERT & CPM

References

1. F. Mazda, *Engineering management*, Addison Wesley, Longman Ltd., 1998
2. Lucy C Morse and Daniel L Babcock, *Managing engineering and technology*, Pearson Prentice Hall
3. O. P. Khanna, *Industrial Engineering and Management*, Dhanpat Rai and Sons, Delhi, 2003.
4. P. Kotler, *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall, New Jersey, 2001
5. Venkata Ratnam C.S & Srivastva B.K, *Personnel Management and Human Resources*, Tata McGraw Hill.
6. Prasanna Chandra, *Financial Management: Theory and Practice*, Tata McGraw Hill.
7. Bhattacharya A.K., *Principles and Practice of Cost Accounting*, Wheeler Publishing
8. Weist and Levy, *A Management guide to PERT and CPM*, Prantice Hall of India
9. Koontz H, O'Donnel C & Weihrich H, *Essentials of Management*, McGraw Hill.
10. Ramaswamy V.S & Namakumari S, *Marketing Management : Planning, Implementation and Control*, MacMillan

Internal Continuous Assessment *(Maximum Marks-15)*

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% - Regularity in the class

University Examination Pattern – for Section 2
Note: Section 1 and Section 2 are to be answered in separate answer books

PART A: *Short answer questions (one/two sentences)* — *2 x 2 marks=4 marks*, *1 x 1 mark = 1 mark*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* — *2 x 5 marks=10 marks*

Candidates have to answer two questions out of three. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* — *2 x 10 marks=20 marks*

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

Maximum Total Marks: 35

AI09 603: Biomedical Instrumentation

Teaching scheme **Credits:** 4
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 (14 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 (14 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.
Instruments for clinical laboratory – tests on blood cells – Chemical tests – Electrical safety – Physiological effects of electric current – shock hazards from electrical equipment – methods of accident prevention.
Introduction to expert system and hospital management, Introduction to telemedicine.

Text Books

1. L. Cromwell, F. J. Weibell, and L. A. Pfeiffer, *Biomedical Instrumentation and Measurements*, Pearson Education, Delhi, 1990
2. J. J. Carr and J. M. Brown, *Introduction to Biomedical Equipment Technology*, 4th ed., Pearson Education, Delhi, 2001

Reference Books

1. J. G. Webster, *Medical Instrumentation Application and Design*, 3rd ed., John Wiley & Sons, N.Y., 1998
2. R. S. Khandpur, *Handbook of Biomedical Instrumentation*, 2nd ed., Tata McGraw Hill, New

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 604: Advanced Control Theory

Teaching scheme **Credits:** 4

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 (review), 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 II (13 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 III (14 hours)

Controller principles-process characteristics-control system parameters. Discontinuous controller modes, Continuous controller modes-Proportional, integral and derivative modes, Composite control schemes – PI, PD and PID controllers – Integral windup, Effects of proportional, integral, derivative, and composite control modes on the response of a controlled process- design considerations. Circuit realization of composite control schemes-PI, PD, & PID, Modifications of PID control schemes-two degrees of freedom control. Controller tuning-criteria for good control, tuning rules- IAE, ISE, ITAE and ¼ decay ratio, Ziegler Nichol's rules, Cohen and Coon rules, auto tuning feature.

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

1. **R. C. Dorf and R. H. Bishop**, ***Modern Control Systems,* 8th ed., Pearson Education, Delhi, 2004**
2. C. D. Johnson, *Process Control Instrumentation Technology,* 7th ed., Prentice Hall of India, New Delhi, 2003
3. K. Ogata, *Modern Control Engineering*, 4th ed., Pearson Education, Delhi, 2002
4. K. Ogata, *Discrete-time Control Systems*, 2nd ed., Prentice Hall Inc., New Jersey, 1992

Reference Books

1. B. C. Kuo, *Automatic Control Systems*, 7th ed., Prentice Hall of India, New Delhi, 1995
2. I. J. Nagrath and M. Gopal, *Control Systems Engineering*, New Age International Publishers, New Delhi, 1997
3. K. J. Astrom and T. Hagglund, *PID Controllers: Theory, Design, and Tuning. 2nd ed.*, Instrument Society of America, Research Triangle Park, NC, 1995
4. C. L. Phillips and H. T. Nagle, *Digital Control System Analysis and Design*, 3rd ed., Prentice-Hall, Englewood Cliffs, N. J., 1995.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 605: Industrial Instrumentation

Teaching scheme **Credits:** 3
2 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 (8 hours)
Measurement of Temperature: Definitions and standards –calibration –Thermal expansion methods– Bimetallic, Liquid-in-glass, Pressure thermometers. Thermocouples-Law of thermocouple–Common thermocouples– Reference junction considerations– measuring circuits, thermopiles. RTDs – RTD materials– 3 lead and 4 lead RTDs – Junction semiconductor sensors– Digital thermometers. Radiation thermometry– radiation fundamentals – total radiation type– optical pyrometer – Ratiometric type. Quartz crystal thermometer.

Module II (10 hours)
Measurement of Pressure: Units of pressure – manometers – different types – elastic type pressure gauges – Bourdon tubes– bellows – diaphragms – Electrical methods – elastic elements with LVDT and strain gauges – capacitive type pressure gauge – Piezo resistive pressure sensor – capacitive type– resonator pressure sensor. Measurement of high pressure. Low pressure measurements – McLeod gauge –thermal conductivity gauges – Ionization gauge– hot cathode and cold cathode types – testing and calibration of pressure gauges – dead weight tester–Differential pressure transmitter.

Module III (10 hours)
Measurement of Flow–Flow characteristics–Classification of flowmeters**–**Head type with restriction– Venturi tube, Flow nozzle, Orifice, dall tube**–** installation of head flow meters — tapping & piping arrangements**,** pilot tube. Variable area flowmeters–rotameter, piston type. Positive displacement type flowmeters, Turbine type flowmeter, Mass flowmeters. Electromagnetic flowmeter, Vortex flowmeter

Module IV (8 hours)
Flow measurement using hotwire anemometry**,** Ultrasonic flowmeter-Doppler, cross-correlation, transit time types. Measurement of Level–Float types-different schemes, displacer types, hydrostatic, and thermal effect types. Resistance, capacitance, and nuclear radiation techniques of level measurement. Ultrasonic method.

Text Books

1. D. Patranabis, *Principles of Industrial Instrumentation*, 2nd ed., Tata McGraw Hill, New Delhi, 1996
2. E. O. Doebelin, *Measurement Systems: Application and Design*, 4th ed., McGraw-Hill, New York, 1990
3. C. S. Rangan, G. R. Sarma, and V. S. V. Mani, *Instrumentation: Devices and Systems*, Tata McGraw Hill, New Delhi, 1997

Reference Books

1. D. V. S. Murty, *Transducers and Instrumentation*, Prentice Hall of India, New Delhi, 1995
2. T. G. Beckwith, R. D. Marangoni, and J. H. Lienhard, *Mechanical Measurements*, 5th ed., Pearson Education, Delhi, 1993

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

AI09 607(P): Instrumentation Lab

Teaching scheme **Credits:** 2
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*

(Any fourteen experiments)

1. Instrumentation amplifier using Op-Amps-gain and CMRR
2. Active notch filter/Narrowband active filter (using Op-Amp)
3. Analog to digital converter circuit
4. Digital to analog converter circuit
5. Frequency to voltage converter
6. Voltage to frequency converter
7. Astable and monostable multivibrators using IC 555
8. Voltage regulators: IC 723, 78XX, 79XX family
9. Design of PLL for given lock and capture ranges, frequency multiplication
10. Measurement using Schering bridge/Hay bridge
11. Study of dead weight tester and calibration of pressure gauge
12. Measurement using LVDT
13. Measurement using
    (1) strain gauge
    (2) pressure transducer
14. Measurements using Photocell/LDR
15. Temperature measurement using RTD
16. Temperature measurement–using thermocouple–using diode
17. Measurement of distance using ultrasonic method
18. Measurement of PH and viscosity
19. Measurement of level
20. Flow measurement

Internal work assessment (Maximum Marks-50)
60%-Laboratory practical and record
30%- Test/s
10%- Other measures like regularity and participation in class

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

AI09 608(P): Mini Project

Teaching scheme **Credits:** 2
3 hours tutorial per week

Objectives

- *To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model of an electronics/instrumentation system.*
- *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 electronics/instrumentation 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. A committee consisting of minimum three faculty members specialised in electronics/instrumentation engineering will perform assessment of the mini project. Students have to submit a report on the mini project and demonstrate the mini project before the evaluation committee.

60% of the total marks to be awarded by the guide/Co-ordinator and the remaining 40% by the evaluation committee.

Internal Continuous Assessment *(Maximum 50 marks)*
40% - Design and development
30% - Final result and Demonstration
20% - Report
10% - Regularity in the class

Semester-End Examination *(Maximum Marks-50)*

20% - Demonstration of mini project
50% - Practical test connected with mini project
20% - Viva voce
10% - Report

AI09 701: Process Control Instrumentation

Teaching scheme **Credits:** 5

4 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 (22 hours)

Introduction to process control – process variables – degrees of freedom. Process modelling– Liquid level system-Linearization example– Two-tank liquid-level system– interacting and non-interacting systems–Thermal process–Mixing process–Heat exchanger–Distillation column. Dynamics of 1st and 2nd order systems, Batch process and Continuous process. Self-regulation. Control systems with inverse response.

Final control-final control operation, signal conversions-analog electrical signals-digital electrical signals, pneumatic signals, Electrical actuators–electric linear motors, Hydraulic systems-basic principle- hydraulic pumps- hydraulic actuators- pressure control valves- accumulator- directional control valves, Pneumatic systems-compressor-dryer-tank-actuators. I/P, P/I converters, Valve positioner. Switches-different types, Relays-electromechanical-solid state relays.

Module III (17 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 (16 hours)

Process identification-purpose-step testing-pulse testing-ATV method-Least squares method-relationship among time, Laplace, and frequency domains.

Multivariable control–control of interacting systems–response of multi-loop control system–non-interacting control–stability of multivariable systems. Controllability and observability of multivariable systems.

Module V (17 hours)

Discrete state process control – characteristics – event sequencing – Programmable logic controllers – advantages of PLC control – Evolution of PLCs- architecture and Hardware – Functional blocks – symbols-PLC programming – relay logic – Ladder diagram –Timers – counters –PLC operation- analog interfacing – PLC selection –Micro PLCs – Design of interlocks and alarms using PLC, PID control on PLC, Creating Ladder diagrams from process control descriptions.

Text Books

1. G. Stephenopoulos: *Chemical Process Control: An Introduction to Theory and Practice*, Pearson Education, Delhi, 2004
2. D. R. Coughanowr, *Process Systems Analysis and Control*, McGraw Hill, New York, 1991
3. C. D. Johnson, *Process Control Instrumentation Technology*, 7th ed., Pearson Education, Delhi, 2003
4. M. L. Luyben and W. L. Luyben, *Essentials of Process Control*, Tata McGraw Hill, New York, 1997

Reference Books

1. C. T. Kilian, Modern Control Technology Components and Systems, 2nd ed., Thomson Asia, Singapore, 2001
2. D. M. Considine, *Process/Industrial Instruments and Controls Handbook*, 4th ed., McGraw-Hill, New York, 1993
3. P. Harriot, *Process Control*, Tata McGraw-Hill, New Delhi, 1972
4. D. E. Seborg,, T. F. Edgar, and D. A. Mellichamp, *Process Dynamics and Control*, 2nd ed., John Wiley & Sons, New York, 2004

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 702: Advanced Instrumentation

Teaching scheme **Credits:** 4

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 (14 hours)

Measurement of Humidity and Moisture- dry and wet bulb psychrometer–hair hygrometer– Wire electrode type hygrometer –dew cell– electrolysis type hygrometer– commercial type dew point meter – different methods of moisture measurement. Measurement of density–liquid density measurement–gas densitometers. Conductivity measurement. Smart sensors-block diagram, Smart transmitter. Recent trends in sensor technology **–** Semiconductor sensors**–**Film sensors-MEMS-Nanosensors.

