Programming in C++

Subject Code	:	06EC661
IA Marks	:	25
No. of Lecture Hrs/ Week	:	

04	
Exam Hrs	
:	
03	
Total no. of Lecture Hrs.	
:	
52	
Exam Marks	
:	
100	

PART - A

Unit - 1

C++, An Overview: Getting started, the C++ program, Preprocessor Directives, The Built-In Array Data Type, Dynamic Memory Allocation and Pointers, An Object – based Design, An Object-Oriented Design, An Exception – based Design.

6 Hours

Unit - 2

The basic language: Literal Constant, Variables, Pointer Type, String Types, const Qualifier, Reference Types, the bool type, Enumeration types, Array types. The ve ctor container type.

6 Hours

Unit - 3

Operators: Arithmetic Operators, Equality, Relational and Logical operators, Assignment operators, Increment and Decrement operator, The conditional Operator, Bitwise operator, bitset operations. Statements: if, switch, for Loop, while, break, goto, continue statements.

7 Hours

Unit - 4

Functions: Prototype, Argument passing, Recursion and linear function.

6 Hours

PART - B

Unit - 5

Exception Handling: Throwing an Exception, Catching an exception, Execption Specification and Execptions and Design Issues.

6 Hours

Unit - 6

CLASSES: Definition, Class Objects, Class Initailization, Class constructior, The class destructor, Class Object Arrays and Vectors.

7 Hours

UNIT - 7

Overload Operators, Operators ++ and --, Operators new and delete.

7 Hours

Unit – 8

Multiple Inheritance, public, private & protected inheritance, Class scope under Inheritance.

6 Hours

Text book:

1. **C++ Primer**– S. B. Lippman & J. Lajoie, 3rd Edition, Addison Wesley, 2000.

Reference Books:

1. **C++ Program Design**– An Introduction to Programming and Object-Oriented Design.
Cohoon and Davidson, 3rd Edn. TMH publication. 2004.

2. **Object Oriented Programming using C++** – R. Lafore, Galgotia Publications, 2004.

Analog and Mixed Mode VLSI Design

Subject Code	
:	
06TE662	
IA Marks	
:	
25	
No. of Lecture Hrs/ Week	

:

04

Exam Hrs

:

03

Total no. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

Unit - 1 & 2

Sampling and Aliasing: Impulse Sampling, Sample and Hold, SPICE models for DACs and ADCs, Quantization noise, Spectral density of quantization noise.

12 Hours

Unit - 3 & 4

Data Converter SNR: Effective number of bits Clock jitter, spectral density, Using averaging to improve SNR, Decimating filters for ADCs, Interpolating filters for DACs, Band pass and High pass Sync filters, Using feedback to improve SNR.

14 Hours

PART - B

Unit - 5 & 6

Sub-Micron CMOS circuit design: Process flow, capacitors and resistors, SPICE MOSFET models, MOSFET Switch, Delay and Adder elements, Analog circuits – MOSFET Biasing, Op-Amp design, Circuit Noise.

12 Hours

Unit - 7

Implementing Data converters: Current Mode and Voltage mode R-2R DAC, Using Op-Amps in data converters, Implementing ADCs, Cyclic ADC.

6 Hours

Unit - 8

Integrator Based CMOS Filters: Integrator Building Blocks, Low pass and Active R-C filters, MOSFET-C integrators, Bilinear and Biquadratic transfer functions – Active R-C, Transconductor-C and Switched Capacitor implementations both transfer functions, Canonic form of a digital filter.

8 Hours.

Text Book:

1. **Mixed signal circuit design (Vol II of CMOS: Circuit design, layout and simulation** – R. Jacob Baker, CMOS –**)**, IEEE Press and Wiley Interscience, 2002.

Reference Books:

1. **Design of Analog CMOS Integrated Circuits** – B Razavi, First Edition, McGraw Hill,2001.

2. **CMOS Analog Circuit Design** – P E Allen and D R Holberg, Second Edition, Oxford University Press,2002.

