FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Year 2019-2020)

and

Common Courses Syllabi

M.E. I to IV Semester

of

Two Year Post Graduate Degree Programme

(With effect from the academic year 2019– 2020)
(As approved in the faculty meeting held on 25-06-2019)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

2019

List of Common Courses offered for M.E./M.Tech

S. No.	Course Code	Course Title
List of Mandatory Courses		
1	MC5121ME	Research Methodology & IPR
List of Open Electives		
1	OE9101CE	Cost Management of Engineering Projects
2	OE9102CS	Business Analytics
3	OE9103EC	Embedded System Design
4	OE9104EE	Waste to Energy
5	OE9105ME	Industrial Safety
List of subjects of Audit Course-I		
1	AD 9001 HS	English for Research Paper Writing
2	AD 9002 CE	Disaster Management
3	AD 9003 HS	Sanskrit for Technical Knowledge
4	AD 9004 HS	Value Education
List of subjects of Audit Course-II		
5	AD 9011 HS	Constitution of India and Fundamental Rights
6	AD 9012 HS	Pedagogy Studies
7	AD 9013 HS	Stress Management by Yoga
8	AD 9014 HS	Personality Development through life Enlightenment Skills

Course Code	Course Title						Core/Elective
MC 5121ME	Research Methodology and IPR						Mandatory Course
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

To make the students to

- Motivate to choose research as career
- Formulate the research problem, prepare the research design
- Identify various sources for literature review and data collection report writing
- Equip with good methods to analyze the collected data
- Know about IPR copyrights

Course Outcomes:

At the end of the course a student will be able to

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT - I

Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT - II

Literature Survey and Report writing: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Need of Review, Guidelines for Review, Record of Research Review.

Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanism of writing a report. **Research Proposal Preparation**: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

UNIT - III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV

Data Collection and Analysis: Methods of data collection, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data. Importance of Parametric, non parametric test, testing of variance of two normal populations, use of Chi-square, ANOVA, F-test, z-test

UNIT - V

Intellectual Property Rights: Meaning, Nature, Classification and protection of Intellectual Property, The main forms of Intellectual Property, Concept of Patent, Patent document, Invention protection, Granting of patent, Rights of a patent, Licensing, Transfer of technology.

Suggested Reading:

1. C.R Kothari, Research Methodology, Methods & Technique□; New Age International Publishers, 2004
2. R. Ganesan, Research Methodology for Engineers□, MJP Publishers, 2011
3. Y.P. Agarwal, Statistical Methods: Concepts, Application and Computation□, Sterling Publs., Pvt., Ltd., New Delhi, 2004
4. Dr. G.B. Reddy, Intellectual Property Rights and the Law 5th Ed. 2005 GogiaLaw Agency
5. Ajit Parulekar and Sarita D‘ Souza, ―Indian Patents Law – Legal & Business Implications□; Macmillan India Ltd , 2006

Course Code	Course Title						Core/Elective
OE 9101 CE	**Cost Management of Engineering Projects**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Obj1
- Obj2

Course Outcomes

1. Students should beable to learn the cost concepts in decision making
2. Student should be able to do cost planning and Marginal Costing
3. Students should be able to create a database for operational control and decision making.

UNIT-I

Introduction and Overview of the Strategic Cost Management Process: Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT-II

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

UNIT-III

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis.

Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

UNIT-IV

Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT-V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Suggested Readings:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting

Course Code	Course Title						Core/Elective
OE 9102 CS	**Business Analytics**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Understand the role of business analytics within an organization
- Analyse data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making
- To become familiar with processes needed to develop, report, and analyse business data
- Use decision-making tools/Operations research techniques
- Mange business process using analytical and management tools
- Analyse and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.
- Student will able to understand the basic rules of research formulation and procedure for obtaining patent rights

Course Outcomes

1. Students will demonstrate knowledge of data analytics
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modelling to support business decision-making
4. Students will demonstrate the ability to translate data into clear, actionable insights

UNIT-I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT-II

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression.Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT-III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without 8 Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent Trends in Embedded and collaborative business intelligence, Visual data 4 recovery, Data Storytelling and Data journalism.

Suggested Readings:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

Course Code	Course Title						Core/Elective
OE 9103 EC	**Embedded System Design**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Detailed overview of important concepts of Embedded system
- Analyze PIC microcontroller, its features and programming
- Describe ARM Microcontroller architectural details and instruction set
- Understand ARM Memory management
- Learn the techniques to develop an embedded system and case studies

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT - I

Introduction to Embedded Systems: Overview of Embedded System Architecture,Challenges & Trends of Embedded Systems, Hardware Architecture, Software Architecture. Application areas of Embedded Systems and Categories of Embedded Systems. Embedded System Design and Co-Design issues and Design Cycle Process

UNIT - II

PIC 18: Family Overview, Architecture, Instruction Set, Addressing modes. Timers,interrupts of PIC 18, Capture/Compare and PWM modules of PIC 18

UNIT - III

ARM Architecture: ARM Design Philosophy, Registers, Program Status Register,Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

UNIT - IV

ARM Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instruction Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions. Exception and interrupt handling.

ARM Memory Management: Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation Access Permissions, Context Switch.

UNIT - V

Embedded Software Development Tools, Host and Target Machines, Linkers/Locators for Embedded Software, Getting Embedded Software into the Target System. Debugging Techniques.

Case Studies: Design of Embedded Systems using Microcontrollers–for applications in the area of communications and automotives. (GSM/GPRS, CAN, Zigbee)

Suggested Reading:

1. Raj Kamal, *Embedded Systems–Architecture, Programming and Design*, 2nd Edition, TMH, 2008.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, *ARM Systems Developer's Guides – Designing & Optimizing System Software*, Elsevier, 2008.
3. Mazidi, MCKinlay and Danny Causey, *PIC Microcontrollers and Embedded Systems*, Pearson Education, 2007
4. David.E.Simon, *An Embedded Software Primer,* 1st Edition, Pearson Education, 1999
5. Jonathan W. Valvano, *Embedded Microcomputer Systems, Real Time Interfacing*, Thomas Learning, 1999.

Course Code	Course Title						Core/Elective
OE 9104 EE	**Waste to Energy**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To enable students to aware about the generation of energy from the waste.

Course Outcomes

1. Students should able to learn the Classification of waste as a fuel.
2. Students should able to learn the Manufacture of charcoal.
3. Students should able to carry out the designing of gasifiers and biomass stoves.
4. Student should able to learn the Biogas plant technology.

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors. Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-II

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-III

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-IV

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction.

Unit - V

Biochemical conversion Anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Suggested Readings:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata
3. McGraw Hill Publishing Co. Ltd., 1983.
4. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
5. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course Code	Course Title						Core/Elective
OE 9105 ME	**Industrial Safety**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Objectives:

The students will be able to understand

- Causes for industrial accidents and preventive steps to be taken.
- Fundamental concepts of Maintenance Engineering.
- About wear and corrosion along with preventive steps to be taken
- The basic concepts and importance of fault tracing.
- The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry

Outcomes:

At the end of the course the students will be able to

1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc

UNIT-I

Industrial Safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc., Safety colour codes. Fire prevention and fire fighting, equipment and methods.

UNIT-II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods

UNIT-IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine

tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Suggested Readings:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

Course Code	Course Title						Core/Elective
AD 9001 HS	**English for Research Paper Writing**						**Audit I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Objectives

The Course will introduce the students to

- Understand the nuances of language and vocabulary in writing a Research Paper.
- Develop the content, structure and format of writing a research paper.
- Produce original research papers without plagiarism

Course Outcomes

After successful completion of the course, the students will be able to

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT - I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits, Limitations – outcomes.

UNIT - II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings, Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT - III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT - IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

UNIT - V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Suggested Reading:

1. C. R Kothari, Gaurav, Garg, ‑Research Methodology Methods and Techniques□, 4/e, New Age International Publishers.
2. Day R, ‑How to Write and Publish a Scientific Paper**",** Cambridge University Press, 2006
3. MLA Hand book for writers of Research Papers□, 7/e, East West Press Pvt. Ltd, New Delhi
4. Lauri Rozakis, Schaum‘s, Quick Guide to Writing Great Research Papers□, Tata McGraw Hills Pvt. Ltd, New Delhi.

Course Code	Course Title						Core/Elective
AD 9002 CE	**Disaster Management**						**Audit I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

- To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
- To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
- To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.

Course Outcomes

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction
2. and humanitarian response.
3. Critically evaluate disaster risk reduction and humanitarian response policy and Practice from multiple perspectives.
4. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
5. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in**.**

UNIT-I

Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT-II

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III

Disasters Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

UNIT-IV

Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-V

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning,

People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Suggested Readings:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal Book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep& Deep Publication Pvt. Ltd., New Delhi.

Course Code	Course Title						Core/Elective
AD 9003 HS	**Sanskrit for Technical Knowledge**						**Audit I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
- To explore the huge knowledge from ancient Indian literature

Outcomes: At the end of the course the students are able to

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT-I

Introduction to Sanskrit Language: Sanskrit Alphabets-vowels-consonants- significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic Sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).