Module II (13 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 (15 hours)

Voltage measurement using digital techniques –ADCs (review), Input circuits of digital voltmeter–auto zero circuit–bipolar operation–buffer circuit–protection–auto ranging–tracking method.

Ratiometric Measurements-Applications–Measurement of modulation index, Q of a coil (any one method)

Noise in instrumentation systems, electromagnetic interference, methods of noise coupling, noise sources, grounding.

Virtual Instrumentation–concepts–historical perspective–virtual versus real instrumentation–advantages of virtual instrumentation–block diagram and architecture of a virtual instrument–Physical quantities and analog interfaces– Hardware and software–User Interfaces–Applications of virtual instrumentation.

Module IV (12 hours)

Common Instrument Interfaces – RS232C, RS422A, RS 432A, RS485A, USB, General Purpose Interface Bus (GPIB), Standard Commands for Programmable Instrumentation (SCPI), VME Extensions for Instrumentation (VXI), Multisystem Extension Interface (MXIbus), Enhanced Parallel Port. Virtual Instrument Software Architecture (VISA)

Text Books

1. D. Patranabis, *Principles of Industrial Instrumentation*, 2nd ed., Tata McGraw Hill, New Delhi, 1996
2. T. S. Rathore, *Digital Measurement Techniques*, 2nd ed., Narosa Publishing House, New Delhi, 2004
3. G. W. Johnson, *LabVIEW Graphical Programming: Practical Application in Instrumentation and Control,* 2nd ed., McGraw Hill, New York, 1997

Reference Books

1. D. Patranabis, *Sensors and Transducers*, 2nd ed., Prentice Hall of India, New Delhi, 2003
2. H. R. Taylor, *Data Acquisition for Sensor Systems*, Chapman & Hall, London, 1992
3. J. Y. Beyon, *Hands-On Exercise Manual for LabVIEW Programming, Data Acquisition and Analysis*, Prentice Hall PTR, 2001

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 703: Electronic Communication Systems

Teaching scheme **Credits:** 3
2 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 (11 hrs)
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 (9 hrs)
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 (8 hrs)
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-ary signaling schemes – multiplexing – TDM, FDM, WDM

Module IV (8 hrs)
(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

1. W. Tomasi, *Electronic Communication System*, Pearson Education, Delhi, 2001
2. K.N.Hari Bhatt, Analog Communications, Sanguine Technical Publishers,2008
3. D. Roddy and J. Coolen, *Electronic Communications*, 4th ed., Pearson Education, Delhi, 2000
4. D. Patranabis, *Telemetry principles*, Tata McGraw Hill, New Delhi, 1999

Reference Books

1. L. Frenzel, Jr., *Communication Electronics*, 3rd ed., Tata McGraw Hill, New Delhi, 2000
2. L. W. Couch, *Digital and Analog Communication Systems*, 6th ed., Pearson Education, Delhi, 2001
3. T. Viswanathan, *Telecommunication Switching System & Networking*, Prentice Hall of India, New Delhi, 1997

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

AI09 704: Analog and Digital Circuit Design

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

Objectives

- *To provide basic knowledge in the design of analog circuits using MOS devices*
- *To equip the students with concepts of digital circuit design using VHDL*

Module II (8 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 (10 hours)

MOS Operational Amplifiers, one stage- cascode and folded cascode, two stage op-amp, Common mode feed back, 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 (10 Hours)

Philosophy of Modem digital design. Introduction to VHDL Entities and Architectures. Configurations, identifiers, data objects, Data types, and operators in VHDL. Entity declaration. Architecture modeling - structural, behavioral & data flow. Constant, signal, aliases, and variable assignments. COTI(I~tional statements - if ..then ..else, when...else, with select, and case statements. Loop statements - for, while, loop, and generate statements. exit, next, block, assertion, and report statements. Generics. Configurations - specification declaration, default rules, conversion functions, instantiation.

Module IV (8 hours)

VHDL representation of combinational building blocks: Three state buffers, decoders, Multiplexers, Priority encoder, Adders, parity checker, VHDL representation of sequential circuit blocks:-latches, Flip flops, Registers, Counters, Memory, sequential multiplier, BCD to excess-3 converter, Implementation of combinational systems with ROM's and PLA's

Text Books

1. B. Razavi, *Design of Analog CMOS Integrated Circuits*, Tata McGraw Hill, New Delhi, 2003
2. R. J. Baker, H. W. Li, D. E. Boyce, *CMOS Circuit Design, Layout and Simulation*, IEEE Press, 2002
3. M. Zwolinski, *Digital System Design with VHDL*, 2nd ed., Pearson Education, Delhi, 2004
4. J. Bhaskar, *VHDL Primer,* Pearson Education, Delhi, 2004

Reference Books

1. K. R. Botkar, *Integrated Circuits*, 9th ed., Khanna Publishers, New Delhi, 1997
2. A. C. Sedra and K. C. Smith, *Microelectronic Circuits*, 5th ed., Oxford University Press, New Delhi, 2004
3. S. Yalamanchili, *Introductory VHDL From Simulation to Synthesis,* Pearson Education, Delhi, 2004
4. Z. Navabi, *VHDL: Analysis and Modeling of Digital Systems*, 2nd ed., Tata McGraw-Hill, New Delhi
5. D. Perry, *VHDL Programming by Example*, 4th ed., Tata McGraw Hill, New Delhi, 2002
6. C. H. Roth Jr., *Digital Systems Design Using VHDL*, PWS Publishing Co., Boston, MA, 1998

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 707(P): System Simulation Lab

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To provide experience to students in computer simulation of systems with emphasis on control systems, digital signal processing, and digital system design*
- *To expose the students to the concepts of virtual instrumentation*

(Any 18 experiments covering all the four sections)

Suitable software may be used for performing the experiments.

Section I: Control Systems

1. Study of first order and second order system responses-measurement of system parameters
2. Check the stability of a system. Report whether the system is stable, unstable, or marginally stable. Given the transfer function of the system.
3. Obtaining the closed loop transfer function of a complex block diagram
4. Obtaining response of a system for an arbitrary input
5. State variable analysis-controllability, observability
6. Design of state feedback
7. Design of observer
8. Simulation of Mass Spring Dashpot system, DC Motor Control

Section II: Digital Signal Processing

9. Response of discrete-time systems for test inputs
10. Design of digital filters-Butterworth and Chebyshev
11. Obtaining DTFT and DFT
12. 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
13. Assembly-level/High-level language program for convolution using overlap add/overlap save method
14. Assembly-level/High-level language program for FFT Computation
15. Interfacing of on chip peripherals with a DSP kit
16. FIR filter design using a DSP kit
17. IIR Filter Design using a DSP kit

Section III: Digital System Design

18, 19. VHDL Code: Analysing & Simulation of basic digital circuits: Adder, Flip-flops, Multiplexer, etc.*(2 experiments)*

20. Simulation of State machine model, Binary to Excess-3 converter

21, 22. Synthesis: using FPGA/CPLD (Example: Xlinix, Altera, etc) *(2 Experiments)*

Section IV: Virtual Instrumentation

23. Introduction to virtual instrumentation programming-simple examples
24. Data acquisition and storage of signals through serial/parallel port (or sound card) to PC
25. PC based data acquisition using add-on (PCI) card: analog/digital inputs
26. Virtual Instrument (VI) for measurement of voltage and frequency
27. Development of VI for signal generator

Reference Books

1. B. C. Kuo, and D.C. Hanselman, *MATLAB Tools for Control System Analysis and Design*, Prentice Hall, Englewood Cliffs, 1994
2. Brian D.Hahn – Daniel T.Valentine, Essential MATLAB For Engineers & Scientists, Elsivier India, 2008
3. Samuel D.Stearns, DSP with examples in MATLAB, CRC Press, 2008
4. K. Ogata, *Designing Linear Control Systems with MATLAB*, Prentice Hall, Englewood Cliffs, 1994
5. V. K. Ingle and J. G. Proakis, *Digital Signal Processing using MATLAB*, Thomson Asia, Singapore, 2000
6. R. Chassaing, *Digital Signal Processing with C and the TMS320C30*, Wiley, N. Y., 1992.
7. S. A. Tretter, *Communication System Design using DSP Algorithms: with Laboratory Experiments for the TMS320C30*, Plenum Press, Norwell, MA, 1995.
8. A. Singh and S.Srinivasan, *Digital Signal Processing, Implementations Using DSP Microprocessors with Examples from TMS320C54xx*, Thomson Learning, U. K., 2004
9. M. Zwolinski, *Digital System Design with VHDL*, 2nd ed., Pearson Education, Delhi, 2004
10. C. H. Roth Jr., *Digital Systems Design Using VHDL*, PWS Publishing Co., Boston, MA, 1998
11. G. W. Johnson, *LabVIEW Graphical Programming: Practical Application in Instrumentation and Control*, 2nd ed., McGraw Hill, New York, 1997
12. J. Y. Beyon, *Hands-On Exercise Manual for LabVIEW Programming, Data Acquisition and Analysis*, Prentice Hall PTR, 2001

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 and tabulation form, Conducting experiment, results and inference
20% - Viva voce
10% - Fair record

AI09 708(P): Process Control Instrumentation Lab

Teaching scheme **Credits:** 2
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
3. Flow 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. Controller tuning for various processes – using Ziegler-Nichols rule
6. Controller tuning for various processes – using Cohen and Coon rule
7. Controller Tuning – Simulation
8. Block diagram simulation of a complex control system
9. Study of PLC-ladder diagram implementation for simple processes
10. PLC Control of water control system
11. PLC Simulator-Simulation of complex control systems
12. Study of feed-forward, cascade, and ratio controls
13. Development of VI for temperature measurement-with display, and visual and sound alarms
14. Development of VI for level measurement-with display, and visual and sound alarms
15. Development of VI for measurement of torque/speed/displacement/light
16. Development of VI for audio signal spectrum analyser
17. Data Logger
18. PC based control of robotic actions
19. Simulation of Artificial Neural Networks –use any software
20. Fuzzy Logic Controller–use any software
21. Simulation of Heat Exchanger Temperature Control

Internal work assessment (Maximum Marks-50*)*
60%-Laboratory practical and record
30%- Test/s
10%- Other measures like regularity and participation in class

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

AI09 709(P): Project

Teaching scheme **Credit:** 1
I hour practical per week

Objective

- *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. The project work may be undertaken in electronics/computer science/instrumentation engg. or any allied area and must have relevance in electronics/instrumentation. Project evaluation committee consisting of the guide and three/four faculty members specialised in electronics/ computer science/instrumentation engg. will 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 is 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 7^{th} semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7^{th} semester.