Random Processes

Subject Code	:	06EC663
IA Marks	:	

25

No. of Lecture Hrs/ Week

:

04

Exam Hrs

:

03

Total no. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

Unit - 1

Introduction to PROBABILITY THEORY: Experiments. Sample space, Events, Axioms, Assigning probabilities, Joint and conditional probabilities,. Baye's Theorem, Independence, Discrete Random Variables, Engg Example.

7 Hours

UNIT - 2

Random Variables, Distributions, Density Functions: CDF, PDF, Gaussian random variable, Uniform Exponential, Laplace, Gamma, Erlang, Chi-Square, Raleigh, Rician and Cauchy types of random variables.

7 Hours

Unit - 3

Operations on a Single R V: Expected value, EV of Random variables, EV of functions of Random variables, Central Moments, Conditional expected values.

6 Hours

Unit - 4

Characteristic functions, Probability generating functions, Moment generating functions, Engg applications, Scalar quantization, entropy and source coding.

7 Hours

PART - B

Unit - 5

Pairs of Random variables, Joint CDF, joint PDF, Joint probability mass functions, Conditional Distribution, density and mass functions, EV involving pairs of Random variables, Independent Random variables, Complex Random variables, Engg Application.

7 Hours

Unit - 6

Multiple Random Variables: Joint and conditional PMF, CDF, PDF,.EV involving multiple Random variables, Gaussian Random variable in multiple dimension, Engg application, linear

prediction.

6 Hours

Unit - 7

Random Process: Definition and characterization, Mathematical tools for studying Random Processes, Stationary and Ergodic Random processes, Properties of ACF.

6 Hours

Unit - 8

Example Processes: Markov processes, Gaussian Processes, Poisson Processes, Engg application, Computer networks, Telephone networks.

6 Hours

Text Book:

1. **Probability and random processes: application to Signal processing and communication** – **S** L Miller and D C Childers Academic Press/ Elsivier 2004.

Reference Books:

1. **Probability, Random variables and stochastic processes**– Papoullis and S U Pillai: McGraw Hill 2002.
2. **Probability, Random variables and Random signal principles**– **Peyton** Z Peebles TMH

4th

Edition 2007.

3. **Probability, random processes and applications** – H Stark and Woods**:** PHI 2001.

Adaptive Signal Processing

Subject Code	:	**06EC664**
IA Marks		

:

25

No. of Lecture Hrs/ Week

:

04

Exam Hrs

:

03

Total no. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

Unit - 1

Adaptive Systems: Definition and characteristics, Areas of application, General properties, Open-and closed-loop adaptation, Applications of closed-loop adaptation, Example of an adaptive system.

4 Hours

Unit - 2

The Adaptive Linear Combiner: General description, Input signal and weight vectors, Desired response and error, the performance function, gradient and minimum mean-square error, Example of a performance surface, Alternative expression of the gradient, Decorrelation of error and input components.

6 Hours

Unit - 3

Properties Of The Quadratic Performance Surface: Normal of the input correlation matrix, Eigen values and Eigen vectors of the input correlation matrix, an example with two weights, geometrical significance of eigenvectors and Eigen values, a second example.

8 Hours

Unit- 4

Searching The Performance Surface: Methods of searching the performance surface, Basic ideal of gradient search methods, a simple gradient search algorithm and its solution, Stability and rate of convergence, The learning curve, Gradient search by Newton's method in multidimensional space, Gradient search by the method of steepest descent, Comparison of learning curves.

7 Hours

PART - B

Unit - 5

Gradient Estimation And Its Effects On Adaptation: Gradient component estimation by derivate measurement, the performance penalty, Derivative measurement and performance

penalties with multiple weights, variance of the gradient estimate, effects on the weight-over solution, excess mean-square error and time constants, mis adjustment, comparative performance of Newton's and steepest-descent methods, Total mis adjustment and other practical considerations.

8 Hours

Unit - 6

The LMS Algorithm: Derivation of the LMS algorithm, convergence of the weight vector, an example of convergence, learning curve, noise in the weight-vector solution, misadjustment, performance.