The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):

Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower-Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures, Chemical laboratory location and layout-equipment-distillation vessel-kosthi yanthram

Suggested Reading:

1. M Krishnamachariar, –History of Classical Sanskrit Literature□, TTD Press, 1937.
2. M.R. Kale, –A Higher Sanskrit Grammar: For the Use of School and College Students□, Motilal Banarsidass Publishers, ISBN 13: 978-8120801783,2015
3. Kapail Kapoor, –Language, Linguistics and Literature: The Indian Perspective□, ISBN- 10: 8171880649, 1994.
4. –Pride of India□, Samskrita Bharati Publisher, ISBN: 81-87276 27-4, 2007
5. Shri RamaVerma, –Vedas the source of ultimate science□, Nag publishers, ISBN:81-7081 618-1, 2005

Course Code	Course Title						Core/Elective
AD 9004 HS	**Value Education**						**Audit I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Objectives

This course aims to:

- Understand the need and importance of Values for self-development and for National development.
- Imbibe good human values and Morals
- Cultivate individual and National character.

Course Outcomes

After completion of the Course, students will be able to:

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books: Self-management and Good health; internal & external cleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasic gunas.

Suggested Reading:

1. Chakroborty, S.K. -Values & Ethics for organizations Theory and practice□, Oxford University Press, New Delhi, 1998.
2. Jaya Dayal Goyandaka, ―Srimad Bhagavad Gita with Sanskrit Text, Word Meaning and Prose Meaning□, Gita Press, Gorakhpur, 2017.

Course Code	Course Title						Core/Elective
AD 9011HS	**Constitution of India and Fundamental Rights**						**Audit II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

Course Outcomes

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

UNIT-I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions.

UNIT-III

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayat raj: Introduction, PRI: Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-IV

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Code	Course Title						Core/Elective
AD 9012 HS	**Pedagogy Studies**						**Audit II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Objectives

- To present the basic concepts of design and policies of pedagogy studies.
- To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
- To familiarize various theories of learning and their connection to teaching practice.
- To create awareness about the practices followed by DFID, other agencies and other researchers.
- To provide understanding of critical evidence gaps that guides the professional development

Course Outcomes

Upon completing this course, students will be able to:

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions, Overview of methodology and Searching.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers‘attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Suggested Reading:

1. Ackers J, Hardman F, ―Classroom Interaction in Kenyan Primary Schools, Compare□, 31 (2): 245 – 261, 2001.
2. Agarwal M, -Curricular Reform in Schools: The importance of evaluation□, Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

3. Akyeampong K, –Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)□, Country Report 1.London: DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, –Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33 (3): 272- 282, 2013.
5. Alexander R J, –Culture and Pedagogy: International Comparisons in Primary Education□, Oxford and Boston: Blackwell, 2001.
6. Chavan M, ―Read India: A mass scale, rapid, _learning to read' campaign□, 2003.

Course Code	Course Title						Core/Elective
AD 9013 HS	**Stress Management by Yoga**						**Audit II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Objectives

The Course will introduce the students to

- Creating awareness about different types of stress and the role of yoga in the management of stress.
- Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
- Prevention of stress related health problems by yoga practice.

Course Outcomes

After successful completion of the course, the students will be able to

1. Understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

UNIT - I

Meaning and Definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT - II

Meaning and Definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT - III

Concept of Stress According to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress

UNIT - IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar.

UNIT - V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation Techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Suggested Reading:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Rajayoga or Conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.
3. Nagendra H.R nad Nagaratna R, –Yoga Perspective in Stress Management□, Swami Vivekananda Yoga Prakashan, Bangalore,

Course Code	Course Title						Core/Elective
AD 9014 HS	**Personality Development Through Life Enlightenment Skills**						**Audit II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Objectives:

The Course will introduce the students to

- Learn to achieve the highest goal happily.
- Become a person with stable mind, pleasing personality and determination.
- Awaken wisdom among them.

Outcomes:

After successful completion of the course, the students will be able to

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. Practice emotional self regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT - I

Neetisatakam – Holistic Development of Personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT - II

Neetisatakam – Holistic Development of Personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT - III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagavadgeetha: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 –Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT - IV

Statements of Basic Knowledge - Shrimad Bhagavadgeetha: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT - V

Role of Bhagavadgeetha in the Present Scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Suggested Reading:

1. Srimad Bhagavad Gita , Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) , P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Online Resources: NTPEL: http://nptel.ac.in/downloads/109104115/

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Year 2019-2020)

and

Syllabus

M.E. I to IV Semester

of

Two Year Post Graduate Degree Programme

in

Electronics and Communication Engineering
Specialization in Digital Systems

(With effect from the academic year 2019– 2020)
(As approved in the faculty meeting held on 25-06-2019)

Issued by

Dean, Faculty of Engineering
Osmania University, Hyderabad – 500 007
2019

SCHEME OF INSTRUCTION & EXAMINATION
M.E. (Electronics and Communication Engineering) – I Semester
Specialization in Digital Systems

S. No.	Course Type/Code	Course Name	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	Core	Program Core – I	3	1	-	4	30	70	3	4
2	Core	Program Core – II	3	-	-	3	30	70	3	3
3	Elective	Professional Elective – I	3	-	-	3	30	70	3	3
4	Elective	Professional Elective – II	3	-	-	3	30	70	3	3
5	MC or OE	MLC/Open Elective	3	-	-	3	30	70	3	3
6	Audit	Audit Course – I	2	-	-	2	30	70	3	0
Practical/ Laboratory Courses										
7	Lab	Laboratory – I	-	-	2	2	25	50	3	1
8	Lab	Laboratory – II	-	-	2	2	25	50	3	1
		Total	**17**	**01**	**04**	**21**	**230**	**520**		**18**

PC: Program Core **PE:** Professional Elective **OE**: Open Elective **AD**: Audit Course
MC: Mandatory Course **HS**: Humanities and social science

L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note:
1. Each contact hour is a Clock Hour.
2. The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.
3. ** Open Elective Subject is not offered to the students of ECE Department.

SCHEME OF INSTRUCTION & EXAMINATION
M.E. (Electronics and Communication Engineering) – II Semester
Specialization in Digital Systems

S. No.	Course Type/Code	Course Name	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	Core	Program Core – III	3	1	-	4	30	70	3	4
2	Core	Program Core – IV	3	1	-	3	30	70	3	4
3	Elective	Professional Elective – III	3	-	-	3	30	70	3	3
4	MC or OE	Open Elective/MLC	3	-	-	3	30	70	3	3
5	Audit	Audit Course – II	2	-	-	2	30	70	3	0
Practical/ Laboratory Courses										
6	Lab	Laboratory – III	-	-	2	2	25	50	3	1
7	Lab	Laboratory – IV	-	-	2	2	25	50	3	1
8		Mini Project with Seminar	-	-	4	4	25	50	3	2
		Total	**14**	**02**	**08**	**24**	**300**	**450**		**18**

PC: Program Core **PE:** Professional Elective **OE**: Open Elective **AD**: Audit Course
MC: Mandatory Course **HS**: Humanities and social science

L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note:
1. Each contact hour is a Clock Hour.
2. The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.
3. ** Open Elective Subject is not offered to the students of ECE Department.

SCHEME OF INSTRUCTION & EXAMINATION
M.E. (Electronics and Communication Engineering) – III Semester
Specialization in Digital Systems

S. No.	Course Type/Code	Course Name	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	Elective	Professional Elective – IV	3	-	-	3	30	70	3	3
2	Elective	Professional Elective – V	3	-	-	3	30	70	3	3
3		Major Project Phase – I	-	-	20	20	100	-	3	10
		Total	**06**	**-**	**20**	**26**	**160**	**140**		**16**

M.E. (Electronics and Communication Engineering) – IV Semester
Specialization in Digital Systems

S. No.	Course Type/Code	Course Name	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1		Major Project Phase – II (Dissertation)	-	-	32	32	-	200	3	16
		Total	**-**	**-**	**32**	**32**	**-**	**200**		**16**

PC: Program Core **PE:** Professional Elective **OE**: Open Elective **AD**: Audit Course
MC: Mandatory Course **HS**: Humanities and social science

L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note:

1. Each contact hour is a Clock Hour
2. The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.
3. ** Open Elective Subject is not offered to the students of ECE Department.
4. The students who are willing to register for MOOCs in the M.E. (ECE) III – semester instead of Professional Electives – IV & V, should register for those of the courses, approved by the CBoS, OU and respective college MOOCs Coordinator. Those students are strictly not permitted to appear for either CIE or SEE of Professional Electives – IV & V if they abstain from attending the semester class work. Further, for students willing to appear for both MOOCS and Professional Electives, they should fulfil the minimum attendance criteria.