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

Internal Continuous Assessment	
20% - Technical relevance of the project	:
40% - Literature survey and data collection	
20% - Progress of the project and presentation	:
10% - Report	
10% - Regularity in the class	

AI09 801: Analytical and Opto-electronic Instrumentation

Teaching scheme **Credits:** 5
4 hours lecture and 1 hour tutorial per week

Objective

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

Module I (16 hours)
Spectrophotometry - radiation sources, wavelength selection, filters, , prisms, grating, detectors, readout modules, ultraviolet spectrophotometer, single beam and double beam photometers, filter photometers-visible and near IR photometers, Infrared spectrophotometer-sources- detectors-FTIR-flame emission and atomic absorption spectrometry, Radiation sources-wavelength choice-cells and detectors-atomic emission spectrometry

Module II (18 hours)
Raman spectrometry-principles and instrumentation, X-ray spectrometer- principles and instrumentation--Magnetic resonance techniques-nuclear magnetic resonance-measurement techniques-ESR spectrometer- Mass spectrometry-principle - magnetic deflection type, time of flight
Chromatography-general principles- -gas chromatography-liquid chromatography, gas-liquid chromatography, chromatographic detectors.- Gas Analysers– thermal conductivity type – thermal analyser –Oxygen analyser – CO monitor – dust and smoke measurement –

Module III (20 hours)
Fundamentals of optics-light sources-principle of polarization-diffraction and interference. Display devices-light emitting diode-plasma displays-liquid crystal displays-photo detectors-PIN diodes-avalanche photodiodes
Optocouplers-various types-modulation of light-electro-optic, magneto-optic, acoustic-optic modulators, Interferometry-Michelson, Fabry-Perot, Jamin & Mach-Zehnder Interferometers-interference filters-interferometer methods in metrology and testing of optical components-Fiezeau & Tymann-Green interferometers-optical spectrum analyser
Lasers-Principle of operation-Einstein relations-population inversion-optical feedback - Laser modes-axial and transverse modes. Classes of lasers-solid state, gas and liquid dye lasers, semiconductor lasers

Module V (18 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
Measurement of fibre characteristics-attenuation, dispersion and refractive index profile measurements, optical time domain reflectometer, losses in optical fibres, application of optical fibres, fibre optic sensors-measurement of temperature, liquid level, and fluid flow, microbend sensors, optical fibre communication -optical telemetry.

Text Book

1. H. H. Williard, L. L. Merrit, J. A. Dean, and F. A. Settle, *Instrumental Methods of Analysis*, 7th ed., CBS Publishers and Distributors, India, 1988
2. D. A. Skoog, F. J. Holler, and T. A. Nieman, *Principles of Instrumental Analysis*, 6th ed., Thomson Learning, U. K., 1998
3. R. S. Khandpur, *Handbook of Analytical Instruments*, Tata McGraw Hill, New Delhi
4. J. R. Meyer-Arendt, *Introduction to Classical and Modern Optics*, 4th ed., Prentice Hall, N.Y., 1995
5. L. Wilson and J. F. B. Hawkes, *Optoelectronics: An Introduction*, 3rd ed., Prentice Hall of India, New Delhi, 1998

Reference Books

1. K Thyagarajan and A. K. Ghatak, *Lasers: Theory and Applications*, Plenum Publishing Corporation, New York, 1981
2. G. Keiser, *Optical Fibre Communications*, 3rd ed., Mc Graw-Hill, New York, 2000.
3. J. Singh, *Optoelectronics: An Introduction to Materials and Devices*, Tata McGraw Hill, New Delhi, 1996
4. R. K. Jain, *Mechanical and Industrial Measurements*, Khanna Publishers, Delhi, 1985
5. G. W. Ewing, Instrumental *Methods of Chemical Analysis*, 5th ed., McGraw Hill, Singapore, 1992
6. R. E. Sherman and L. J. Rhodes (Eds), Analytical Instrumentation, ISA Press, New York, 1996

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks:70

AI09 802: Data and Computer Communications

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

Objective

- *This course describes the basic and advanced concepts used in the information transfer between computers using the communication networks.*

Module I (8 hrs)

Data communication and networking overview- Data communication, data communication networking, - Examples of networks - PSDN & Broadband networks, Multi-service networks, standards, Data transmission, concepts, analog and digital transmission, transmission impairment, channel capacity – Guided and Wireless transmission – Signal encoding Techniques.

Module II (9 hrs)

Digital data communication Techniques – Asynchronous and Synchronous Transmission - Bit / character oriented synchronisation – Errors – Error detection methods – parity, cyclic redundancy – Error correction circuits – common circuits – interfacing – characteristics – communication control devices statistical, time division multiplexing, asymmetric digital subscribers line – XDSL, spread spectrum and code division multiple access (Brief description only) – Protocol basics – Data link control protocol, Flow control, Error control, Link management.

Module III (10 hrs)

Computer networks - local area networks, wired LANs – topologies and transmission media – Medium access control methods – LAN protocol – Architecture, Bridges, wireless LANs – Technology, high speed LANs – Ethernet switching – FDDI, Bridges – wide area networks – Circuit switching and Packet switching, asynchronous transfer mode, routine and congestion control in switched data networks- cellular wireless network –

Module IV (9 hrs)

Communication architecture and protocol – Internet working – architecture, protocol standards, transport protocol – inter-network protocol –application support protocols –network security – distributed application

Text Books

1. W. Stallings, *Data and Computer Communications*, 7th ed., Pearson Education, Delhi, 2003
2. F. Halsall, *Data Communications, Computer Networks and Open Systems*, 4th ed., Pearson Education, Delhi, 2002

Reference Books

1. B. A. Forouzan, Data Communications and Networking, 3rd ed., Tata Mc-Graw Hill, New Delhi, 2004
2. U. D. Black, *Data Communications and Distributed Networks*, 3rd ed., Prentice Hall of India, New Delhi, 005

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks:70

AI09 805(P): Seminar

Teaching scheme **Credits:** 2
3 hours practical per week

Objective

To assess the ability of the student to study and present a seminar on a topic of current relevance in electronics/computer science/instrumentation engg. 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
20% - Relevance of the topic and literature survey
50% - Presentation and discussion
20% - Report
10% - Regularity in the class and Participation in the seminar

AI09 806(P): Project

Teaching scheme
11 hours practical per week

Total Credits: 7
Credits for interim evaluation: 2
Credits for final evaluation: 5

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 electronics/computer science/instrumentation engg.

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

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

AI09 807(P): Viva-Voce

Credits: 3

Objective

- *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 (two interim reports and main report). 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
40% - Subjects 30% - Project and Mini Project 20% - Seminar 10% - Industrial training/industrial visit/educational tour or Paper presented at National-level

AI09 L01: Wireless Communication Systems

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

Objective

- *To introduce the concepts and strategies used in wireless communication systems*

Module I (14 hours)
Microwave Communication – Advantages – analog and digital microwave – FM Microwave radio system – Repeaters – Diversity reception – Protection switching arrangements – FM microwave radio stations. Satellite Communication – Introduction – Kepler's laws – Orbits – Geostationary orbits – Antenna look angles – Classification – Spacing and frequency allocation – System parameters – Link Models – Link budget.

Module II (13 hours)
Satellite Multiple Access System – FDM/FM Satellite systems – Multiple accessing – Channel capacity – Satellite Navigation. Spread spectrum – Concept – frequency hopping and Direct sequence – CDMA – Generation of spreading sequences. Introduction to modern wireless communication systems: Second generation cellular networks – Third generation wireless networks – Wireless local loop and LMDS – wireless LANs – Personal area networks.

Module III (13 hours)
The cellular concept –frequency reuse - Handoff strategies – Interference and system capacity- Improving coverage and capacity in cellular systems. Mobile Radio Propagation – Practical link budget design using path loss models – outdoor and indoor propagation models – Fading and Multipath channels and their parameters.

Module IV (14 hours)
Multiple Access Techniques for wireless communications – FDMA, TDMA, SSMA, SDMA. Pact radio. Codes for Mobile Communication. Wireless systems and standards – GSM – CDMA digital (IS-95) – Cordless systems – Wireless Local Loop – Mobile IP 386 – Wireless application Protocol. Wireless LAN – Infrared, Spread Spectrum and Narrow band Microwave LANs. Bluetooth – Overview – Radio, base band and Link Manager specifications – Logical link control and adaptation Protocol.

Text Books

1. W. Tomasi, *Advanced Electronics Communication systems*, 4th ed., Pearson Education, Delhi, 2001
2. T. S. Rappaport, *Wireless Communication Principles and Practice*, 2nd Ed., Pearson Education, Delhi, 2002
3. W. Stallings, *Wireless Communications and Networks*, 7th *ed.*, Pearson Education, Delhi, 2002

Reference Books

1. D. Roddy and J. Coolen, *Electronic Communications*, 4th ed., Pearson Education, Delhi, 2000
2. J. Schiller, *Mobile Communications*, Pearson Education, Delhi, 2000
3. W. L. Pritchard, H. G. Suyderhoud, and R. A. Nelson, *Satellite Communication System Engineering*, 2nd ed., Pearson Education, Delhi, 1993
4. T. Pratt and C. W. Postian, *Satellite Communications*, John & Sons, New York, 1999
5. M. Richharia, *Mobile Satellite Communications: Principles and Trends*, Pearson Education, Delhi, 2003.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L02: Multimedia Communications

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

Objectives

- *To impart knowledge on the components, techniques and standards of Multimedia Communications*
- *To provide knowledge on the information contained in the signal*

Module I (10 hours) : Multimedia Components

Introduction – components of multimedia – images and graphics – digital image representation - Image format – graphics format – color images – color models – file formats in multimedia systems- fundamental concepts in video and digital audio – digital video standards – digital audio – MIDI

Module II (15 hours) Compression Techniques

Multimedia compression techniques – audio compression techniques – quantization – non linear quantization – differential encoding – linear prediction encoding – DPCM –adaptive DPCM – lossless compression – run length encoding – statistical encoding – Huffman coding

Module III (14 hours) Lossy Compression

Lossy compression techniques – transform coding – DFT – DCT- Haar transforms – KLT – Wavelet transforms – embedded zero tree coder – EZW algorithm

Module II (15 hours) Compression Standards

Compression standards – JPEG standards – JPEG modes – JPEG 2000 standards – JPEG –LS standard MPEG – video compression – MPEG 1 – MPEG 2 – MPEG 4 –coding audio visual objects –2D mesh coding –MPEG audio compression – temporal masking – MPEG-2 audio coding –MPEG – 4 audio

Text Books

1. Krishna Kumar D N., Multimedia communications , Sanguine Technical Publishers,Bangalore, 2008
2. Khalid Sayood, Introduction to Data Compression, Morgan Kaufman Publishers 2000
3. Gourav Bhatnagar, Shika Mehta, Sugota Mitra, Introduction Multimedia Systems, Academic Press, 2002

Reference Books

1. Ralf steinmetz & Klara Nehrstedt, Multimedia : Computing, Communications & Applications, Pearson 1995
2. Ze- Nian – Li & Mark S. Drew, Fundamentals of Multimedia, PHI: 2006

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L03: Digital Design with VHDL

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To familiarise the integration of industry standard hardware description language VHDL into the digital design process*

