Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

B.Tech. 2nd Year (ECE)

Course Code: CEC104
Course Title: Analog Electronics

Programme: B.Tech.	**L:** 3 **T:**0 **P:** 2	**Credits:**4
Semester: 4	**Theory/Practical:** Theory	**Teaching Hours:** 45(L)+30(P) = 75hrs
Total Max. Marks: 150	**Continuous Assessment (CA) Marks:** 90	**End Semester Examination (ESE) Marks:** 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 30%		
Duration of End Semester Examination (ESE): 3 hours		
Course Type: Professional Core Course		

Prerequisites (if any): CEC201

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Comprehend the working and frequency response of multistage and tuned amplifiers using various coupling techniques.
2	Analyze and compare performance characteristics of large-signal amplifier classes and configurations.
3	Evaluate the impact of negative feedback on amplifier performance and analyze oscillator circuits
4	Interpret the characteristics and performance parameters of operational amplifier and use it in designing analog signal processing circuits for real-world applications.
5	Analyze and select appropriate DAC and ADC architectures for data conversion applications.
6	Verify underlying concepts and techniques in order to analyze and design analog systems through experimentation.

Contents

Part-A

Unit 1: Multistage Amplifiers **6(L) hrs**

Coupling of transistor amplifiers, frequency response of coupled amplifiers, Types of coupling: RC coupling, Transformer coupling, direct coupling. Tuned Amplifiers: single tuned, double tuned and stagger tuned amplifiers.

Unit 2: Large Signal Amplifiers **7(L) hrs**

Class A direct coupled with resistive load, Transformer coupled with resistive load, harmonic distortion, variation of output power with load, Push-pull amplifiers: Operation of Class A, Class B, Class AB, Crossover distortion in Class B, Transistor phase inverter, Complementary- symmetry amplifier.

Unit 3: Feedback Amplifiers **10(L) hrs**

Types of feedback, effect of negative feedback on gain, input impedance, output impedance, bandwidth, stability, distortion and frequency response, voltage series, current series, voltage shunt, current shunt feedback circuits and their analysis, Sinusoidal oscillators, Criterion for oscillation, Different types of oscillators: RC Phase Shift, Wein Bridge, Hartley, Colpitt, Crystal Oscillators and Derivation of frequency for these oscillators.

Part-B

Unit 4: Op-Amp Theory **8(L) hrs**

Introduction, Differential Amplifier- Basic Circuit and its operation, Differential Amplifier circuit configurations- their dc analysis, Current mirror circuit, Block diagram of an Op-Amp, schematic symbol, Ideal Op-amp and its characteristics, Ideal voltage transfer characteristics, performance parameters of an Op-Amp, Input bias current, input offset current, output offset voltage, differential gain, common mode gain, CMRR,SVRR.

Unit 5: Applications of Op-Amp **8(L) hrs**

Basic configuration of Op-Amp-Differential, Inverting & Non-inverting, Integrator, differentiator, summing amplifier, Basic comparator, Zero crossing detector, Schmitt trigger, Active filters: Low pass, High pass, Band pass and Band stop, Square wave generator, Triangular wave generator, IC 555 timer: Block diagram and its operation, IC 555 as a monostable multivibrator.

Unit 6: DACs and ADCs **6(L) hrs**

Digital to Analog Convertors (DAC): Weighted resistor, R-2R ladder. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash type.

Laboratory Work

Experiment No.	Experiment Title
1	To demonstrate RC, transformer and direct coupling technique for transistor amplifier.
2	To plot frequency response of a tuned amplifier.
3	To plot the characteristics of Class A, B and AB push pull amplifier and calculate efficiency.
4	To analyze the effect of negative feedback on amplifier gain.
5	To observe the response of RC phase shift oscillator and determine frequency of oscillation.
6	To observe the response of Hartley oscillator and determine frequency of oscillation.
7	To observe the response of Colpitts oscillator and determine frequency of oscillation.
8	To observe the response of Wein Bridge oscillator and determine frequency of oscillation.
9	To measure the output of an op-amp in the inverting and non-inverting configuration.
10	To measure the output of an op-amp in the differential amplifier configuration.
11	To measure the output of summing, scaling and averaging op-amp circuits.
12	To measure the output of op-amp as an integrator and differentiator.
13	To design low-pass, high-pass and band-pass 1st order Butterworth active filters using op-amp.
14	To verify the operation of an op-amp as Schmitt trigger.