List of subjects of Professional Core

S. No.	Course Code	Course Title
1	PC 3101DS	Micro Controllers for Embedded System Design
2	PC 3102 DS	Digital Systems Design
3	PC 3103 DS	VLSI Design & Technology
4	PC 3104 DS	Digital Signal Processors

List of subjects of Professional Electives I to V

S. No.	Course Code	Course Title
1	PE 3116DS	SoC Design
2	PE 3117DS	Wireless Mobile Communication
3	PE 3118DS	Advanced Digital Design with Verilog HDL
4	PE 3119DS	Image and Video Processing
5	PE 3120DS	Global and Regional Navigational Satellite Systems
6	PE 3121DS	Analog IC Design
7	PE 3122DS	Speech Signal Processing
8	PE 3123DS	Advanced Computer Organization
9	PE 3124DS	Modern Digital Communication Systems
10	PE 3125DS	Optical Fibre Communication Systems
11	PE 3126DS	Wireless Channel Coding Techniques
12	PE 3127DS	GNSS Signals & Receiver Technology
13	PE 3128DS	Advanced Computer Networks
14	PE 3129DS	Mobile Adhoc and Sensor Networks
15	PE 3130DS	Multimedia Information systems

List of Mandatory Courses

S. No.	Course Code	Course Title
1	MC 5121ME	Research Methodology & IPR

List of Open Electives

S. No.	Course Code	Course Title
1	OE9101CE	Cost Management of Engineering Projects
2	OE9102CS	Business Analytics
3	OE9103EC**	Embedded System Design
4	OE9104EE	Waste to Energy
5	OE9105ME	Industrial Safety

Note: ** Open Elective Subject is not offered to the students of ECE Department.

List of subjects of Audit Course-I

S. No.	Course Code	Course Title
1	AD 9001 HS	English for Research Paper Writing
2	AD 9002 CE	Disaster Management
3	AD 9003 HS	Sanskrit for Technical Knowledge
4	AD 9004 HS	Value Education

List of subjects of Audit Course-II

S. No.	Course Code	Course Title
5	AD 9005 HS	Constitution of India and Fundamental Rights
6	AD 9006 HS	Pedagogy Studies
7	AD 9007 HS	Stress Management by Yoga
8	AD 9008 HS	Personality Development through life Enlightenment Skills

Course Code	Course Title						Core/Elective
PC 3101 DS	**Microcontrollers for Embedded System Design**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

- Detailed overview of important concepts of Embedded system
- Analyze PIC microcontroller, its features and programming
- Describe ARM Microcontroller architectural details and instruction set
- Understand ARM Memory management
- Learn the techniques to develop an embedded system and case studies

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Introduction to Embedded Systems: Overview of Embedded System Architecture,Challenges & Trends of Embedded Systems, Hardware Architecture, Software Architecture. Application areas of Embedded Systems and Categories of Embedded Systems. Embedded System Design and Co-Design issues and Design Cycle Process

UNIT II

PIC 18: Family Overview, Architecture, Instruction Set, Addressing modes. Timers,interrupts of PIC 18, Capture/Compare and PWM modules of PIC 18

UNIT III

ARM Architecture: ARM Design Philosophy, Registers, Program Status Register,Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

UNIT IV

ARM Thumb Instruction Set: Register Usage, Other Branch Instructions, DataProcessing Instruction Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions. Exception and interrupt handling.

ARM Memory Management: Cache Architecture, Polices, Flushing and Caches, MMU, PageTables, Translation Access Permissions, Context Switch.

UNIT V

Embedded Software Development Tools, Host and Target Machines, Linkers/Locators forEmbedded Software, Getting Embedded Software into the Target System. Debugging Techniques.

Case Studies: Design of Embedded Systems using Microcontrollers–for applications in the area ofcommunications and automotives. (GSM/GPRS, CAN, Zigbee)

Suggested Reading:

6. Raj Kamal, *Embedded Systems–Architecture, Programming and Design*, 2nd Edition, TMH, 2008.
7. Andrew N. Sloss, Dominic Symes, Chris Wright, *ARM Systems Developer's Guides – Designing & Optimizing System Software*, Elsevier, 2008.
8. Mazidi, MCKinlay and Danny Causey, *PIC Microcontrollers and Embedded Systems*, Pearson Education, 2007
9. David.E.Simon, *An Embedded Software Primer,* 1st Edition, Pearson Education, 1999
10. Jonathan W. Valvano, *Embedded Microcomputer Systems, Real Time Interfacing*, Thomas Learning, 1999.

Course Code	Course Title						Core/Elective
PC 3102 DS	**Digital System Design**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

- Design combinational logic circuits using PLDs and model sequential circuits as finite state machines
- Synthesize synchronous sequential circuits and fundamental mode asynchronoussequential circuits
- Realize digital systems in terms of State Machines (SM) charts
- Model logical faults for combinational circuits using conventional test generation methods
- Learn basic fault diagnosis algorithms in sequential circuits

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Digital Design: Top-Down Modular Combination Logic Design, Combinational circuit Design with Programmable logic Devices (PLDs).

Sequential circuits design: state table, state diagrams. Latches and Flip-Flops- excitation table, characteristic equations - Mealy, Moore models and Sequence detector

UNIT II

Minimization and Transformation of Sequential Machines: The Finite State Model – Capabilities and limitations of FSM – State equivalence and machine minimization – Simplification of incompletely specified machines.

Fundamental mode model – Flow table, State reduction, Minimal closed covers – Races, Cycles and Hazards.

UNIT III

State Machine Charts: State machine charts, Derivation of SM Charts - Implementation of Binary Multiplier, Realization of SM Chart- Robot controller and Coin operated candy machine design.

UNIT IV

Fault Modeling & Test Pattern Generation: Logic Fault model in combinational circuits – Fault detection and Redundancy, Fault equivalence and fault location, Fault dominance, Single stuck at fault model.

Fault diagnosis of combinational circuits by conventional methods – Path sensitization techniques, Boolean Difference method, and D algorithm. Test generation - Random testing, Transition count testing and Signature analysis.

UNIT V

Fault Diagnosis in Sequential Circuits: Circuit Test Approach, Transition Check Approach – State identification and fault detection experiment, Machine identification, Design of Fault detection experiment.

Suggested Reading:

1. John F. Wakerly, *Digital Design, Principle and Practices*, 3rd Edition, Pearson Education, 2003.
2. CD Victor, P. Nelson, H Troy Nagle, Bill D. Carrol and J David Irwin. *Digital Logic CircuitAnalysis and Design*, PHI, 1996.
3. Charles H. Roth, *Fundamentals of Logic Design*, 5th edition, Cengage Learning 2010.
4. Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, *Digital Systems Testing andTestable Design*, John Wiley & Sons Inc 1990.
5. Parag.K.Lala, *Fault Tolerant and Fault Testable Hardware Design*, BS Publications, 2007.
6. Biswas N.N. *Logic Design Theory*, PHI, 2001.
7. Zvi Kohavi, S*witching and Finite Automata Theory*, TMH, 2001.

Course Code	Course Title						Core/Elective
PC 3103 DS	**VLSI Design and Technology**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

- Study of the structure and operation of MOS transistor, CMOS Inverter Design, Bipolar Inverter
- Design of Combinational logic gates in CMOS and design of Sequential Logic circuits
- Demonstrate Lambda based design rules, designing layouts and strategies for building Low power gates
- Learn Data path design and study of Semiconductor Memory Design
- Design of resistive Interconnect, inductive Interconnect and Interconnect coupling capacitance

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Transistors and Devices MOS and Bipolar: Introduction, the MOS Transistor structure andoperation, Threshold voltage, first order I-V characteristics, velocity saturated current equation, Sub threshold conduction, Capacitance of MOS transistor, MOS Inverter Circuits: Introduction, Voltage Transfer characteristics, Complementary MOS (CMOS) Inverters Design. BiCMOS Inverter.

UNIT II

Designing Combinational Logic Gates in CMOS: Introduction, Static CMOS Design, transmissiongate logic and Dynamic CMOS Design

Designing Sequential Logic circuits: Introduction, Static Latches and Registers, Dynamic Latchesand Registers

UNIT III

High Speed CMOS Logic Design: Switching Time Analysis, Detailed Load CapacitanceCalculation, Improving Delay Calculation with input slope, Gate sizing for optimal Path Delay, Optimizing Paths with logical effort. Scaling of MOS Transistors, Design Rules, Stick diagram and Layout Design

UNIT IV

Data path Design: Adder, Multiplier, Barrel Shifter and Logarithmic shifter.

Semiconductor Memory Design: Introduction, core memory, MOS Decoder, Static RAM cellDesign, Memory Architecture Content-Addressable Memories (CAM).

UNIT V

Interconnect Design: Introduction, Interconnect RC Delays, Buffer Insertion very long wires,Interconnect coupling capacitance: Components of Coupling capacitance, coupling effects on Delay, Crosstalk, and Interconnect Inductance.

Suggested Reading:

1. David A Hodges, Horace G Jackson Resve A Saleg Analysis *and Design of DigitalIntegrated circuits*, McGraw Hill Companies 3rdedition, 2006.

2. Jan M Rabaey, A Chandrakasan, Borvioje N, *Digital Integrated Circuits DesignPerspective*, 2nd edition, PHI, 2005.
3. Wayne Wolf, *Modern VLSI Design*, 3rd edition, Pearson Education, 1997.
4. Neil H E Weste Kamran Eshraghian, *Principles of CMOS VLSI Design a systemperspective*, 3rd edition, Pearson, 2005.
5. K. Eshraghian , A. Pucknell, *Essentials of VLSI Circuits and Systems*, PHI, 2005.

Course Code	Course Title						Core/Elective
PC 3104 DS	**Digital Signal Processors**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Analyse and synthesize signals
- Compute errors caused by conversion
- Describe functional blocks of DSP processor and their use
- Understand processors with examples
- Design various interfacing devices with processor

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Introduction to Digital Signal Processing: A Digital signal-processing system,The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation.