Module I (14 hours) : Fundamental Concepts

Modeling digital systems – Domains and levels of modelling – Modeling languages – VHDL modelling concepts – Elements of behaviour – elements of structure – Mixed structural and behavioural models –test benches –analysis elaboration and execution – lexical elements and syntax

Scalar Data types and operations

Constants and variables – constant and variable declarations – variable assignment – scalar types – type declarations –integer types – floating point types – physical types – enumeration types –Type classification – subtypes – type qualification – type conversion – attributes of scalar types – expressions and operators

Sequential statements – if statements – case statements – null statements – loop statements – exit – next statements – while loops – for loops –Programming examples

Module II (16 hours) : Composite data types

Arrays – multi dimensional arrays – array aggregates –array attributes – unconstrained array types – strings – bit vectors – standard logic arrays – string and bit string literals – unconstrained array ports

Basic modelling constructs - entity declarations –architecture bodies – concurrent statements – signal declarations – behavioural descriptions – signal assignment – signal attributes –wait statements – delta delays – transport and inertial delay mechanisms – process statements – concurrent signal assignment – concurrent assertion statements – Structural description – component instantiation and port maps

Subprograms – procedures –return statement in a procedure – procedure parameters – signal parameters – concurrent procedure Call statements.- Functions – function modelling – overloading – overloading operator symbols – programming examples

Module III (12 hours) : Packages and Use Clauses

Package declaration – subprograms in Package declarations – constants in Package declarations – package bodies IEEE standard packages – Std logic 1164 multi value logic system –package interface

Resolved signals – basic resolved signals – IEEE Std Logic 1164 resolved subtypes –resolved signals and ports

Components and Configurations – component declarations – component instantiation – packaging components – configuring component instances – basic configuration declaration –generic and port maps in configurations –configuration specification – programming examples

Module IV (12 hours) : Files and Input/Output

File declarations – reading from files – writing to files – files declared in subprograms - explicit open and close operations – file operators in subprograms – portability of files

Attributes and groups – Predefined attributes – attributes of scalar types – attributes of signals – user defined attributes – attribute declarations – attribute specifications -

Hardware Testing and Design for Testability – Testing combinational logic – Testing sequential logic – scan testing –boundary scan – built n self test

Text Books

1 Peter J.Ashenden, The Designer's guide to VHDL,4TH Edition, Morgan Kaufmann Publishers,2006

2 Volnei A. Pedroni, Digital Electronic & Design with VHDL, Morgan Kaufmann Publishers,2008

3 Charles H. Roth, Jr. ,Digital System Design with VHDL, PWS Publishing Company,2006

4 Peter J. Ashenden, The Students Guide to VHDL, Morgan Kaufmann Publishers, 2006

5. J. Bhaskar, VHDL Primer, Third Edition, PHI

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L04: Information Theory and Coding

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the concepts of information, communication channel and channel capacity.*
- *To provide knowledge on coding techniques.*

Module I (12 hours) Information Theory and source coding

Introduction to Information theory – uncertainty and Information – Average mutual information and entropy – information measures- source coding theorem – Huffman coding – Problems based on Hufman Coding –Rate Distortion function

Module II (14 hours) Channel Capacity and Coding

Introduction – Channel Models – Channel Capacity – Channel Coding- Information capacity theorem – Shannon limit- Random selection of codes - Dimensionality of space – cutoff rate

Module III (14 hours) Error Control Coding

Introduction to Error correcting codes – Matrix description of Linear block codes – correct equivalent codes – parity check matrix – Probability of error correction - Hamming codes

Module IV (14 hours) Cyclic Codes

Introduction to cyclic codes – Polynomials – division algorithm for polynomials – method for generating cyclic codes – Matrix description of cyclic codes – burst error correction –Cyclic Redundancy Check Codes – circuit of Cyclic codes – Introduction to convolution codes – polynomial description of convolution codes –Matrix description of convolution codes

Text Books

1. Ranjan Bose, Information Theory, Coding and Cryptography,Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005
2. Taub Schilling, Principles of Communication Systems, McGraw- Hill International Edition
3. Khalid Sayood, Introduction to Data Compression, Morgan Kaufman Publishers, 2000

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

AI09 L05: Embedded Systems

Teaching scheme **Credits:** 4

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*

Module I (13 hours)

An Introduction to Embedded Systems: Real-Time Systems. Hard Real-Time. Soft Real-Time. Real-Time Embedded Systems. Embedded Processors. The Advent of PC Embedded Systems. PC Hardware Components. Embedded system Design: Tools and components

Module II (13 hours)

Embedded System Hardware Approach: Overview of 8051 family, ADC /DAC Interface issues, Timer/Counter Programming in the 8051. 8051 Serial Communication. Interrupts Programming. Real World Interfacing: Sensors. Stepper Motor, Keyboard, DAC. 8051/31 Interfacing to External Memory.

Module III (14 hours)

Intel 80196 microcontroller – CPU operation – Memory space – software overview – Peripheral overview – Interrupts -Programming concepts (Not in detail). Peripheral Interface Controller(PIC)-General architecture-PIC16F84-Architecture-Addressing modes-Instruction set-Simple Programming (Not in detail)

Module IV (14 hours)

Embedded System Software: Round-Robin with Interrupts. Function-Queue-Scheduling Architecture. Introduction to Real-Time Operating Systems. Real-Time Operating System Architecture. Selecting an Architecture. Tasks and Task States. Tasks and Data. Real Time and Embedded Linux: Features

Text Books

1. M. A. Mazidi and J. G. Mazidi, *The 8051 Microcontroller and Embedded Systems*, Pearson Education, Delhi, 2004
2. D. E. Simon, *An Embedded Software Primer*, Pearson Education, Delhi, 2004

Reference Books

1. C. Hollabaugh, *Embedded Linux: Hardware, Software, and Interfacing*, Pearson Education, Delhi, 2004
1. R. Grehan, R. Moote, and I. Cyliax, *Real-Time Programming: A Guide to 32-bit Embedded Development*, Pearson Education, Delhi, 2004
2. Intel Data Book Vol. 1, *Embedded Microcontrollers and Processors*
3. Intel Data book, *EBK 6496-16 bit embedded controller Hand book*
4. Intel Data book, *EBK 6485 Embedded Microcontrollers Data book*
5. PIC Data Manual, Microchip, 2002

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L06: DSP Controllers

Teaching scheme **Credits:** 4

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*

Module I (13 hours)

Architecture of TMS 320C6x-functional units-fetch and execute-pipelining-registers-addressing modes-instruction sets-timers-interrupts-serial ports-DMA-memory

Module II (13 hours)

Fixed and floating point formats-code improvement-constraints-TMS320C64x CPU-simple programming examples using C/assembly

Module III (14 hours)

Review of FIR, IIR filters-DFT and FFT. Adaptive filters-examples for noise cancellation and system examples-code optimization-procedure-software pipelining

Module IV (14 hours)

Typical DSP development systems-support tools and files-compilers-assemblers-code compressor studio-codecs-DSP application examples in codec, voice scrambling, PLL, AI, image processing, FSK modems, voice detection and reverse playback, multi rate filters, PID controllers

Text Book

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

Reference Books

1. B. Venkataramani and M. Bhaskar, *Digital Signal Processors*, Tata McGraw Hill, New Delhi, 2002
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 Experiments for the TMS320C6700*, Kluwer Academic Publishers, 2003
4. N. Kehtarnavaz, *DSP System Design: Using the TMS320C6000*, Prentice-Hall, New Jersey, 2001

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L07: Pattern Recognition

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

Objectives

- *To enlighten the students with various techniques of pattern recognition*

Module 1 (15 hrs)
Introduction: Introduction to statistical, syntactic and descriptive approaches, features and feature extraction, learning.
Bayes Decision theory: introduction, continuous case, 2-category classification, minimum error rate classification, classifiers, discriminant functions, and decision surfaces. Error probabilities and integrals, normal density, discriminant functions for normal density, Bayes Decision theory Discrete case.

Module II (13 hrs)
Parameter estimation and supervised learning: Maximum likelihood estimation, the Bayes classifier, learning the mean of a normal density, general Bayesian learning.
Nonparametric technique: density estimation, parzen windows, k-nearest Neighbour estimation, estimation of posterior probabilities, k_n nearest neighbour rule, nearest- neighbor rule, k-nearest neighbour rule.

Module III (13 hrs)
Linear discriminant functions- linear discriminant functions and decision surfaces, generalized linear discriminant functions, 2-category linearly separable case, non-separable behaviour, linear programming procedures.
Multilayer neural networks- Feed forward operation and classification, Back propagation algorithm, error surfaces, back propagation as feature mapping, practical techniques for improving back propagation.

Module IV (13 hrs)
Supervised learning and clustering- Mixture densities and identifiably, maximum likelihood estimates, application to normal mixtures, unsupervised Bayesian learning, data description and clustering, Hierarchical clustering, low dimensional representation of multidimensional map

Text Books

1. R. O. Duda, P. E. Hart, and D. G. Stork, *Pattern Classification*, 2nd ed., John Wiley & Sons, New York, 2001
2. R. O. Duda and P. E. Hart, *Pattern Classification and Scene Analysis*, John Wiley & Sons, New York, 1973.
3. E. Gose, R. Johnsonbaugh, and S. Jost, *Pattern Recognition and Image Analysis*, Prentice Hall of India, NewDelhi, 1999

Reference Books

1. K. S. Fu, *Syntactic Pattern Recognition and Applications*, Prentice Hall, Eaglewood cliffs, N.J., 1982
2. C. M. Bishop, *Neural Network for Pattern Recognition*, Oxford University Press, New York, 1998

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L08: VLSI Design

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

- *The objective of this course is to acquaint students with the basic concepts of VLSI design.*

Module I (13 hours)

Integrated Circuit Manufacturing. CMOS Technology. Integrated Circuit Design Techniques. MOS Transistors. MOS Transistor Theory. Characteristics: I-V, switching effect of non-ideal characteristics. CMOS Processing Technology. CMOS Technologies. Layout Design Rules. Circuit Characterization and Performance Estimation. Delay Estimation. Logical Effort and Transistor Sizing. Power Disruption. Interconnect Wire Engineering. Design Margin. Reliability. Scaling.

Module II (14 hours)

Circuit Simulation. Device Models. SPICE Models Device Characterization. Interconnect Simulation. Combinational Circuit Design. Introduction. Circuit Families. Comparison of Circuit Families. Silicon-on-Insulator Circuit Design. Sequential Circuit Design:. Sequencing Static Circuits. Circuit Design of Latches & Flip-Flops. Static Sequencing Element Methodology. Synchronizers. Wave Pipelining

Module III (14 hours)

Design Methodology and Tools: Structured Design Strategies. Basic Design Methods. Design Flows. Behavioural/Functional Synthesis Design Flow (ASIC Design Flow).Programmed Behavioural Synthesis. Automated Layout Generation. Mixed Signal or Custom Design Flow. Additional Design Interchange Formats. Testing and Verification. Reliability. Logic Verification Principles. Silicon Debug Principles. Manufacturing Test Principles. Design for Testability. Boundary Scan.

Module IV (13 hours)

Data path Subsystems. Addition/Subtraction. One/Zero Detectors. Comparators. Counters. Boolean Logical Operations. Coding. Shifters. Multiplication. Parallel Prefix Computations. Array Subsystems. SRAM. Special-Purpose RAMs. DRAM. Read Only Memory. Content-Addressable Memory. Programmable Logic Arrays.