15	To implement Digital to Analog Converter and Analog to Digital Converter.
16	a. To design a touch sensor circuit using BJT transistor. b. To design a Sound-Activated Switch Using BJT transistor. c. To design a Light Sensor Using BJT (LDR + BJT).

Mini Project: Student has to do an experiment no. 16 or any other as suggested by course coordinator independently as project.

Text Books

1. J. Millman, C. Halkias and C. D. Parikh, "Integrated Electronics: Analog and Digital Circuits and Systems", McGraw Hill Education, 2nd Edition, 2010.
2. R. Gayakwad, "Op-Amp and Linear Integrated Circuits", Pearson prentice hall.
3. R. P. Jain, Modern Digital Electronics, Tata McGraw–Hill Education Pvt. Limited, New Delhi.
4. Laboratory Manuals

Reference books

1. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 2011.
2. A. Malvino and D. J. Bates, "Electronic Principles", Tata McGraw-Hill, 7th Edition, 2007.
3. T. L. Floyd, "Electronic Devices", Pearson Education, 9th Edition, 2012.
4. R. Boylested and L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall of India, 10th Edition, 2009.
5. R.F Coughlin and F.F Driscoll, "Operational Amplifier and Linear Integrated Circuits", Prentice Hall.
6. Malvino, "Electronic principles", Tata McGraw-Hill Publications.
7. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 5 ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.

Online Learning Materials

1. https://nptel.ac.in/courses/117108486 Accessed on 30/04/2025
2. https://www2.mvcc.edu/users/faculty/jfiore/OpAmps/OperationalAmplifiersAndLinearICs_3E.pdf Accessed on 30/04/2025
3. https://www.scribd.com/document/356463964/Linear-Integrated-Circuit-2nd-Edition-D-Roy-Choudhary-pdf Accessed on 30/04/2025

Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1.	Analog Circuits	Prof. A.N. Chandorkar	IIT, Bombay	https://nptel.ac.in/courses/117101106
2.	Analog Circuits	Dr. Pramod Agarwal	IIT, Roorkee	https://nptel.ac.in/courses/117107094

Guru Nanak Dev Engineering College, Ludhiana

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B.Tech. 2nd Year (ECE)

Experiments to be performed through Virtual Labs

Sr. No.	Experiment Name	Experiment Link(s)
1	Study of basic properties of operational amplifier: inverting and non-inverting amplifiers	https://be-iitkgp.vlabs.ac.in/exp/non-inverting-amplifiers/
2	To study the following mathematical operations using Operational Amplifier (a) Addition (b) Subtraction (c) Multiplication/division by a constant	https://ade2-iitr.vlabs.ac.in/exp/mathematical-operations/
3	Study of Differentiator and Integrator using Operational Amplifier	https://be-iitkgp.vlabs.ac.in/exp/operational-amplifier/
4	To design a Touch sensor circuit using Bipolar Junction Transistor (BJT)	https://ade2-iitr.vlabs.ac.in/exp/bjt-transistor/

Guru Nanak Dev Engineering College, Ludhiana

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B.Tech. 2nd Year (ECE)

Course Code: CEC105
Course Title: Control Systems

Programme: B.Tech.	**L:** 3 **T:**1 **P:** 0	**Credits:** 4
Semester: 4	**Theory/Practical:** Theory	**Teaching Hours:** 45(L)+15(T)= 60 hrs
Total Max. Marks: 100	**Continuous Assessment (CA) Marks:** 40	**End Semester Examination (ESE) Marks:** 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 60%		
Duration of End Semester Examination (ESE): 3 hours		
Course Type: Professional Core Course		

Prerequisites (if any): CEC202

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Classify control systems and understand the role of Laplace Transform in system analysis.
2	Use different techniques for mathematical modelling of various types of physical systems.
3	Evaluate the time-domain response of low order systems and analyze steady-state errors.
4	Assess system stability using Routh-Hurwitz criterion, root locus techniques, and frequency domain approaches, including Bode plots.
5	Design a stable network meeting desired needs within realistic constraints using concept of feedback compensation.
6	Demonstrate the domain knowledge of various control system components such as potentiometers, tachometers, servo motors and synchros.