UNIT II

Computational Accuracy in DSP Implementation: Number formats for signalsand coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT III

Architectures for Programmable DSP Devices: Basic Architectural features,DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing. Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

UNIT IV

Programmable Digital Signal Processors: Commercial Digital signal-processingDevices: : Fixed point DSPs – Architecture of TMS 320C5X, C54X Processors , addressing modes, Memory space, Assembly instructions, Program Control ,Pipelining and on-chip peripherals. Floating point DSPs: Architecture of TMS 320 – IX.

UNIT V

Interfacing Memory and I/O Peripherals to Programmable DSP Devices : Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

Suggested Reading:

1. K. Shin, *DSP Applications with TMS 320 Family*, Prentice Hall, 1987.

2. B. Ventakaramani, M. Bhaskar, *Digital Signal Processes, Architecture Processingand Applications*, Tata Mc Graw Hill, 2002.
3. Lapsley et al., *DSP Processor Fundamentals, Architectures & Features*, S. Chand & Co, 2000.
4. Avtar Singh and S. Srinivasan, *Digital Signal Processing*, Thomson Publications, 2004.
5. Woon-Seng Gan, Sen M. Kuo, *Embedded Signal Processing with the Micro SignalArchitecture*, Wiley-IEEE Press, 2007.
6. C. Marren & G. Ewess, *A Simple Approach to Digital Signal Processing*, Wiley Inter-science, 1996.
7. R. Vijayarajeswaran, Ananthi.S, *A Practical Approach to Digital Signal Processing*, New Age International, 2009

Course Code	Course Title						Core/Elective
PE 3116 DS	**SoC Design**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Understand Integration of hardware and software on a single chip
- Describe various processors
- Design of Memory for SoC
- Familiarize with Interconnection of various devices and reconfiguration
- Explore various application of system on single chip

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures,
Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT II

Processors: Introduction , Processor Selection for SOC, Basic concepts inProcessor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT III

Memory Design for SOC: Overview of SOC external memory, Internal Memory,Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation , SOC Memory System, Models of Simple Processor – memory interaction.

UNIT IV

Interconnect Customization and Configuration: Inter Connect Architectures,
Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance-Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT V

Application Studies / Case Studies: SOC Design approach, AES algorithms,Design and evaluation, Image compression – JPEG compression.

Suggestive Reading:

1. Ricardo Reis, "*Design of System on a Chip: Devices and Components*, 1st Ed., Springer, 2004.
2. Michael J. Flynn and Wayne Luk, *Computer System Design System-on-Chip*, Wiley India Pvt. Ltd.

3. Steve Furber, *ARM System on Chip Architecture*, 2nd Ed., Addison Wesley Professional, 2000.
4. Jason Andrews, *Co-Verification of Hardware and Software for ARM System on ChipDesign (Embedded Technology)*, Newnes, BK and CDROM.
5. Prakash Rashinkar, Peter Paerson and Leena Singh L, *System on Chip Verification–Methodologies and Techniques,*, Kluwer Academic Publishers, 2001.

Course Code	Course Title						Core/Elective
PE 3117 DS	**Wireless Mobile Communication**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Understand Evolution of Cellular Networks, and review of Cellular concepts
- Learn Large scale Outdoor and Indoor propagation models
- Familiarize with Small scale fading, multipath and Multiple Access techniques
- Learn Modulation techniques for mobile radio.
- Understand Wireless Networking, Systems and Standards

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Modern Wireless Communication Systems: 1G, 2G, 2.5G, 3G, and 4G technologies. **Cellular Concept**: Frequency reuse, Channel assignment strategies, Handoff strategies. Interferenceand system capacity. Trunking and Grade of service, Improving coverage and capacity in cellular systems

UNIT II

Mobile radio propagation : Large scale propagation free space propagation model. Outdoor propagation models: longely Rice model, Durkin's model, A case study, okumura model, Hata model, PCS Extension to Hata model. Indoor propagation models: partition losses(same floor), partition losses(between floors), log distance path loss model, ericsson multiple breakpoint model, attenuation factor model, signal penetration into buildings.

UNIT III

Small scale fading & multipaths: Factors influencing small scale fading, small scale multipathmeasurements, parameters of mobile multipath channel. Types of small scale fading. **Multiple Access techniques**: FDMA, TDMA, CDMA.

UNIT IV

Modulation techniques for mobile radio: Constant envelop modulation. **Spread Spectrum Modulation Techniques**: PN Sequences. Direct Sequence Spread Spectrum (DS-SS), Frequencyhopped Spread Spectrum (FH-SS). Performance of Direct Sequence Spread Spectrum. Performance of Frequency hopped Spread Spectrum.

UNIT V

Wireless Networking: Traffic Routing in Wireless Networks, Wireless Data Services. CommonChannel Signaling (CCS), ISDN, Broadband ISDN and ATM. Signalling System No 7. SS7 User Part. Services and Performance. **Wireless Systems and Standards**: AMPS and ETACS, GSM. Advanced intelligent network (AIN)

Suggested Reading:

1. Rappaport, "*Wireless Communication*", Pearson Education, 2nd edition, 2002.
2. William C. Y. Lee, "*Mobile Cellular Telecommunications: Analog and Digital Systems*", 2nd edition, McGraw-Hill Electronic Engineering Series, 1995.

3. William C.Y. Lee, "*Mobile Communication Engineering*", Mc-Graw Hill, 1997.
4. Mike Gallegher, Randy Snyder, "*Mobile Telecommunications Networking with IS-41*", McGraw Hill 1997.
5. Kernilo, Feher, "*Wireless Digital Communications*", PHI, 2002.

Course Code	Course Title						Core/Elective
PE 3118 DS	**Advanced Digital Design with Verilog HDL**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Describe modelling styles of Verilog HDL
- Design modelling of Combinational and Sequential Logic modules
- Learn synthesis and synthesizers
- Understand verification methods and timing analysis
- Demonstrate case studies using Verilog HDL

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Review of Verilog HDL, Modelling styles: Behavioural, Dataflow, and Structural Modelling, gate delays, switch-level Modelling, Hierarchal structural modelling.

UNIT II

Modelling of basic MSI Combinational Logic modules and Sequential Logic modules. Finite State Machine modelling.

UNIT III

Synthesis: Design flow of ASICs and FPGA based system, design environment andconstraints logic synthesizers, Language structure synthesis, coding guidelines for clocks and reset.

UNIT IV

Verification: Functional verification, simulation types, Test Bench design, Dynamic timinganalysis, static timing analysis, value change dump (VCD) files. FPGA based design flow- a case study.

UNIT V

Design Examples: Adders and Subtractors, Multiplication and Division Algorithms, ALU,Digital Signal Processing modules: FIR and IIR Filters, Bus structures, Synchronous & Asynchronous data transfer, UART, baud rate generator. A simple CPU design

Suggested Reading:

1. Ming-Bo Lin., *Digital System Designs and Practices Using Verilog HDL and FPGAs*. Wiley, 2008.
2. Michael D. Ciletti, *Advanced Digital Design with the Verilog HDL*", PHI, 2005.
3. Samir Palnitkar, "*Verilog HDL: A Guide to Digital Design and Synthesis*", PearsonEducation, 2005.
4. Bhasker J.,*Verilog HDL Primer Hardcove*r, 2nd Edition, Star Galaxy Publishing ,1999

Course Code	Course Title						Core/Elective
PE 3119 DS	**Image and Video Processing**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Study fundamental concepts of Image Processing and various Image Transforms
- Learn Image Enhancement Techniques in Spatial and Frequency domain, Image Segmentation methods
- Familiarize with fundamentals of Image compression, Lossy & Lossless Compression methods.
- Define concepts of Video Processing, Image Formation models, and processing of Video signals.
- Understand general methodologies of 2 D Motion Estimation and Video coding methods.

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Fundamentals of Image Processing and Image Transforms: Basic steps of Image Processing System, Sampling and Quantization of an image, relationship between pixels

Image Transforms: 2 D- Discrete Fourier Transform, Discrete Cosine Transform (DCT), Wavelet **Transforms:** Continuous Wavelet Transform, Discrete Wavelet Transforms.

UNIT II

Image Processing Techniques: Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. **Frequency domain methods:** Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering. Laplacian of Gaussian (LOG) filters.

Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region Based segmentation, Hough Transform, Boundary detection, chain coding.

UNIT III

Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, JPEG Standards.

UNIT IV

Basic concepts of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT V

2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block-Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding, constant dependent video coding and joint shape and texture coding .MPEG and H.26X standards.

Suggested Reading:

1. Gonzaleze and Woods, *Digital Image Processing*, 3rd edition, Pearson.
2. Yao Wang, Joem Ostermann , Ya–quin Zhang, *Video processing and communication*, 1st Edition, PH Int.
3. S.Jayaraman, S.Esakkirajan, T.Veera Kumar *Digital Image Processing*, TMH, 2009.
4. M. Tekalp, *Digital Video Processing*, Prentice Hall International
5. John Woods, *Multi-dimensional Signal, Image and Video Processing and Coding* 2nd Edition, Elsevier.
6. Vipula Singh, *Digital Image Processing with MATLAB and LabVIEW*, Elsevier, 2013
7. Keith Jack, *Video Demystified–A Hand Book for the Digital Engineer*, 5th Edition, Elsevier.