Text Books

1. N. H. E. Weste and D. Harris, *CMOS VLSI Design: A Circuits and Systems Perspective*, 3rd ed., Pearson Education, Delhi, 2004
2. J. P. Uyemura, *Introduction to VLSI Circuits and Systems*, Pearson Education, Delhi, 2001

Reference Books

1. S. K. Gandhi, *VLSI Fabrication Principles*, 2nd ed., John Wiley & Sons, New York, 1994
2. E. Fabricius, *Introduction to VLSI Design*, Tata McGraw-Hill, New Delhi, 1990
3. W. Wolf, *Modern VLSI Design: System-on-Chip Design*, 3rd ed., Prentice Hall PTR, 2002
4. J. M. Rabaey and A. Chandrakasan, *Digital Integrated Circuits - A Design Perspective*, Prentice Hall of India, New Delhi, 2003

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L09: Advanced Biomedical Instrumentation

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

Objective

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

Module I (14 hours)
Nuclear Medical Imaging System–Radioisotopes 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 (13 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 analyser, portable arrhythmia monitor, arrhythmia analysis.

Text Books

1. J. G. Webster, *Medical Instrumentation Application and Design*, 3rd ed., John Wiley & Sons, N.Y., 1998
2. R. S. Khandpur, *Handbook of Biomedical Instrumentation*, 2nd ed., Tata McGraw 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-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

AI09 L10: Robotics and Automation

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

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

Module I (13 hours)

Basic Concepts: Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

Module II (13 hours)

Power Sources and Sensors: Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

Module III (12 hours)

Manipulators, actuators and grippers: Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

Module IV (16 hours)

Kinematics and Path Planning: Solution of inverse kinematics problem – multiple solution jacobian work envelope – hill climbing techniques – robot programming languages. Case Studies: Multiple robots – machine interface – robots in manufacturing and non-manufacturing applications – robot cell design – selection of robot.

Text Books

1. P. Mikell, G. M. Weiss, R. N. Nagel, and N. G. Odraj, *Industrial Robotics*, McGraw-Hill, Singapore, 1996
2. B. K. Ghosh, *Control in Robotics and Automation: Sensor Based Integration*, Allied Publishers, Chennai, 1998

Reference Books

1. S. R. Deb, *Robotics Technology and Flexible Automation*, Tata McGraw Hill, New Delhi, 1994.
2. R. P. Klafter, T. A. Chmiclewski, and M. Negin, *Robotics Engineering: Integrated Approach*, Prentice Hall of India, New Delhi, 1994.
3. C. R. Asfahl, *Robots and Manufacturing Automation*, John Wiley & Sons, New York, 1992
4. P. J. Mc Kerrow, *Introduction to Robotics*, Addison Wesley, Singapore, 1991.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L11: Computer Networks

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

- *This course presents the fundamental concepts involved in computer networks*

Module I (13 hours)

Computer Networks and the Internet-The Network Edge. The Network Core. Network Access and Physical Media, ISPs and Internet Backbones. Delay and Loss in Packet-Switched Networks. Protocol Layers and Their Service Models. Application Layer. Principles of Application Layer Protocols. The Web and HTTP. File Transfer: FTP. Electronic Mail in the Internet. DNS-The Internet's Directory Service.

Module II (13 hours)

Transport Layer. Introduction and Transport-Layer Services. Multiplexing and Demultiplexing. Connectionless Transport: UDP. Principles of Reliable Data Transfer. Connection-Oriented Transport: TCP. Principles of Congestion Control. TCP Congestion Control.

Module III (14 hours)

Networking Layer & Routing. Introduction and Network Service Model. Routing Principles. Hierarchical Routing. The Internet Protocol. Routing and the Internet. Router architecture .IPv6.Multicast Routing. Mobility and the Network Layer.

Module IV (14 hours)

Link Layer. Data Link Layer: Introduction and Services. Error Detection and Correction Techniques. Multiple Access Protocols. LAN Addresses and ARP. Hubs, Bridges and Switches. Wireless Links. PPP: The Point-to-Point Protocol. Asynchronous Transfer Mode (ATM). Wireless & Mobility (in brief). Security-Principles of Cryptography. Authentication. Integrity. Key Distribution. Access Control, Firewalls.

Text Book

1.J. Kurose and K. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, 3rd ed., Pearson Education, Delhi, 2001

Reference Books

1. S. Keshav, *An Engineering Approach to Computer Networking: ATM Networks, the Internet, and the Telephone Network*, Pearson Education, Delhi, 1997
2. W. Stallings *Computer Networking with Internet Protocol*, Pearson Education, Delhi, 2003
3. D. Comer, *Computer Networks and Internets with Internet Applications*, 4th ed., Pearson Education, Delhi, 2003

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L12: Soft Computing Techniques

Teaching scheme **Credits:** 4
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.*

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 (14 hours)
Fuzzy Logic–Crisp & fuzzy sets – fuzzy relations – fuzzy conditional statements – fuzzy rules – fuzzy algorithm. Fuzzy logic controller – fuzzification interface – knowledge base – decision making logic – defuzzification interface – design of fuzzy logic controller –case studies.

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

1. R. Rajasekaran and G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications*, Prentice Hall of India, New Delhi, 2003
2. L. Fausett, *Fundamentals of Neural Networks*, Prentice Hall, Upper Saddle River, N.J, 1994.

Reference Books

1. D. E. Goldberg, *Genetic Algorithms in Search, Optimisation, and Machine Learning*, Addison-Wesley, Reading, MA, 1989
2. M. T. Hagan, H. B. Demuth, and M. H. Beale, *Neural Network Design*, PWS Publishing, Boston, MA, 1996.
3. T. Ross, Fuzzy Logic with Engineering Applications, Tata McGraw Hill, New Delhi, 1995
4. J. R. Koza, *Genetic Programming: On the Programming of Computers by Natural Selection*, MIT Press,
   Cambridge, 1992.
5. B. Yegnanarayana, *Artificial Neural Networks*. Prentice Hall of India, New Delhi, 1999

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L13: Speech Processing

Teaching scheme **Credits:** 4
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.*

Module I (12 hours)
Production and Classification of Speech Sounds. Anatomy and Physiology of Speech Production. Spectrographic Analysis of Speech. Categorization of Speech Sounds. Speech Perception. Acoustics of Speech Production**.** Physics of Sound. Uniform Tube Model. A Discrete-Time Model Based on Tube Concatenation. Vocal Fold/Vocal Tract Interaction. Analysis and Synthesis of Pole-Zero Speech Models**.** Time-Dependent Processing. All-Pole Modelling of Deterministic Signals.

Module II (13 hours)
Linear Prediction Analysis of Stochastic Speech Sounds. Criterion of "Goodness". Synthesis Based on All-Pole Modeling. Pole-Zero Estimation. Decomposition of the Glottal Flow Derivative. Homomorphic Signal Processing**.** Homomorphic Systems for Convolution. Complex Cepstrum of Speech-Like Sequences. Spectral Root Homomorphic Filtering. Short-Time Homomorphic Analysis of Periodic Sequences.

Module III (14 hours)
Short-Time Speech Analysis. Analysis/Synthesis Structures. Short-Time Fourier Transform Analysis and Synthesis. Short-Time Analysis. Short-Time Synthesis. Short-Time Fourier Transform Magnitude. Signal Estimation from the Modified STFT or STFTM. Time-Scale Modification and Enhancement of Speech. Filter-Bank Analysis/Synthesis. Phase Vocoder. Phase Coherence in the Phase Vocoder. Constant-Q Analysis/Synthesis. Auditory Modelling.

Module III (15 hours)
Frequency-Domain Pitch Estimation. A Correlation-Based Pitch Estimator. Pitch Estimation Based on a Comb Filter. Speech Coding**.** Statistical Models of Speech. Scaler Quantization. Vector Quantization (VQ). Frequency-Domain Coding. Model-Based Coding. LPC Residual Coding. Speech Enhancement**.** Wiener Filtering. Model-Based Processing. Enhancement Based on Auditory Masking. Speaker Recognition. Introduction. Spectral Features for Speaker Recognition. Speaker Recognition Algorithms. Non-Spectral Features in Speaker Recognition.

Text Books

1. T. F. Quatieri, *Discrete Time Speech Signal Processing: Principles and Practice*, Pearson Education, Delhi, 2002.
2. L. R. Rabiner, R. W. Schafer, *Digital Processing of Speech Signal*, Pearson Education, Delhi, 1993

Reference Books

1. J. R. Deller Jr, J. H. L. Hansen, and J. G. Proakis, *Discrete-Time Processing of Speech Signals*, 2nd ed., IEEE Press, New York, 2000
2. B. Gold and N. Morgan, *Speech and Audio Signal Processing*, John Wiley & Sons, N. Y., 1999
3. D. O. Shaughnessy, *Speech Communication: Human and Machine*, 2nd ed., IEEE Press, New York, 2000

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L14: Advanced Signal Processing

Teaching scheme **Credits:** 4
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*

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)
Multirate Filter banks–Maximally decimated filter banks–Quadrature mirror filter (QMF) banks – Polyphase representation–Errors in the QMF bank. Aliasing and Imaging–Method of cancelling aliasing error. Amplitude and phase distortion. Prefect reconstruction (PR) QMF bank – PR condition. M-channel perfect reconstruction filter banks

Module III (15 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
3. G. Strang and T. Nguyen, *Wavelets and Filter Banks*, Wellesley-Cambridge Press, MA, 1996

Reference Books

1. M. Vetterli and J. Kovacevic, *Wavelets and Subband Coding*, Prentice-Hall, Englewood Cliffs, N. J., 1995
2. S. K. Mitra, *Digital Signal Processing: A Computer Based Approach*, 2nd ed., Tata Mc-Graw Hill, New Delhi, 2001
3. C. S. Burrus, R. A. Gopinath, and H. Guo, *Introduction to Wavelets and Wavelet Transforms: A Primer*, Prentice Hall, Englewood Cliffs, N. J., 1997

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L15: Artificial Intelligence and Expert Systems

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

Objective

- *This course deals with the algorithms used in artificial intelligence and expert systems.*

Module I (13 hours)
Artificial Intelligence: History and Applications, Production Systems, Structures and Strategies for state space search- Data driven and goal driven search, Depth First and Breadth First Search, DFS with Iterative Deepening, Heuristic Search- Best First Search, A* Algorithm, AO* Algorithm, Constraint Satisfaction, Using heuristics in games- Minimax Search, Alpha Beta Procedure

Module II (12 hours)
Knowledge representation - Propositional calculus, Predicate Calculus, Theorem proving by Resolution, Answer Extraction, AI Representational Schemes- Semantic Nets, Conceptual Dependency, Scripts, Frames, Introduction to agent based problem solving

Module III (14 hours)
Machine Learning- Symbol based and Connectionist, Social and Emergent models of learning, The Genetic Algorithm- Genetic Programming, Languages and Programming Techniques for AI- Introduction to PROLOG and LISP-features. Basics of search strategies and Logic Programming in LISP

Module IV (15 hours)
Overview of Expert System Technology - Rule based Expert Systems, Expert systems Inference: Forward chaining and backward chaining. Deduction process. Languages and tools. Knowledge acquisition and uncertainty: Explanation facilities, knowledge acquisition, dealing with uncertainty, fuzzy reasoning. Introduction to natural language processing. Understanding, perception, learning; explanation facilities and knowledge acquisition.