5 Hours

Unit - 7

Adaptive Modeling And System Identification: General description, Adaptive modeling of multipath communication channel, adaptive modeling in geophysical exploration, Adaptive modeling in FIR digital filter synthesis.

5 Hours

Unit - 8

Adaptive Interfacing Canceling: The concept of adaptive noise canceling, stationary noise-canceling solutions, effects of signal components in the reference input, The adaptive interference canceller as a notch filter, The adaptive interface canceller as a high-pass filter, Effects of finite length and causality, multiple-reference noise canceling.

7 Hours

Text Book:

1. Stearns**, Adaptive Signal Processing**– Bernard Widrow and Samuel D., Pearson Education Asia, 2001.

Reference Books:

1. **Adaptive filter Theory**– Simon Haykin, , 4e, Pearson Education Asia, 2002.
2. **Theory and Design of Adaptive Filters** – Jophn R. Treichler C. Richard Johnson, Jr. and Michael G. Larimore, Pearson education/PHI

2002.

Low Power VLSI Design

Subject Code	:	**06EC665**
IA Marks	:	25

No. of Lecture Hrs/ Week	
:	
04	
Exam Hrs	
:	
03	
Total no. of Lecture Hrs.	
:	
52	
Exam Marks	
:	
100	

PART - A

Unit - 1

INTRODUCTION: Sources of power dissipation, designing for low power. Physics of power dissipation in MOSFET devices – MIS Structure, Long channel and sub-micron MOSFET, Gate induced Drain leakage.

6 Hours

Unit - 2

Power dissipation in CMOS : Short circuit dissipation, dynamic dissipation, Load capacita nce. Low power design limits

- Principles of low power design, Hierarchy of limits, fundamental limits, Material, device, circuit and system limits.

8 Hours

Unit – 3 & 4

Synthesis for Low power: Behavioral, Logic and Circuit level approaches, Algorithm level transforms, Power-constrained Least squares optimization for adaptive and non-adaptive filters, Circuit activity driven architectural transformations, voltage scaling, operation reduction and substitution, pre- computation, FSM and Combinational logic, Transistor sizing.

12 Hours

PART - B

Unit – 5 & 6

Design and Test of Low-Voltage CMOS Circuits: Introduction, Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing

short channel effect, Low voltage design techniques using reverse V

gs

, steep subthreshold swing and multiple threshold voltages, Testing with elevated intrinsic leakage, multiple supply voltages.

12 Hours

Unit - 7

Low energy computing: Energy dissipation in transistor channel, Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core, Design of peripheral circuits – address decoder, level shifter and I/O Buffer, supply clock generation.

8 Hours

Unit - 8

Software design for low power: Introduction, sources of power dissipation, power estimation and optimization.

6 Hours

Text Book:

1. **Low-Power CMOS VLSI Circuit Design** – Kaushik Roy and Sharat C Prasad, Wiley Inter science, 2000.

MODERN CONTROL THEORY

Subject Code	:	06EC666
IA Marks	:	25

No. of Lecture Hrs/ Week	
:	
04	
Exam Hrs	
:	
03	
Total no. of Lecture Hrs.	
:	
52	
Exam Marks	
:	
100	

PART - A

Unit - 1

Linear Spaces and Linear Operators : Introduction, Fields, Vectors and Vector Spaces, Linear Combinations and Bases, Linear Transformations and Matrices,

Scalar Product and Norms, Solution of

Linear Algebraic Equations, Eigen values, Eigen vectors and a Canonical-Form,

Functions of a Square Matrix.

7 Hours

Unit - 2

State Variable Descriptions: Introduction, The Concept of State, State Equations for Dynamic Systems, Time-Invariance and Linearity, Non uniqueness and State Model, State diagrams.

6 Hours

UNIT - 3

Physical Systems and State ASSIGNMENT: Introduction, Linear Continuous-Time Models, Linear Discrete-Time Models, Nonlinear Models, Local Linearization of Nonlinear Models, and Plant Models of some Illustrative Control Systems.