Course Code	Course Title						Core/Elective
PE 3120 DS	**Global and Regional Navigation Satellite Systems**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Familiarize with GNNS fundamentals
- Learn GNSS signal structure, errors and their modeling
- Understand GPS errors and their modeling techniques
- Study GPS integration and data processing techniques
- Analyze GNSS augmentation and Regional navigation systems

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

GPS fundamentals: GPS principle of operation, architecture, operating frequencies, orbits,Keplerian elements. Solar and Sidereal day, GPS and UTC Time

Other GNNSs: Architecture and features of Russian Global Navigation Satellite System(GLONASS), European Navigation System (Galileo), Chinese Global Navigation System (BeiDou-2/COMPASS).

UNIT II

GNSS Signals: Original and modernized GPS, GLONASS and Galileo signal structure,Signal components and modulation schemes. Important components of a receiver for the acquisition and tracking of GPS signals.

GNSS Datums: Datums used for GPS and Galileo (ECEF and WGS 84). Datum used byRussian GLONASS and Indian Datums.

UNIT III

GPS Error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors,Satellite and receiver instrumental biases, Antenna Phase center variation, multipath; estimation of Total Electron Content (TEC) using dual frequency measurements, Various DOPs, UERE. Spoofing and Anti-spoofing. Link budget. Klobuchar model, Hopfield model and modeling of multipath error.

UNIT IV

GPS data processing: RINEX Navigation and Observation formats, Code and carrier phaseobservables, linear combination and derived observables, Ambiguity resolution, cycle slips, Position estimation.

GPS integration: GPS/GIS, GPS/INS, GPS/pseudolite, GPS/cellular.

UNIT V

Augmentation systems: Relative advantages of SBAS and GBAS, Wide area augmentationsystem (WAAS) architecture, GAGAN, EGNOS and MSAS. Principle of operation of DGPS, architecture and errors. Local area augmentation system (LAAS) concept.

Regional Navigation Satellite Systems (RNSS): Chinese Area Positioning System (CAPS).Indian Regional Navigation Satellite System (IRNSS), Japan's Quasi-Zenith Satellite System(QZSS).

Suggested Reading:

1. Pratap Misra and Per Enge, *Global Positioning System Signals, Measurements, andPerformance*, Ganga-Jamuna Press, Massachusetts, 2001.
2. Rao G.S., *Global Navigation Satellite Systems - With Essentials of SatelliteCommunications*, Tata McGraw Hill, 2010.
3. B.Hofmann Wollenhof, H.Lichtenegger, and J.Collins, *GPS Theory and Practice*, Springer Wien, New York, 2000.
4. Ahmed El-Rabbany, *Introduction to GPS*, Artech House, Boston, 2002.
5. Bradford W. Parkinson and James J. Spilker, *Global Positioning System: Theory andApplications*, Volume I and II, American Institute of Aeronautics and Astronautics,Inc., Washington, 1996.
6. E-book available on: http://www.unoosa.org/pdf/publications/icg_ebook.pdf

Course Code	Course Title						Core/Elective
PE 3121 DS	**Analog IC Design**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Develop models of basic CMOS amplifiers.
- Learn the concepts of advanced current mirrors and band-gap reference circuits.
- Design and develop two-stage Opamp.
- Analyze applications of Opamp: comparator and oscillator
- Familiarize with switched capacitor based circuits.

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Brief Review of Small Signal and Large Signal Model of BJTs and MOSFETs.Current Mirrors and Single Stage Amplifiers – Simple CMOS current mirror, common source amplifier, source follower, common gate amplifier, cascode amplifiers. Source degenerated current mirrors.

UNIT –II

High out impedance–current mirrors, cascode gain stage Wilson current mirror,MOS differential pair and gain stage. Wide swing current mirrors. Bipolar current mirrors – bipolar gain stages. Differential pairs with current mirror loads MOS and bipolar widlar current sources, supply insensitive biasing, temperature insensitive biasing, band gap reference, band gap reference circuits.

UNIT- III

Operational amplifiers, Basic two stage MOS Operational amplifier–Characteristic parameters, Design of two stage opamp. two stage MOS Op-Amp with Cascodes. MOS Telescopic-cascode Op-Amp. MOS Folded cascode op-amp. MOS Active Cascode Op-Amp. Fully differential folded cascode op-amp. CMFB Circuits. Current feedback op-amps. Stability and frequency compensation of op-amps. Phase margin and noise in op-amps.

UNIT – IV

Comparators: Op-Amp Based Comparators, Charge Injection Errors–LatchedComparators – CMOS and BiCMOS Comparators – Bipolar Comparators.

Oscillators and mixers: Basics of oscillators - Feedback oscillators, negative resistance oscillators, (two port oscillators), ring oscillators - Differential ring oscillators, LC oscillators, relaxation oscillators, voltage controlled oscillators, Tuning delay and frequency.

UNIT –V

Switched capacitor circuits: Basic building blocks; basic operation and analysis,inverting and non-inverting integrators, signal flow diagrams, first order filter. Implementation of Higher order filters using switched capacitor circuits.

Suggested Reading:

1. David Johns, Ken Martin, *Analog Integrated Circuit Design*, John Wiley & sons. 2004
2. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, Tata Mc Grah Hill. 2002

3. Paul.R. Gray & Robert G. Major, *Analysis and Design of Analog Integrated Circuits*, John Wiley & sons. 2004
4. Jacob Baker.R.et.al., *CMOS Circuit Design*, IEEE Press, Prentice Hall, India, 2000

Course Code	Course Title						Core/Elective
PE 3122 DS	**Speech Signal Processing**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Describe speech production and perception and modelling
- Analyze speech signal and computation
- Represent speech with models
- Represent speech with coders, encoders and decoders
- Learn Automatic Speech Recognition

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

The process of speech production: Production Mechanism and acoustic phonetics. Digital models for speech signals: Vocal Tract, Radiation, Excitation and complete model speech. **perception:** Loudness, Bark Scale, masking, perception and Psychoacoustics.

UNIT II

Short-time Period analysis: Short-time energy, Average magnitude, zero crossing, Speechvs Silence discrimination and zero crossing rate, Pitch period estimation using parallel processing approach. Autocorrelation function, Pitch period estimation using Auto correlation function, The average magnitude function, median smoothing. Short time Fourier Analysis: Fourier transform interpretation, linear filtering interpretation, sampling rates in time and frequency, Filter banks, Spectctrograms, pitch detection. Cepstral analysis, Complex and real cepstrum, pitch detection and Formant estimation.

UNIT III

Digital Models for Speech Signals: Review of PCM, adaptive PCM, differential PCM, deltamodulation. Linear Predictive coding (LPC) analysis: Basic principles, autocorrelation and covariance methods, Computation of LP coefficients, Cholesky decomposition, Durbin's recursive solution, Frequency domain interpretation of LPC, CELP.

UNIT IV

Analysis by Synthesis: Phase vocoder, subband coding, Formant /homomorphic vocoder,cepstral vocoder, vector quantizer coder, Speech enhancement techniques: Spectral subtraction, enhancement by resynthesis.

UNIT V

Automatic speech recognition: Basic pattern recognition approaches, evaluating thesimilarity of speech patterns, Dynamic Time Warping (DTW), HMM's for speech recognition, forward, backward algorithms and parameter estimation. Speaker recognition, Features that distinguish speakers.

Suggested Reading:

1. Rabinar and Schafer, *Digital Processing of Speech Signals*, Pearson Education, 2004.
2. Deller, Hansen, Proakis, *Discrete-Time Processing of Speech signals*, IEEE presses, 2000.
3. R & J Rabinar and Juang, *Fundamentals of speech recognition*, Prentice Hall, 1993.

4. Douglas O'Shaughnessy, *Speech Communication: Human and Machine*, 2nd edition, University Press, Hyderabad, 2001.

Course Code	Course Title						Core/Elective
PE 3123 DS	**Advanced Computer Organization**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Design CPU organization, Data representation, Pipelining, Superscalar architectures
- Learn Hardwired and Micro-Programmed Control UNIT Design
- Understand memory organization and hierarchy
- Describe IO interfacing concepts
- Learn concepts, challenges and limitations of Instruction Level Parallelism (ILP)

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Processor Design: CPU Organization, Data Representation, Instruction Formats, Data Path Design: Fixed Point Arithmetic and Floating Point Arithmetic, Instruction Pipelining, Super Scalar techniques, Linear pipeline processors, Super scalar and super pipeline design, Multi vector and SIMD computers.

UNIT II

Control UNIT Design: Basic Concepts: Hardwired Control UNIT Design approach, Micro-programmed Control UNIT Design Approach, Micro program sequencer, Case studies based on both the approaches.

UNIT III

Memory Organization: Internal memory, computer memory system overview, The memory Hierarchy, Random access memories, Cache memory, Elements of cache design, Virtual memory- protection and examples of virtual memory, Replacement Policies.

UNIT IV

I-O Organization: Accessing I/O Devices, Programmed I-O, Interrupts, DMA, Bus Arbitration; Synchronous bus and asynchronous bus, Interface circuits, Parallel port, Serial port, standard I/O interfaces, IO Processor, PCI bus, SCSI bus, USB bus protocols.

UNIT V

Parallel Computer Systems: Instruction Level Parallelism (ILP) – Concept and Challenges, Dynamic Scheduling, Limitations on ILP, Thread Level Parallelism, Multi-processors – Characteristics, Symmetric and Distributive Shared Memory Architecture, Vector Processors and Super computers.