Text Books

1. G. F. Luger, *Artificial Intelligence- Structures and Strategies for Complex Problem Solving*, 4th ed., Pearson Education, Delhi, 2002
2. E. Rich and K. Knight, *Artificial Intelligence*, 2nd ed., Tata McGraw-Hill, New Delhi, 1991

Reference Books

1. D. W. Rolston, *Principles of Artificial Intelligence & Expert Systems Development*, McGraw Hill, Ney York, 1988
2. D. W. Patterson, *Introduction to Artificial Intelligence and Expert Systems*, Prentice Hall of India, New Delhi, 1990
3. N. J. Nilsson, *Principles of Artificial Intelligence*, Narosa Publishing House, New Delhi, 1990

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L16: Nanotechnology and Nanoelectronics

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

Objectives

- *To provide an introduction to Nanotechnology*

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

Module II (14 hours) Syntheis of nanomaterials
Synthesis of Metal colloids- nanoclusters – polymer supported clusters – nanotubes – carbon nanotubes – nanowires – nanorods – nanocrystalline materials

Module III (14 hours) Characterization of nanaomaterials
Structures of nanomaterials – x ray diffracion nd absorption – spectroscopy – luminescence – microscopy – standards for Nanometerology

Module I (13 hours) Applications of Nanotechnology
Nanobiology – nanocatalysts –nanoelectrodes – nanomachines – nanoswitches – nanofilters - nanocomputers

Text Books

1. V.S.Murlidharan, A Subramania, Nanocience & Technology, Ane Books Pvt. Ltd. New Delhi, 2009
2. W.R.Fahrner, Nanaotechnology and Nanoelectronics, Springer(India) Pvt. Ltd. NewDelhi 2008

Reference Book

1. KarlGoser, Nanoelectronic and Nanosystems, Springer (India) Pvt. Ltd., NewDelhi, 2008

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L17: Power Plant Instrumentation and Control

Teaching scheme **Credits:** 4
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*

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 (15 hours)
Measurements in Power Plants: Electrical measurements – current, voltage, power, frequency, power factor etc. Non electrical parameters – flow of feed water, fuel, air and steam with correction factor for temperature – steam pressure and steam temperature – drum level measurement – radiation detector – smoke density measurement – dust monitor. Analysers in Power Plants **–**Flue gas analyser – dissolved oxygen analyser & PH – fuel analyser – pollution monitoring instruments.

Module III (13 hours)
Control Loops in Boiler: Combustion control – air/fuel ratio control – furnace draft control – drum level control – main stem and reheat steam temperature control – superheater control – deaerator control – distributed control system in power plants – interlocks in boiler operation.

Module IV (14 hours)
Turbine Monitoring and Control: Speed, vibration, shell temperature monitoring and control – steam pressure control – lubricant oil temperature control – cooling system. Automation strategy of thermal power plant (PLC, DCS, SCADA). Hydroelectric power generation, regulation and monitoring of voltage and frequency. Nuclear power generation and control station.

Text Books

1. S. G. Dukelow, *The Control of Boilers*, 2nd ed., ISA Press, New York, 1991
2. M. J. Jervis, *Power Station Instrumentation*, Butterworth Heinemann, Oxford, 1993

Reference Books

1. P.C Martin, I.W Hannah, *Modern Power Station Practice*, British Electricity International Vol. 1 & VI, Pergamon Press, London, 1992
2. H. P. Kallen, *Handbook of Instrumentation and Controls*, McGraw Hill, New York.
3. D. Lindsley, *Boiler Control Systems*, McGraw Hill, New York, 1991

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L18: Software Engineering

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction: FAQ's about Software Engineering - Professional and Ethical responsibility, System Modeling, System Engineering process. *Software products*: System software, Application software, Software product attributes, Software Engineering Approach, The need for an engineering approach, phased development process. *Software process*: Software development process life cycle models, Waterfall model, Spiral model, Incremental development, Rapid application development, Iteration model. *Software Prototyping*: Prototyping techniques, Throw-away prototyping, Evolutionary prototyping.*System Models*: Context models, Behavior model, Data models.*Computer Aided Software Engineering:* CASE tools, Advantages of using CASE tools, Components of a CASE tool, Function oriented CASE tools – (e.g. Designer 2000/6i), Object oriented CASE tools – (e.g. Rational Rose)

Module II (13 hours)

Software Requirement Analysis and Specification: Software requirements, functional and non-functional requirements, user requirements, system requirements, Requirement definition, Software requirement specification (SRS), Components of an SRS, Specification languages, Requirement validation, Requirement reviews. *Software Design*: Software design techniques, Top-down design technique, Bottom-up design techniques, Data flow oriented design, Object oriented design, User Interface design, Design Principles and Issues – Modularity, Abstraction, Encapsulation, Re-usability, Support maintainability.

Module III (14 hours)

Software Coding and Verification: Structured programming, Programming style, internal documentation, Code Inspections, Code reviews. *Software Testing*: Testing process, Test plans, Test cases and test criteria, Test case execution and analysis, Test results specification, Testing strategies, Top-down integration, *Bottom*-up integration, Testing techniques, Black-box testing, White-box testing, Alpha testing, Beta testing, object oriented testing. *Software Evolution*: Legacy systems, Software change, Software maintenance, Architectural evolution, Software re-engineering, Data re-engineering. *Overview of Critical systems*: Availability, Reliability, Safety, Security.

Module IV (14 hours)

Software Project Management: Project planning, Scheduling, Risk management. *Managing People*: Group working, closing and keeping people. *Quality Management*: Quality Assurance and standards, Quality planning, Quality control, Software measurement and metrics. *Process Improvement*: Process and product quality, Process analysis and modeling, Process measurement, Process CMM. *Configuration Management:* Planning, Change management, Version and Release management, System building

Text Book

1. I. Sommerville, *Software Engineering*, 6th ed., Pearson Education, Delhi, 2001

Reference Books

1. R. S. Pressman, *Software Engineering*, 4th ed., McGraw Hill, New York, 1997
2. R. Mall, *Fundamentals of Software Engineering*, Prentice Hall of India, New Delhi, 2000
3. A. Behferooz and F. J. Hudson, *Software Engineering Fundamentals*, Oxford University Press, New York, 1996
4. P. Jalote, *An Integrated Approach to Software Engineering*, Narosa Publishing House, New Delhi, 1993

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L19: Adaptive Filter Theory

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

Objective

- *To develop the mathematical theory of various realization of linear adaptive filters*

Module I (14 hours)
The filtering Problem – linear optimum filters – adaptive filters – linear filter structures – approaches to development of linear adaptive filters -

Module II (13 hours) Wiener Filters
Linear optimum filtering – Principle of orthogonality – Minimum Mean Square Error – Wiener –Hopf Equations-Linearly constrained minimum – variance filter

Module III (15 hours) Linear Prediction
Forward linear prediction – Backward linear prediction – Levinson Durbin algorithm – properties of prediction error filters –Basic idea of the Steepest Descent algorithm –stability of the steepest descent algorithm – Least mean square adaptive filters – Statistical LMS Theory

Module IV (12 hours) Kalman Filters
Recursive Least Squares adaptive filters – preliminaries- Recursive least squares algorithm – convergence analysis of the RLS algorithm – robustness of RLS filters – Kalman Filters – Statement of the Kalman filtering problem – filtering – summary of the Kalman filter

Text Book

Simon Haykin, Adaptive filter theory, Pearson Education Asia, 2006on Education, Delhi, 2003.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L20: Digital Image Processing

Teaching scheme **Credits:** 4

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*

Module I (16 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

R. Gonzalez and R. E. Woods, *Digital Image Processing*, 2nd ed., Pearson Education, Delhi, 2002.

Reference Books

1. A. K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall of India, New Delhi, 1988
2. A. Rosenfeld and A. C. Kak, *Digital Picture Processing*, 2nd ed., Academic Press, New York, 1997
3. W. K. Pratt, *Digital Image Processing*, 3rd ed., John Wiley & Sons, New York, 2001
4. Andrews A. C and Hunt B. R., *Digital Image Restoration*, Prentice Hall, New Jersey, 1997

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L21: Signal Compression

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

- *To impart thorough knowledge on the various algorithms for signal compression.*

Module 1 (14 hours)

Compression Techniques – Lossless and Lossy compression. Measures of Performance. Modeling and Coding Uniquely Decodable Codes. Prefix Codes Huffman Coding-Minimum Variance Huffman Codes. Application of Huffman Coding. Lossless Image Compression. Text compression. Arithmetic Coding. Generating a Tag. Deciphering a Tag. Uniqueness and Efficiency of the Arithmetic Code. Comparison of Huffman and Arithmetic coding. Applications. Bi-level Image Compression.

Module II (12 hours)

Dictionary Techniques – Introduction. Static Dictionary. The LZ77 Approach. The LZ78 Approach. File Compression–The Graphics Interchange Format–Predictive Coding. The Burrows-Wheeler Transform. CALIC. Run-Length Coding. Differential Encoding. The Basic Algorithm. Prediction in DPCM. Adaptive DPCM. Delta modulation.

Module III (14 hours)

Quantization – Introduction–Scalar quantization–Uniform Quantizer–Adaptive Quantization– Forward Adaptive Quantization–Backward Adaptive Quantization–Nonuniform Quantization–Vector Quantization. Advantages of Vector Quantization over Scalar Quantization. The Linde-Buzo-Gray Algorithm. Lattice Vector Quantizers

Module IV (14 hours)

Transform Coding – Introduction Karhunen – Loeve Transform. Discrete Cosine Transform. Discrete Walsh-Hadamard Transform. Quantization and Coding of Transform Coefficients. Application to Image Compression-JPEG. Subband Coding. Application to Audio-Mpeg

Text Book

1. K. Sayood, *Introduction to Data Compression*, 2nd ed., Morgan-Kaufmann Publishers, San Fransisco, CA, 2000.

Reference Books

1. T. M. Cover, J. A. Thomas, *Elements of Information Theory*, *John Wiley & Sons*, New York, 1991
2. D. Salomon, *Data Compression: The Complete Reference*, 2nd ed., Springer-Verlag, New York, 2000
3. K. M. Nelson, *Data Compression Book*, BPB Publishers, New Delhi, 1998

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L22: Nonlinear Control Systems

Teaching scheme **Credits:** 4

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*

Module I (14 hours)

Nonlinear systems-introduction-behaviour of nonlinear systems-jump resonance-limit cycles. Common physical nonlinearities-saturation-friction-backlash- dead zone-relay. Multivariable nonlinearities (definition), The phase-plane method-basic concepts-singular points-nodal point-saddle point-focus point-vortex point. Construction of phase trajectories-analytical method-graphical methods-isocline method, delta method, Example problems.