6 Hours

UNIT - 4

Solutions of State Equations: Introduction, Existence and Uniqueness of Solutions to Continuous –Time State Equations, Solution of Nonlinear Continuous-Time Equations, Solution of Linear Time-Varying Continuous –Time State Equations, Solution of Linear Time-Invariant continuous-Time State Equations, Solution of Linear Discrete-Time State Equations, State Equations of Sampled –Data Systems.

7 Hours
PART-B

Unit - 5

Controllability and Observability: Introduction, General Concept of Controllability, General Concept of Observability, Controllability Tests for Continuous-Time Systems, Observability Tests for Continuous- Time Systems, Controllability and Observability of Discrete-Time Systems, Controllability and Observability of State Model in Jordan Canonical Form, Loss of Controllability and Observability due to Sampling, Controllability and Observability, Canonical Forms of State Model.

7 Hours

Unit - 6

Relationship between State Variable and Input-Output Descriptions: Introduction, Input-output Maps from State Models, Output Controllability, Reducibility, State models from Input-Output Maps.

7 Hours

Unit -7

STABILITY: Introduction, Stability Concepts and Definitions, Stability of Linear Time- Invariant Systems, Equilibrium Stability of Nonlinear Continuous-Time Autonomous Systems, The Direct Method of Lyapunov and the Linear Continuous-Time Autonomous Systems, Aids to Finding Lyapunov Functions for Nonlinear Continuous-Time Autonomous Systems, Use of Lyapunov Functions to Estimate Transients, The Direct Method of Lyapunov and the Discrete-Time Autonomous Systems.

6 Hours

Unit - 8

Model Control: Introduction, Controllable and Observable Companion Forms, The effect of State Feedback on Controllability and Observability, Pole Placement by State Feedback, Full-Order Observers, Reduced-Order Observers, Deadbeat Control by State Feedback, Deadbeat Observers.

6 Hours

Text Book:

1. **Modern Control System Theory** – M. Gopal :–; 2nd Edition; New Age Int (P) Ltd. 2007

Reference Books:

1. **Modern Control System**– Richard Dorf & Robert Bishop – Pearson Education/ PHI.
2. **Modern Control Engineering** – K. Ogata - - Pearson Education / PHI

Digital Systems Design Using VHDL

Subject Code	:	**06EC667**
IA Marks	:	25
No. of Lecture Hrs/ Week	:	04
Exam Hrs		

:

03

Total no. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

Unit -1

Introduction: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.

7 Hours

Unit - 2

Designing With Programmable Logic Devices: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner.

6 Hours

Unit - 3

Design Of Networks For Arithmetic Operations: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider.

6 Hours

Unit - 4

Digital Design with SM Charts: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

7 Hours

PART - B

Unit - 5

Designing With Programmable Gate Arrays And Complex Programmable Logic Devices: Xlinx 3000 series FPGAs, Designing with FPGAs, Xlinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.

6 Hours

Unit - 6

Floating-Point Arithmetic: Representation of floating-point numbers, Floating-point multiplication, and other floating-point operations.

7 Hours

Unit - 7

Additional Topics In VHDL: Attributes, Transport and Inertial delays, Operator overloading, Multi-valued logic and signal resolution, IEEE-1164 standard logic, Generics, Generate statements, Synthesis of VHDL code, Synthesis examples, Files and Text IO.

7 Hours

Unit - 8

HDL Models For Memories And Buses:
Static RAM, A simplified 486 bus model, Interfacing memory to a microprocessor bus.

6 Hours

Text Books:

1. **Digital Systems Design is using VHDL** – Charles H. Roth. Jr:, , Thomson Learning, Inc, 9th reprint, 2006.

Reference Books:

1. **Fundamentals of Digital Logic Design with VHDL** – Stephen Brwon & Zvonko Vranesic, , Tata McGraw-Hill, New Delhi, 2nd Ed., 2007.

2. **Digital System Design with VHDL** – Mark Zwolinski, , 2 Ed, Pearson Education., 2004

3. **Digital electronics and Design with VHDL**– Volnei A Pedroni,. Elsivier Science, 2009