Suggested Reading:

1. Hayes John P; *Computer Architecture and Organization*; 3rd Edition, MGH, 1998.
2. John L. Hennessy and David A. Patterson, *Computer Architecture–A quantitative Approach*, 3rd Edition, Elsevier, 2005.
3. William Stallings, *Computer Organization and Architecture designing for Performance*, 7th edition, PHI, 2007.

Course Code	Course Title						Core/Elective
PE 3124 DS	**Modern Digital Communication Systems**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Represent communication channel as Band Pass system
- Understand Transmission of data and equalization
- Compare performance of MSK and Mary receiver
- Learn Encryption and decryption of data
- Analyze multipath fading

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Characterization of Communication signals and systems: Bandpass signals, LinearBandpass systems and its response, Bandpass stationary stochastic processes, Power spectra of linearly modulated signals.

UNIT II

Baseband Data Transmission: Correlative coding: Duobinary signalling, Duo-binarydecoding, Pre-coding, Duo-binary equivalent transfer function, Comparison of Binary with Duo-binary signalling Poly-binary signalling, Inter symbol interference, Equalization.

UNIT III

Bandpass Data Transmission: Coherent and non-coherent modulation and detection ofdigital (binary and M-ary) signals, Optimum Receiver, MSK, Mary signalling and performances.

UNIT IV

Encryption and Decryption: A model of the encryption and decryption process, ciphersystems, stream encryption and public key encrypt systems.

UNIT V

Fading channel characteristics: channel characteristics, channel classification, channelcorrelation function and power spectra, the effect signal characteristics on the choice of channel model, Mitigation techniques for multipath fading channel: space diversity, frequency diversity, time diversity, multipath diversity and RAKE Receiver, frequency selective and non-selective fading, Example of Radio channels.

Suggested Reading:

1. John G.Proakis, *Digital Communications*, 4th ed, McGraw Hill International edition, 2001.
2. Bernard Sklar,*Digital communications fundamentals and Application*,2nd ed,Pearson edu, 2001.
3. Fuqin Xiong, Digital modulation *Techniques*, Artech House, 2000.
4. Stephen G. Witson, *Digital Modulation and Coding*, Prentice Hall, New Jessey, 1996.
5. Rodger E. Ziemer and Roger L Peterson, *Introduction to Digital communication*, 2nd edition, Prentice Hall International edition, 2001.

Course Code	Course Title						Core/Elective
PE 3125 DS	**Optical Fibre Communication Systems**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Analyze optical fibre as wave guide
- Learn various optical sources and detectors used in optical signal transmission
- Familiarize with various components used in optical communication like, preamplifiers, links
- Estimate Performance evaluation of optical communication
- Explore applications of optical communication in Local Area Networks

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Optical Fibres: Fibre Structures, Wave-guiding and fabrications, Overview ofOptical fibre communications, Elements of an Optical fibre transmission Link, Nature of light, Basic optical laws and definitions, Modes and configurations, Mode theory of circular wave guides, Single, Multi mode step index and Graded index Fibres , Fibre materials. Signal degradation in Optical Fibres. Dispersion, Pulse broadening in graded index fibres, Mode coupling, Design optimization of single mode Fibres.

UNIT II

Optical Sources & Detectors: Semiconductors as optical Sources and theirfabrication. LED and Laser diodes, Linearity of sources, Modal, Partition and reflection noise, Physical principles of PIN and APD, Photo detector noise, detector response time, Avalanche multiplication noise, Temperature effect on avalanche gain, Comparison of Photo detectors.

UNIT III

Optical Fibre communication: Basic communication system, Fundamental receiveroperation, Digital receiver performance calculations. Preamplifiers types, Analog receivers. Fibre Links: Point to point links, Line coding, Error correction, Noise effects on digital transmission system performance. Overview of analog links, Carrier noise ratio in analog systems.

UNIT IV

Multi-channel transmission techniques: WDM concepts and components. Operational principles of WDM, Passive components, Tunable sources, Tunable filters, Introduction of optical amplifiers.

UNIT V

Optical Networks: Basic Networks, SONET/SDH, Broadcast and select WDMnetworks, Wavelength Routed Networks, Nonlinear effects on Network Performance, Performance of EDFA+WDM systems, Optical CDMA, Ultrahigh capacity Networks.

Suggested Reading:

1. Djafar K.mynbaev Lowell l.Scheiner “Fibre Optic Communications Technology”,Pearson Education Asia.
2. Senior John M. “Optical Fibre Communications Principles and Practice”, Prentice HallIndia, second edition, 1996
3. Keiser Gerd , “Optical Fibre Communications”, Mc GrawHill, second edition,1991

Course Code	Course Title						Core/Elective
PE 3126 DS	**Wireless Channel Coding Techniques**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Describe performance of digital communication systems. Coding gain.
- Design encoder and decoder for various coding schemes
- Learn cyclic codes
- Analysis of Performance improvement of convolution codes
- Design of turbo encoder and decoder

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Introduction: Modulation and coding, Performance measures of coded modulation fields, Binary field arithmetic, construction of Galois Field

UNIT II

Introduction to Linear block codes, the minimum distance of Block codes, Syndrome decoding,Hamming codes, Reed-Muller codes, interleaved codes.

UNIT III

Cyclic codes, Generator and parity-check matrices of cyclic codes, Syndrome computation and errordetection. Binary BCH codes, Decoding of BCH codes and Reed Solomon codes.

UNIT IV

Convolutional Codes: Encoding of convolutional codes, Structural properties of convolutional codes. The Viterbi algorithm and BCJR algorithm.

UNIT V

Turbo Coding: Introduction to turbo coding, Performance analysis of Turbo codes, Design of Turbocodes, decoding of Turbo codes, Introduction to LDPC Codes, Tanner graph for Linear Block codes.

Suggested Reading:

1. Shu Lin, Daniel J., Costello, Jr., *Error Control Coding*, 2nd edition, Pearson, 2011
2. Simon Haykin, *Communication Systems*, 4th Edition, John Wiley & Sons, 2007.
3. Proakis J.G. & M. Salehi, *Digital Communications*, Mc Graw-Hill, 2008.
4. Biglieri E., *Coding for Wireless Channels*, Springer, 2007.

Course Code	Course Title						Core/Elective
PE 3127 DS	**GNSS Signals and Receiver Technology**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Locate user in GNSS available for positioning
- Describe GNSS receiver hardware
- Understand Signal generation, analysis, synthesis and modulation techniques
- Learn Detection of signal and range calculations
- Familiarize with Extraction of information from signal and mitigation of errors

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Basic GPS Concept: Principle of Operation, Architecture, Space, control and user segments. Other GNSS systems: GLONASS and Galileo. GPS Signal **:** Signals and Data, GPS Signal Scheme, C/A Code, Gold Sequence, Gold Sequence Generation, Correlation Properties, Doppler Frequency Shift, Code Tracking, Navigation Data, Telemetry and Handover Words, Data in Navigation Message. Galileo Signal**:** Galileo L1 OS Signal: Signal Generation, Coherent Adaptive Sub-carrier Modulation, Binary Offset Carrier Modulation, and Message Structure: Frames and Pages Cyclic Redundancy Check, Forward Error Correction and Block Interleaving, Message Contents: Time and Clock Correction Parameters, Conversion of GST to UTC and GPST, Service Parameters, the Received L1 OS Signal, GLONASS and other GNSS signals.

UNIT II

GNSS Receiver Operation Overview: Receiver Channels, Acquisition, Tracking, Navigation Data Extraction, Computation of Position, GNSS Antennas and Front Ends: GNSS L1 Front-End Components, GNSS Antenna, Filter, Amplifier, Mixer/Local Oscillator, Analog-to-Digital Converter, Resulting Sampled Data, GNSS Front-End ASICS.

UNIT III

Acquisition: Serial Search Acquisition, PRN Sequence Generation, Carrier Generation, Integration and Squaring, Parallel Frequency Space Search Acquisition, Parallel Code Phase Search Acquisition, Data Size, Execution Time, Parameter Estimation.

UNIT IV

Carrier and Code Tracking: Motivation, Demodulation, Second-Order PLL, Damping Ratio, Noise Bandwidth, Carrier Tracking, Code Tracking, Multipath, Complete Tracking Block, Pseudo-range Computations.

UNIT V

Data Processing for Positioning, Navigation Data Recovery, Finding the Bit Transition Time and the Bit Values, Navigation Data Decoding, Location of Preamble, Extracting the Navigation Data, Computation of Satellite Position, Pseudo-range Estimation, The Initial Set of Pseudo-ranges, Estimation of

Subsequent Pseudo-ranges, Computation of Receiver Position, Time, Linearization of the Observation Equation, Using the Least-Squares Method, Real-Time Positioning Accuracy, Time Systems Relevant for GPS, Coordinate Transformations, Universal Transverse Mercator Mapping, Dilution of Precision, World Geodetic System 1984, Time and Coordinate Reference Frames for GPS and Galileo

Suggested Reading:

1. Kai Borre, Dennis M. Akos, Nicolaj Bertelsen, Peter Rinder, Søren Holdt Jensen, *A Software-Defined GPS and Galileo Receiver A Single-Frequency Approach,* Birkhauser, Boston, 2007
2. James Bao-Yen Tsui, *Fundamentals of global positioning system receivers: a software*, Wiley Inter-science, 2005
3. Hofmann-Wellenhof, Bernhard, Lichtenegger, Herbert, Wasle, Elmar GNSS – Global Navigation Satellite Systems: GPS, GLONASS, Galileo, and More, Springer, 2008.