Module II (13 hours)

Describing function method-basic concepts, derivation of describing functions-dead zone and saturation, relay with dead-zone and hysterisis, 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 (13 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

1. J. Slotine and W. Li, *Applied Nonlinear Control*, Prentice Hall, Englewood Cliffs, 1991
2. I. J. Nagarath and M. Gopal, *Control system Engineering*, Wiley Eastern, New Delhi, 1995
3. H. Marquez, *Nonlinear Control Systems: Analysis and Design***,** John Wiley & Sons, New York, 2003

Reference Books

1. M. Vidyasagar, *Nonlinear Systems Analysis*, 2nd ed., Prentice Hall, Englewood Cliffs, 1993.
2. H. K. Khalil, *Nonlinear Systems,* 3rd ed., Prentice Hall, Englewood Cliffs, N.J., 2001.
3. W. E. Dixon, A. Behal, D.M. Dawson, and S. Nagarkatti, *Nonlinear Control of Engineering Systems: A Lyapunov-Based Approach*, Birkhäuser, Boston, 2003

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L23 Micro Electro Mechanical Systems

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

To introduce the following concepts to the students

- *manufacturing of a micro device from material selection to final product design*
- *the various materials used in microfabrication and their applications*
- *how basic engineering design can couple with practice manufacturing techniques for getting a MEMS device*
- *the changes in properties when the dimensions of the system are scaled*

Module I (12 hours)

MEMS and microsystems: MEMS and microsystem products – evaluation of microfabrication – microsystems and microelectronics – applications of microsystems – working principles of microsystems – microsensors – microactuators – MEMS and microactuators – microaccelerometers.

Scaling laws in miniaturization: Introduction – scaling in geometry – scaling in rigid body dynamics – the Trimmer force scaling vector – scaling in electrostatic forces, electromagnetic forces, scaling in electricity and fluidic dynamics, scaling in heat conducting and heat convection.

Module II (13 hours)

Materials for MEMS and microsystems: Substrates and wafers – Silicon as a substrate material, ideal substrates for MEMS – single crystal Silicon and wafers crystal structure – mechanical properties of Si – Silicon compounds – SiO_2, SiC, Si_3N_4 and polycrystalline Silicon – Silicon piezoresistors – Gallium arsenside, quartz – piezoelectric crystals – polymers for MEMS – conductive polymers.

Engineering mechanics for microsystems design: Introduction – static bending of thin plates – circular plates with edge fixed, rectangular plate with all edges fixed and square plates with all edges fixed. Mechanical vibration - resonant vibration – microaccelerometers – design theory and damping coefficients. Thermomechanics – thermal stresses. Fracture mechanics – stress intensity factors, fracture toughness and interfacial fracture mechanics.

Module III (16 hours)

Basics of fluid mechanics in macro and mesco scales: Viscosity of fluids – flow patterns Reynolds number. Basic equation in continuum fluid dynamics – laminar fluid flow in circular conduits – computational fluid dynamics – incompressible fluid flow in microconducts, surface tension, capillary effect and micropumping - Fluid flow in submicrometer and nanoscale – rarefield gas, Kundsen and Mach number and modelling of microgas flow – heat conduction in multilayered thin films – heat conduction in solids in submicrometer scale - Thermal conductivity of thin films - heat conduction equation for thin films.

Microsystem fabrication process: Photolithography – photoresist and applications – light sources. Ion implanation – diffusion process – oxidation – thermal oxidation – silicon diode – thermal oxidation rates – oxide thickness by colour - Chemical vapour deposition - principle – reactants in CVD – enhanced CVD physical vapour deposion – sputtering – deposition by epitaxy – etching – chemcial and plasma etching.

Module IV (13 hours)

Micromanufacturing and microsystem packaging: Bulk Micromachining - Isotropc And Danisotropic Etching, Wet etchants, etch stops, dry etching comparison of wet and dry etching - Surface micromachining, process in general – problems associated surface micromachining - The LIGA process – description – materials for substrates and photoresists – electroplating – The SLIGA process. Microsystem packaging - General considerations - The three levels of microsystem packaging – die level, device level and system level – essential packaging technologies – die preparation – surface bonding wire bonding and sealing - Three dimensional

packaging, assembly of microsytems – selection of packaging materials.

Text Book

1 Tai-Ran Hsu, *MEMS and Microsystems Design and Manufacture*, Tata McGraw Hill, New Delhi, 2002

Reference Books

1. Mark Madou, *Fundamentals of Microfabrication*, CRC Press, 1997.
2. J. W. Gardner, *Microsensors: Principles and Applications*
3. S. M. Sze, *Semiconductor Sensors*, McGraw Hill, New York, 1994
4. C. Y. Chang and S. M. Sze, *VLSI Technology*, 2000

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L24: Mobile Communications

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

Objective

To introduce the concepts of Mobile Communication Cellular environment

Module I (14 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 (16 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 managemnt – fixed channel assignment – non fixed channel assignment – traffic and channel assignment – why handoff - types of handoff and their characteristics – handoff analysis

Module IV(12 hours) Multiple access techniques

FDMA/TDMA – CDMA, FDM/TDM Cellular systems – cellular CDMA – soft capacity – Earlang capacity comparison of FDM/TDM systems and Cellular CDMA
GSM architecture – mobile management – network signalling – frequency allocation and control

Text Books

1. T.S.Rappaport, Wireless Communications : Principles and Practice, Second edition, PHI, 2003
2. G.L. Stuber, Principles of Mobile Communications, Kluwer Academic Press

Reference Books

3. Dr Kamilo Feher, Wireless and Digital Communications, PHI
4. R.Blake , Wireless Communication Technology, Thomas Delmar, 2003

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

AI09 L25: Probability and Random Processes

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

Objective

To impart knowledge on tools and skills in probability theory for solving engineering problems

Module I (12 hours) Introduction to Probability Theory
Experiments – sample spaces and Events – axioms of Probability – Assigning Probabilities – joint and conditional probabilities –Baye's thorem – independence - Dicrete random variables – Bernoulli – Binomial – poisson - Geometric

Module II (14 hours) Random Variables, Distributions and density functions
The Cumulative distribution function - Probability density function – gaussian Random variable – Uniform random variable – exponential –Laplace – gamma – erlang –Chi – squared –Rayleigh –Rician -Cauchy

Module III (14 hours) Operations on a single Random Variable
Expected value of a random variable - expected values of functions of random variable – Moments – central moments – conditional expected values – probability generating functions –Moment generating functions

Module IV (14 hours) Random Processes
Definition and classification of Processes – Mathematical tools for studying random processes – stationary and ergodic random processes – Properties of the Auto correlation function – gaussian random processes- Definition and examples of Markov Processes - calculating transition and state probabilities in Markov chains

Text Books

1 Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009
2 Jean Jacod, Philip Protter, Probability Essentials, Springer 2008

Reference Books

3. Peyton Z. Peebles, Probability, Random Variables and Random signal Principles, Tata McGraw – Hill Publishing Limited, New Delhi, 4TH Edition
4. X. Rong Li, Probability, Random Signals, and Statistics

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

IT09 L24: MANAGEMENT INFORMATION SYSTEMS

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

Objective
This course will introduce the methods and the influence of the information systems in management milieu and use MIS as an effective tool in management and decision making.

Module - I: (12 hours)
Information systems - functions of management - levels of management - framework for information systems - systems approach - systems concepts - systems and their environment - effects of system approach in information systems design - using systems approach in problem solving - strategic uses of information technology

Module - II: (10 hours)
An overview of computer hardware and software components - file and database management systems - introduction to network components - topologies and types - remote access - the reasons for managers to implement networks - distributed systems - the internet and office communications

Module - III: (14 hours)
Application of information systems to functional - tactical and strategic areas of management, decision support systems and expert systems

Module - IV: (16 hours)
Information systems planning - critical success factor - business system planning - ends/means analysis - organizing the information systems plan - systems analysis and design - alternative application development approaches - organization of data processing - security and ethical issues of information systems

Text Book

1. Robert Schultheis & Mary Sumner, *Management Information Systems-The Manager's View*, Tata McGraw Hill.

Reference Books

1. Laudon K.C. & Laudon J.P, *Management Information Systems - Organization and Technology*, Prentice Hall of India
2. Sadagopan S, *Management Information Systems*, Prentice Hall of India
3. Basandra S.K, *Management Information Systems*, Wheeler Publishing.
4. Alter S, *Information Systems: A Management Perspective*, Addison Wesley.
5. Effy Oz, *Management Information Systems*, Thomson, Vikas Publishing House.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

CH09 L23 NANOMATERIAL AND NANOTECHNOLOGY

Teaching scheme **Credits:** 4

3 hours lecture & 1 hour tutorial per week

Objectives

- *To impart the basic concepts of nanotechnology*
- *To develop understanding about application of nanomaterials.*

Module 1 (13 Hours)

Introduction to nanotechnology, nanoscale, electromagnetic spectrum, top down and bottom up approach, particle size, chemistry and physics of nanomaterials, electronic phenomenon in nanostructures, optical absorption in solids, quantum effects.

Module 2 (13 Hours)

Nanomaterials, preparation of nanomaterials like gold, silver, different types of nano-oxides, Al_2O_3, TiO_2, ZnO etc. Sol-gel methods, chemical vapour deposition, ball milling etc. Carbon nanotubes, preparation properties and applications like field emission displays. Different types of characterization techniques like SEM, AFM, TEM & STM.

Module 3 (13 Hours)

Nanocomposites, nanofillers, high performance materials, polymer nanocomposites, nanoclays, nanowires, nanotubes, nanoclusters etc. Smart materials, self assembly of materials, safety issues with nanoscale powders.

Module 4 (13 Hours)

Nanomanipulation, Micro and nanofabrication techniques, Photolithography, E-beam, FIB etc. Nanolithography., softlithography, photoresist materials. Introduction to MEMS, NEMS and nanoelectronics. Introduction to bionanotechnology and nanomedicines.

\

References:

1. Nanocomposite science and technology, Pulikel M. Ajayan, Wiley-VCH 2005
2. Nanolithography and patterning techniques in microelectronics, David G. Bucknall, Wood head publishing 2005
3. Transport in Nanostructures, D.K. Ferry and S.M. Goodmick, Cambridge university press 1997.
4. Optical properties of solids, F. Wooten, Academic press 1972
5. Micro and Nanofabrication, Zheng Cui, Springer 2005
6. Nanostructured materials, Jackie Y. Ying, Academic press 2001
7. Nanotechnology and nanoelectronics, W.R, Fahrner, Springer 2005
8. Nanoengineering of structural, functional and smart materials, Mark J. Schulz, Taylor & Francis 2006.
9. Hand book of Nanoscience, Engineering, and Technology, William A. Goddard, CRC press 2003.
10. Nanoelectronics and Information Technology, Rainer Waser, Wiley-VCH 2003.
11. The MEMS Handbook Frank Kreith, CRC press 2002.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

EE09 L24 MECHATRONICS

Teaching scheme **Credits:** 4
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.*

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 (13 hours)
System devices: System drives-hydraulic systems, DC motors, stepping motors, AC motors- Feedback devices-Encoders, pulse digitizers, resolvers, Inductosyn, tachometers.- Counting devices-Flip Flops, counters ,decoders, digital to analog converters. Interpolation- linear interpolator-circular interpolators, CNC software interpolator-Flow of data in NC machines.

Module III (13 hours)
NC Part programming: Manual Programming-Concepts-tape formats- tab sequential- fixed block word address and variable block formats- Part Programming examples-Point to point programming and simple contour programming- Computer aided programming- Concepts – Post processor programming languages- APT programming-Part programming examples.