Contents

Part-A

Unit-1 Introduction **4(L) hrs**

An Example of Control Action, General Classification: Open loop and Closed loop control systems, Elements of Automatic Control Systems, Comparison between Open Loop and Closed Loop systems, Use of Laplace Transform in Control Systems, Laplace Transforms of Elementary Functions.

Unit-2 Mathematical Modelling **9(L) hrs**

Transfer function, Poles and Zeros of Transfer Function, Transfer Function and its relationship with Impulse Response, Procedure for determining the Transfer Function of a Control System, Block diagram method, Signal flow Graphs, Mason's Gain Formula, Modelling of Physical Systems: Basic Elements, Electrical Networks, Mechanical Systems, Analogous System.

Unit-3 Time Domain Analysis **9(L) hrs**

Transient and Steady State Response, Standard Test signals, Transient response of first and second order systems, Time domain specifications, Steady-state Errors and Error constants, Control Actions: Proportional Control, Derivative Control, Integral Control, Proportional Plus Derivative Plus Integral Control (PID Control).

Part-B

Unit 4. Stability Analysis **8(L) hrs**

Stability in term of Characteristic equation of a Control System, Hurwitz Stability Criterion, Routh Stability Criterion, Root Locus technique, Construction of Root Locus.

Unit 5. Frequency Domain Analysis and System Compensation **11(L) hrs**

Transfer Function and Frequency Response of first order and second order systems, Correlation between Time Response and Frequency Response, Bode Plot, Calculation of Gain Margin and Phase Margin using Bode Plot. Compensation of Control Systems:Necessity of compensation, Lag, Lead, Lag-Lead Compensation.

Unit 6. Control System Components **4(L) hrs**

Potentiometers, Tachometers: AC and DC Tachometers, Servo motors: AC and DC Servo motors, Synchros.

Tutorial hours will be used for practice sessions for design/numerical problems/programming/case-studies etc. (as the case may be).

Text Books

1. B. S. Manke, "Linear Control Systems", Khanna Publishers, 12th Edition, 2016.
2. I.J. Nagrath and M. Gopal, "Control System Engineering", New Age International(P) Limited (formerly Wiley Eastern Ltd), 4th Edition, 2006.

Reference Books

1. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall, 5th Edition, 2021.
2. Syed Hasan Saeed, "Automatic Control Systems", S.K. Kataria & Sons, 9th Edition, 2017.
3. Norman S. Nise, "Control System Engineering", Wiley, 7th Edition, 2015.
4. A. Anand Kumar, "Control Systems", PHI Learning Pvt. Ltd., 2nd Edition, 2014.
5. AK Jairath, "Control Systems with Essential Theory", CBS Publishers, 6th Edition, 2023.

Online Learning Materials

1. **a.**https://ocw.mit.edu/courses/16-06-principles-of-automatic-control-fall-2012/pages/lecture-notes/
   b. https://ocw.mit.edu/courses/16-30-feedback-control-systems-fall-2010/pages/lecture-notes/
   Accessed on March 28, 2025
2. https://www.vssut.ac.in/lecture_notes/lecture1423904331.pdf
   Accessed on March 28, 2025
3. https://www.jbiet.edu.in/pdffls/EEE-Coursematerial/Control-Systems-Notes.pdf
   Accessed on March 28, 2025