Course Code	Course Title						Core/Elective
PE 3128 DS	**Advanced Computer Networks**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Overview of computer networks, internet, and foundation of basic networking protocols.
- Detailed study of Link layer, Routing and Congestion control at the network layer.
- Learn Protocols in Network layer, Transport layer, and Application Layer.
- Describe Concepts of Tunneling, VPN's, Multimedia Networking Protocols, and Optical networks.
- Overview of Wireless Networks, Mobile IP, Mobile A-Hoc and Wireless Sensor Networks

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Computer Networks and the Internet: What is the Internet, The Network edge, The Network core, Access Networks and Physicalmedia, ISPs and Internet Backbones, Delay and Loss in Packet-Switched Networks.

Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model, InternetProtocols and Addressing, Equal-Sized Packets Model.

UNIT II

Link Layer and Local Area Networks: Introduction and Services, Error-Detection andError-Correction techniques, Multiple Access Protocols, LAN Addresses and ARP, Ethernet, Hubs, Bridges and Switches, PPP: The Point-to-Point Protocol

Wide Area Routing: Path Selection Algorithms -Dijkstra's Algorithm, Bellman-Ford Algorithm,Packet Flooding and Deflection Routing Algorithm.

Congestion Control at the Network Layer : Unidirectional Congestion Control, BidirectionalCongestion Control, Random Early Detection (RED).

UNIT III

Network layer: Internet Protocol: Internetworking, IPv4, IPv6Transition from IPv4 to IPv6.

Multicast Routing and Protocols: Basic Definitions and Techniques, Internet Group Management Protocol (IGMP).

Transport and End-to-End Protocols: User Datagram Protocol (UDP), Transmission ControlProtocol (TCP), Mobile Transport Protocols, TCP Congestion Control.

Application Layer: The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, DomainName System (DNS).

UNIT IV

Tunneling, VPN's and MPLS Networks – Tunneling, Virtual Private Networks (VPNs),Multiprotocol Label Switching (MPLS).

Multimedia Networking - Protocols for Real–Time Interactive Applications–RTP, RTCP, SIP,and H.323. Overview of Voice over IP, SIP to H.323, SIP to PSTN, Wireless Cellular Multimedia Internetworking.

Optical Networks and WDM Systems: Overview of Optical Networks, Basic Optical NetworkingDevices, Large-Scale Optical Switches, Optical Routers, Wavelength Allocation in Networks, Case Study: An All-Optical Switch.

UNIT V

Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LANTechnologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs). **Mobile A-Hoc Networks:** Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks

Wireless Sensor Networks: Sensor Networks and Protocol Structures, Communication EnergyModel, Clustering Protocols- LEACH Clustering and DEEP Clustering Protocol, Routing Protocols

Suggested Reading:

1. James F. Kurose, Keith W.Ross, *Computer Networking: A Top-Down Approach Featuringthe Internet*, 3rdEdition, Pearson Education, 2007
2. Nader F. Mir, *Computer and Communication Networks*, Pearson Education, 2007
3. Behrouz A. Forouzan, *Data Communications and Networking*, 4th Edition, Tata McGraw Hill, 2007
4. Greg Tomsho,Ed Tittel, David Johnson, *Guide to Networking Essentials*, 5th Edition, Thomson.
5. S.Keshav, *An Engineering Approach to Computer Networking*, Pearson Education.
6. Diane Teare, Catherine Paquet, *Campus Network Design Fundamentals*, Pearson Education (CISCO Press)
7. Andrew S. Tanenbaum, *Computer Networks*, 4th Edition, Prentice Hall.
8. William Stallings, *Data and Computer Communications*, 8th Edition, Pearson Prentice Hall, 2007.

Course Code	Course Title						Core/Elective
PE 3129 DS	**Mobile Ad-hoc and Sensor Networks**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Outline of sensing, computing and communication elements
- Describe Data dissemination and accumulation, catching and storage
- Detection of signal topology, management and topological routing. Dispersed sensors covering geographic area
- Learn Synchronization of signals and recognition channel sharing and locality
- Understand Identification and error detection and routing of signals, sensor nodes have limited energy, limited communication and computational capabilities and limited memory

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Introduction: mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs),concepts and architectures, Routing: proactive routing, reactive routing (on demand), hybrid routing, power-aware routing, Network simulators (OPNET, NS2, etc.)

UNIT II

Broadcasting and multicasting: broadcast storm, network flooding avoidance, multicast routing, TCP over mobile ad hoc networks: IP address acquisition, effects of partitions on TCP, provisions for mobility and fairness, Wireless LAN (WiFi): 802.11 specifications, Medium Access Control Protocol issues; power control, spatial reusability, and QoS. Bluetooth: specifications, Piconet synchronization and master-slave switch, scatter-net formations, interference issues, interoperability with WiFi.

UNIT III

Wireless sensor networks (WSNs): single node architecture: hardware and softwarecomponents of a sensor node, Tiny OS operating system, nesC language, WSN Network architecture: typical network architectures, data relaying strategies, aggregation, role of energy in routing decisions, WSN MAC layer strategies: MAC layer protocols, energy management, contention-based protocols, schedule-based protocols, 802.15.4 standard.

UNIT IV

WSN naming and addressing: addressing services, publish-subscribe topologies, WSNClock Synchronization: clustering for synchronization, sender-receiver and receiver-receiver synchronization. Error analysis

UNIT V

WSN Node Localization: absolute and relative localization, triangulation, multi-hoplocalization and error analysis, anchoring, geographic localization, WSN Routing: Agent-based routing, random walk, trace routing.

Suggested Reading:

1. C.Siva Ram Murthy and B.S.Manoj, *Ad Hoc Wireless Networks: Architectures andProtocols*, Prentice Hall PTR, 2007.
2. Holger Karl and Andreas Willig, *Protocols and Architectures for Wireless SensorNetworks,* WILEY (ISBN: 0-470-09510-5)
3. C. Siva Ram Murthy and B. S. Manoj, *Ad Hoc Wireless Networks: Architectures andProtocol*, Prentice Hall, 2004.
4. Feng Zhao and Leonidas J. Guibas, *Wireless Sensor Networks: An Information ProcessingApproach*, Morgan Kaufmann, 2004
5. Kazem Sohraby, Daniel Minoli and Taieb Znati, *Wireless Sensor Networks Technology-Protocols and Applications*, John Wiley & Sons, 2007.
6. Charles E. Perkins, *Ad Hoc Networking*, Addison Wesley, 2000.

Course Code	Course Title						Core/Elective
PE 3130 DS	**Multimedia Information Systems**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Describe information on digital media
- Outline networking synchronization of various systems
- Study methods of computation, analyze various models
- Study methods for interfacing different systems with different sampling ratio
- Learn reconstruction of signals, coding and decoding

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

UNIT I

Definition of Multimedia, Multimedia system description. Applications of Multimedia. **Types of Multimedia:** a non-interactive, interactive. Hypertext.

UNIT II

Multimedia Networking: ATM. ISDN. WAN and their comparisons, Multimedia synchronization. Serial and Parallel.

UNIT III

Motion estimation techniques: Bruteforce, algorithm three step, search algorithm. 2-D algorithm and conjugate direction search algorithm.

Image compression standards: Review on loseless and lossy compression models.JPEG.H261 MPEG1, MPEG2 and MPEG4.

UNIT IV

Audio coding: Introduction to multi rate signals. MPEG1 and MPEG2 audio encoder and decoder.

UNIT V

Multimedia information indexing and Retrieval: General information Retrieval (IR) model. Differences between IR and DBMS Basic IR models. File structure, audio indexing and Retrieval methods. Image Retrieval based on shape and moments and watermarking Techniques.

Suggested Reading:

1. Guojun Lu, *Communication and Computing for distributed multimedia systems*, Artech House, Boston, London, 1995.
2. Bhaskar, V and Konstantindes K, *Image and Video Compression Standardsalgorithms and Architecture*, Kluwer Academic, Sept, 1997.
3. Judith Jeffocate, *Printmedia in practice (Theory and Applications)*, PHI, 1998.

Course Code	Course Title						Core/Elective
PC 3151 DS	**Embedded Systems Lab**						**Lab – I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To create, develop, apply, and disseminate knowledge within the embedded systems development environment.
- To focus on the embedded system hardware development
- To understand interfacing of basic peripherals with microcontrollers & ARM processors

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

PART –A

Microcontroller & Interfacing Programs

1. Simple Assembly Language Programs for:
   a. Addition/Subtraction/Multiplication/Division.
   b. Addressing modes and Interrupts.
   c. Loops & Branches.
2. Assembly Language programs to configure and control general purpose I/O (GPIO) port pins.
3. Assembly Language programs for interfacing DAC to generate different waveforms.
4. Assembly Language programs for interfacing traffic light control at a junction.
5. Assembly Language programs for interfacing stepper motor and to control it.
6. Assembly Language programs to read digital values from external peripherals and execute them with the Target board.
7. Program for reading and writing of a file.
8. Program to demonstrate Time delay Program using built in Timer/Counter feature on IDE environment.