Module IV (14 hours)
Industrial Robotics: Basic concepts- Robotics and automation- Specification of Robots- Resolution, Repeatability and accuracy of manipulator- Classification of Robots- Industrial application- Robot drives- Characteristics of end of arm tooling- Sensors-Tactile, proximity and range sensors- contact and non-contact sensors- velocity sensors- touch and slip sensors- Force and torque sensors- Programming- Lead through programming- Textual programming- Programming languages - On line and offline programming- Intelligent Robots.

References

1. Yoram Koren, *Computer Control of Manufacturing Systems*, McGrawHill
2. Michel P. Groover, *Industrial Robots-Technology, Programming and Applications*, McGrawHill
3. Fu K.S , Gonzales et al, *Robotics-Control, sensing, vision and intelligence*, McGrawHill.
4. Yoram Koren and Ben Yuri, *Numerical Control of machine tools*, Khanna Publishers.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

BM09 L23: Operations Research

Teaching scheme **Credits:** 4
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

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 (13 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 (14 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

1. H. Taha, *Operations Research: an introduction*, 8th Edition, 2007.
2. F. Hillier, *Introduction to Operations Research*, 7th. Ed. December, 2000. McGraw-Hill.
3. W. Winston, *Operations Research: Applications and Algorithms*, Duxbury Press, 2003.

Reference Book

Hilier and Liebermann, *Introduction to Operations Research*, McGraw-Hill, 2001

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

EC09 L023: Data Structures & Algorithms

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

Objectives

- *To give ideas of basic data structures*
- *To impart knowledge about algorithm specification*

Module I (14hours)
Study of basic data structures – Arrays- Structures-Sparse matrix – Stacks – Queues- Circular queues- Priority queues - Dqueues. Evaluation of expressions – Polynomial representation using arrays.

Module II (14 hours)
Linked Lists - Linked stacks and queues - Doubly linked lists - Polynomial representation using linked lists, Strings – Data representation – Pattern matching.

Module III (15 hours)
Trees - Binary Trees – Tree Traversal – Inorder - Preorder and Postorder, Graphs – Depth first and breadth first search. Sorting methods: Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Heap sort, Radix sort, External sorting methods (basic idea only).

Module IV (11 hours)
Principles of programming – System Life Cycle - Algorithm Specification-Recursive Algorithms- Documentation- Performance Analysis and Measurements- Time and Space complexity-Complexity calculation of simple algorithms.

Text Books

1. Classic Data Structures: Samanta, PHI
2. Data Structures and program design in C: Robert Kruse, Pearson Education Asia
3. An introduction to Data Structures with applications: Trembley & Sorenson, McGraw Hill

Reference Books

1. Fundamentals of Data Structures in C++: Horowitz, Sahni & Mehta, Galgottia Pub.
2. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum
3. Fundamental Algorithms: Knuth.
4. Algorithms + Data Structures & Programs: N.Wirth, PHI
5. Data structures in Java: Thomas Standish, Pearson Education Asia

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

EC09 L24: Electronic Packaging

Teaching scheme **Credits:** 4
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.

Module I (13 hours)
Introduction – role of packaging – IC packaging – MEMS packaging – consumer electronics packaging – medical electronics packaging – Trends – challenges
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 (10 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 (10 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

1. Tummala, Rao R., *Fundamentals of Microsystems Packaging*, McGraw Hill

Reference Books

1. Blackwell (Ed), *The electronic packaging handbook*, CRC Press
2. Tummala, Rao R, *Microelectronics packaging handbook*, McGraw Hill
3. Bosshart, *Printed Circuit BoardsDesign and Technology*,TataMcGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

CS09 L24: Computer Based Numerical Methods

Teaching scheme **Credits:** 4
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.*

Module I (13 hours)
Errors in numerical computation - mathematical preliminaries - errors and their analysis - machine computations - computer software. Algebraic and Transcendental Equations - bisection method - iteration method - method of false position - rate of convergence - method for complex root - Muller's method - quotient difference method - Newton-Raphson method.

Module II (13 hours)
Interpolation – introduction - errors in polynomial interpolation - finite differences - decision of errors - Newton's formula for interpolation. Gauss, Sterling, Bessel's, Everett's Formula - interpolation by unevenly spaced points - Lagrange interpolation formula - divided difference - Newton's general interpolation formula.

Module III (13 hours)
Numerical Integration and Differentiation – introduction - numerical differentiation - numerical integration - trapezoidal rule - Simpson 1/3 rule - Simpson 3/8 rule - Boole's and Weddle's rules - Euler-Maclariaun formula - Gaussian formula - numerical evaluation of singular integrals.

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

1. E. Balagurusamy, *Numerical Methods*, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.
2. C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis, 6th Ed.*, Pearson Education Asia, New Delhi, 2002.

Reference Books

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, *Numerical Methods*, S.Chand Co. Ltd., New Delhi, 2003.
2. R.L. Burden and T.D. Faires, *Numerical Analysis, 7th Ed.*, Thomson Asia Pvt. Ltd., Singapore, 2002.
3. Shastri, *Introductory methods of numerical analysis*, Prentice Hall International.
4. V. Rajaraman, *Introduction to Numerical Methods*, Tata McGraw Hill.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

CS09 L25: Pattern Recognition

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

Objectives

- *To impart a basic knowledge on pattern recognition and to give a sound idea on the topics of parameter estimation and supervised learning, linear discriminant functions and syntactic approach to PR.*
- *To provide a strong foundation to students to understand and design pattern recognition systems.*

Module I (12 hours)
Introduction - introduction to statistical - syntactic and descriptive approaches - features and feature extraction - learning - Bayes Decision theory - introduction - continuous case - 2-category classification - minimum error rate classification - classifiers - discriminant functions - and decision surfaces - error probabilities and integrals - normal density - discriminant functions for normal density

Module II (12 hours)
Parameter estimation and supervised learning - maximum likelihood estimation - the Bayes classifier - learning the mean of a normal density - general bayesian learning - nonparametric technic - density estimation - parzen windows - k-nearest neighbour estimation - estimation of posterior probabilities - nearest-neighbour rule - k-nearest neighbour rule

Module III (12 hours)
Linear discriminant functions - linear discriminant functions and decision surfaces - generalised linear discriminant functions - 2-category linearly separable case - non-separable behaviour - linear programming procedures - clustering - data description and clustering - similarity measures - criterion functions for clustering

Module IV (16 hours)
Syntactic approach to PR - introduction to pattern grammars and languages - higher dimensional grammars - tree, graph, web, plex, and shape grammars - stochastic grammars - attribute grammars - parsing techniques - grammatical inference

Text Books
1. Duda & Hart P.E, *Pattern Classification And Scene Analysis*, John Wiley
2. Gonzalez R.C. & Thomson M.G., *Syntactic Pattern Recognition - An Introduction*, Addison Wesley.

Reference Books
1. Fu K.S., *Syntactic Pattern Recognition And Applications*, Prentice Hall, Eaglewood cliffs
2. Rajjan Shinghal, *Pattern Recognition: Techniques and Applications*, Oxford University Press, 2008.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

CE09 L24: REMOTE SENSING AND GIS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

To make the students aware of the technological developments in the geographical database management and its advantages

Module I (14 Hours)

Remote sensing: definition – components of remote sensing- energy sensor, interacting body – active and passive remote sensing – platforms – arial and space platforms – balloons ,helicopters, aircrafts and satellites – synoptivity and repeativity – electromagnetic radiation (EMR) – EMR spectrum – visible, infrared (IR) near IR, middle IR, thermal IR and microwave – black body radiation – Plancks Law – Stefan –Boltzman law.

Atmospheric characteristics – scattering of EMR – Raliegh, Mie, Non-selective and Raman scattering – EMR interaction with water vapur and ozone – atmospheric windows – significance of atmospheric windows – EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy – reflectance – specular and diffused reflection surfaces – spectral signature – spectral signature curves – EMR interaction with water, soil and earth surface.

Module II (14 Hours)

Opticaa and Microwave Remote sensing:

Satellites – classification – based on orbits – sun synchronous and geo synchronous – based on purpose – earth resources satellites , communication satellites, weather satellites, spy satellites – satellite sensors – resolution – spectral, spatial, radiometric and temporal resolution – description of multi-spectral scanning – along and across track scanners- description of sensors in IRS series – current satellites – radar – speckle – back scattering- side looking air borne radar – synthetic aperture radar – radiometer radar – geometrical characteristics. Principles of thermal remote sensing. Principles of microwave remote sensing.

Module III (13 Hours)

Geographic information system – components of GIS – hardware, software and organisational context – data – spatial and non spatial maps – types of maps – projection- types of projection – data input-digitiser, scanner, editing – raster and vector data structures – comparison of raster and vector data structure – analysis using raster and vector data – retrieval, reclassification, overlaying, buffering - data output – printers and plotters.

Module IV (13 Hours)

Miscellaneous topics: interpretation of satellite images- elements of interpretation – visual interpretation – digital image processing techniques – image enhancement – filtering – image classification – FCC composites - supervised and unsupervised integration of GIS and remote sensing –application of remote sensing and GIS – urban applications – water resources – urban analysis – watershed management – resources information system – hazard mitigation.

Text books:

1. Anji Reddy, Remote sensing and Geographical systems, BS Publications
2. M G Srinivas (Edited by), remote sensing applications, Nerusa publishing house
3. Lillesand T M and Kuefer R W., Remote sensing and image interpretation, John Wiley and sons
4. Jensan J R, Introductory digital image processing, Prentice Hall of India
5. Sabins, Flyod, F., Remote sensing principles and Interpretation, W H Freman and Co., NewYork

References:

1. Janza F J, Blue H M and Johnston, J E., Manual of remote sensing vol. I., American Society of Photogrammetry, 1975
2. Burrough P A., Principles of GIS for land resource assessment, Oxford
3. Star Jeffrey L (Ed), Ests Joh E and McGwire Kenneth, Integration of geographical systems and remote sensing, Cambridge university.
4. De Merse, Michael N., Fundamentals of geographic information system, 2nd edn., John Wiley and sons.

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

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

Maximum Total Marks: 70

ME09 L25: ENERGY ENGINEERING AND MANAGEMENT

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

Objectives

- *To provide knowledge on energy conservation and management.*
- *To impart the basics of renewable energy technology*

Pre-requsites: *Nil*

Module I (13 hours)
Energy and environment: Introduction – fossil fuel reserves – world energy consumption – green house effect – global warming – renewable energy sources – environmental aspects utilization – energy prices – energy policies

Module II (14 hours)
Energy conservation: Industrial energy use – energy surveying and auditing – energy index – energy cost – energy conservation in engineering and process industry, in thermal systems, in buildings and non conventional energy resources schemes.

Module III (14 hours)
Energy technologies: Fluidized bed combustion – fluidized bed boilers – waste heat recovery systems – heat pump and refrigerators – wind energy collectors and storage systems – insulated pipe work systems.

Module IV (13 hours)
Energy management: Energy management principles – energy resources management – energy management information systems – computerized energy management. Costing techniques – cost optimization – optimal target investment schedule – financial appraisal and profitability.

Text Books

1. W. R. Murphy, G. Mc Kay, *Energy Management*, Butterworths, London

Reference Books

1. O. Callaghn, *Design and Management for energy conservation*, Pergamon Press, Oxford
2. D. Merick, *Energy - Present and Future Options*, vol 1 and 2, John Wiley and Sons
3. N. A. Chaigier, *Energy Consumption and Environment*, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

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% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70