PART -B

Interfacing Experiments using Arm Development Board

1. Programs to interface 8-Bit LED and control them.
2. Program to implement Buzzer interface on IDE environment.
3. Program to display message in a 2 line x 16 characters LCD display.
4. Stepper motor interface to ARM development boards & control it.
5. DAC interface to ARM development boards for the generation of different waveforms.
6. ADC & Temperature sensor LM35 interface to ARM development boards.
7. Transmission from kit and reception from PC using serial port.
8. Timer operations in different modes.

Note:

i. Minimum of 10 experiments has to be performed with 5 from each part.
ii. The above listed programs are to be implemented on 8051 architecture based Microcontroller & ARM based processors/Equivalent development boards.
iii. Kiel Microcontrollers Development tool or Equivalent simulation software should be used.

Course Code	Course Title						Core/Elective
PC 3152 DS	**Digital Systems Design Lab**						**Lab – II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To understand the programming constructs of Verilog HDL.
- To demonstrate the programming models of Verilog HDL: gate level, data flow, behavioural and structural modelling.
- To carry out projects using Verilog HDL.

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

List of Experiments:

1. Verilog implementation of
    a. 8:1 Mux/Demux
    b. Full Adder
    a. 8-bit Magnitude comparator
    b. Encoder/decoder and Priority encoder
    c. D-FF, 4-bit Shift registers (SISO, SIPO, PISO,bidirectional)
    d. 3-bit Synchronous Counters
    e. Binary to Gray converter, Parity generator.
2. Sequence generator/detectors, Synchronous FSM – Mealy and Moore machines.
3. Vending machines - Traffic Light controller, ATM, elevator control.
4. PCI Bus & arbiter and downloading on FPGA.
5. UART/ USART implementation in Verilog.
6. Realization of single port SRAM in Verilog.
7. Verilog implementation of Arithmetic circuits like serial adder/ subtractor, parallel adder/subtractor, serial/parallel multiplier.

Course Code	Course Title						Core/Elective
PC 3153 DS	**DSP Lab**						**Lab – III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To understand the concept of N-point FFT algorithm.
- To understand the concept of analog and digital filters and simulation using MATLAB.
- To understand the concept of Linear Convolution and simulate it using CCSTUDIO/Visual DSP ++.

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

PART-A (Experiments using MATLAB or equivalent)

1. DFT and FFT algorithm.
2. Linear and circular Convolutions.
3. FIR filter design using different data windows.
4. IIR filter design: Butterworth and Chebyshev.
5. Implementation of multi-rate systems.

PART-B (Experiments on DSK and CCS)

1. Impulse Response.
2. Convolution & Correlation.
3. FFT (DIT, DIF) and Bit Reversal Operation
4. FFT and its Applications
5. Design of FIR filters using windows
6. Design of IIR filters.
7. Audio Codec and its Applications
8. Real Time Data Exchange
9. Modulation schemes (FM, AM)
10. Voice scrambler- application of low pass filtering and AM modulation

Note:

i. Part-A, experiments can be performed in MATLAB with different toolboxes like Signal Processing, Signal Processing block set, and SIMULINK/ MATHEMATICA/ any popular software can be used.
ii. Part-B Experiments can be performed on TMS320c6713 DSK processor kit and CC Studio
iii. A total of 12 experiments to be completed during the semester

Course Code	Course Title						Core/Elective
PC 3154 DS	**VLSI Lab**						**Lab – IV**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- Design digital and analog Circuit using CMOS.
- Use EDA tools like Cadence, Mentor Graphics and other open source software tools like Ngspice

Course Outcomes

After completing this course, the student will be able to:

1. CO1
2. CO2
3. CO3

List of Experiments:

1. Use VDD=1.8V for 0.18um CMOS process, VDD=1.3V for 0.13um CMOS Process and VDD=1V for 0.09um CMOSProcess.
   a. Plot ID vs. VGS at different drain voltages for NMOS,PMOS determineVt
   b. Plot log ID vs. VGS at particular gate voltage (high) for NMOS, PMOS and determine IOFF and sub-thresholdslope.
   c. Plot ID vs. VDS at different gate voltages for NMOS, PMOS and determine Channel length modulationfactor.
   d. Extract Vth of NMOS/PMOS transistors (short channel and long channel). Use VDS = 30mV

   To extract Vth use the following procedure.

   i. Plot gm vs VGS using NGSPICE and obtain peak gmpoint.
   ii. Plot y=ID/(gm)1/2 as a function of VGS usingNgspice.
   iii. Use Ngspice to plot tangent line passing through peak gm point in y (VGS) plane and determineVth.
   iv. Plot ID vs. VDS at different drain voltages for NMOS, PMOS, plot DC load line and calculate gm, gds, gm/gds, and unity gainfrequency.

   Tabulate your result according to technologies and comment on it.
2. Use VDD=1.8V for 0.18um CMOS process, VDD=1.2V for 0.13um CMOS Process and VDD=1V for 0.09um CMOSProcess.
   Perform thefollowing
   a. Plot VTC curve for CMOS inverter and thereon plot dVout vs. dVin and determine transition voltage and gain g. Calculate VIL, VIH, NMH, NML for theinverter.
   b. Plot VTC for CMOS inverter with varyingVDD.
   c. Plot VTC for CMOS inverter with varying deviceratio.
   d. Perform transient analysis of CMOS inverter with no load and with load and determine tpHL, tpLH, 20%-to-80% tr and 80%-to-20% tf. (use VPULSE = 2V, Cload =50fF)
   e. Perform AC analysis of CMOS inverter with fanout 0 and fanout 1. (Use Cin= 0.012pF, Cload = 4pF, Rload =k)
3. Use CAD tools to build a three stage and five stage ring oscillator circuit in 0.18um and 0.13um technology and compare its frequencies and timeperiod.
   Perform thefollowing
   a. Draw small signal voltage gain of the minimum-size inverter in 0.18um and 0.13um technology as a function of input DC voltage. Determine the small signal voltage gain

at the switching point using CAD tools and compare the values for 0.18um and 0.13umprocess.

b. Consider a simple CS amplifier with active load, as explained in the lecture, with NMOS transistor MN as driver and PMOS transistor MP as load, in 0.18um technology. (W/L)MN=5, (W/L)MP=10 and L=0.5um for both transistors.
c. Establish a test bench, as explained in the lecture, to achieveVDSQ=VDD/2.

4. Calculate input bias voltage if biascurrent=50uA.
   a. Use CAD Tools and obtain the bias current. Compare its value with50uA.
   b. Determine small signal voltage gain, -3dB BW and GBW of the amplifier using small signal analysis in CAD Tools (consider 30fF load capacitance).
   c. Plot step response of the amplifier for input pulse amplitude of 0.1V. Derive time constant of the output and compare it with the time constant resulted from -3dBBW
5. Three OPAMP INA. Vdd=1.8V Vss=0V, CAD tool: MentorGraphicsDA.
   Note: Adjust accuracy options of the simulator (setup->options inGUI). Use proper values of resistors to get a three OPAMP INA with differential-mode voltage gain=10. Consider voltage gain=2 for the first stage and voltage gain=5 for the secondstage.
   a. Draw the schematic of op-amp macromodel.
   b. Draw the schematic ofINA.
   c. Obtain parameters of the op-amp macro model suchthat
      i. low-frequency voltage gain =5x104,
      ii. unity gain BW (fu) =500KHz,
      iii. inputcapacitance=0.2pF,
      iv. output resistance =,
      v. CMRR=120dB

Course Code	Course Title						Core/Elective
PC 1155 SE	**Mini Project**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**4**	**100**	**-**	**2**

Course Objectives

- Obj1
- Obj2

Course Outcomes

1. Identify structural engineering problems reviewing available literature
2. Study different techniques used to analyse complex structural systems.
3. Work on the solutions given and present solution by using his/her
4. technique applying engineering principles.

Syllabus Content:

- Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.
- End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.
- Continuous assessment of Mini Project at Mid Semester and End Semester will be monitored by the departmental committee.

Course Code	Course Title						Core/Elective
PC 1156 DS	**Major Project Phase – I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**20**	**30**	**70**	**10**

Course Outcomes

At the end of this course, students will be able to

- Identify structural engineering problems reviewing available literature.
- Identify appropriate techniques to analyse complex structural systems.
- Apply engineering and management principles through efficient handling of project

Syllabus Contents:

The Dissertation-I will have mid semester presentation and end semester presentation. The mid semester presentation will include identification of problem based on literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individual contribution.

Continuous assessment of Dissertation-I and Dissertation-II at mid semester and end semester will be monitored by the departmental committee.

Course Code	Course Title						Core/Elective
PC 1157 DS	**Major Project Phase – II (Dissertation)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**32**	**-**	**200**	**16**

Course Outcomes

At the end of this course, students will be able to

- Solve complex structural problems by applying appropriate techniques and tools.
- Exhibit good communication skill to engineering community and society.
- Demonstrate professional ethics and work culture.

Syllabus Contents:

Dissertation-II will be extension of the work on the topic identified in Dissertation-I

Continuous assessment should be done of the work done adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre-submission seminar at the end of academic term. After the approval the student has to submit the detailed report and external examiner is called for the viva-voce to assess along with guide.