Supplementary SWAYAM Course

SN.	Course Name	Instructor	Host Institute	URL
1	Control Engineering	Prof. Madan Gopal	IIT Delhi	https://nptel.ac.in/courses/108102043
2	Control System Design	Prof. Ravi Banavar	IIT Bombay	https://nptel.ac.in/courses/107101001

Guru Nanak Dev Engineering College, Ludhiana

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B.Tech. 2nd Year (ECE)

Course Code: ESEC101
Course Title: Object Oriented Programming and Data Structures

Programme: B.Tech.	**L:** 3 **T:**0 **P:** 2	**Credits:**4
Semester: 4	**Theory/Practical:** Theory	**Teaching Hours:** 45(L)+30(P) = 75hrs
Total Max. Marks: 150	**Continuous Assessment (CA) Marks:** 90	**End Semester Examination (ESE) Marks:** 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 40%		
Duration of End Semester Examination (ESE): 3 hours		
Course Type: Engineering Science Course		

Prerequisites (if any): ESC103

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Illustrate an understanding of object-oriented programming concepts such as classes, objects and encapsulation.
2	Apply dynamic memory management techniques using pointers and understand common issues like memory leaks and dangling pointers.
3	Develop programs using constructors, destructors, inheritance, polymorphism and type conversion.
4	Incorporate exception handling along with function and class templates for generic programming.
5	Evaluate problems involving data structure operations.
6	Design and implement codes to develop problem solving skills that incorporate the concepts of object-oriented programming and data structures using C++ programming.

Contents

Part-A

Unit 1. Object Oriented Programming Essentials **6(L) hrs**

Features of object-oriented programming, standard input/output, specifying a class, declaring objects, defining member functions: inside and outside class, access specifiers and their scope, static member variables.

Unit 2. Pointers and Dynamic Memory Management **5(L) hrs**

Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using new and delete operators, pointer to an object, this pointer, pointer related problems - wild pointers, dangling pointers, memory leaks and prevention.

Unit 3. Constructors, Destructors and Inheritance **10(L) hrs**

Need for constructors and destructors, types of constructors, constructors and destructors with static members, virtual destructors, initializer lists, introduction to inheritance, base classes and derived classes, public, private and protected inheritance, Types of inheritance,

overriding member functions, order of execution of constructors and destructors in inheritance.

Part-B

Unit 4. Polymorphism and Type Conversion **6(L) hrs**

Introduction, Concept of binding – Early binding and late binding, virtual functions, pure virtual functions, abstract classes, unary and binary operator overloading using member functions, introduction to type conversion and its types.

Unit 5. Exception Handling and Templates **4(L) hrs**

Exception handling mechanism: use of try, throw and catch block, function template, class template.

Unit 6. Data Structures **14(L) hrs**

Introduction to data structures, difference between linear and non-linear data structures, basic operations on data structures, algorithms: complexity, time-space trade-off, asymptotic notations. Arrays: Linear array and its representation, operations on linear arrays**,** representation of multi-dimensional arrays, sorting- bubble sort, Stacks: array representation of stacks, operations on stacks, Application of stacks – Evaluation of postfix expressions, Conversion from infix to postfix expressions, quicksort, Queues: introduction, representation using array, enqueue and dequeue operations, types of queue: circular queue, dequeue, priority queue.

Laboratory Work

Experiment No.	Experiment Title (Write all listed programs using C++)
1	To demonstrate the use of basic conditional control statements and loop control statements.
2	To demonstrate the use of static data members and const data members.
3	To implement the concept of classes and objects with member variables given under: (a) public access specifier (b) private access specifier
4	To demonstrate dynamic memory allocation using memory management operators.
5	To implement a program demonstrating (a) zero argument constructor (b) parameterized constructor (c) destructor
6	To demonstrate the use of initializer list in constructors.
7	To implement a program demonstrating concept of (a)single inheritance (b)hybrid inheritance (c)order of execution of constructor and destructor in inheritance

8	To demonstrate the use of both unary and binary operator overloading in C++.
9	To explore the concept of runtime polymorphism in C++ using the virtual keyword.
10	To implement and demonstrate exception handling, function templates and class templates.
11	To perform the following operations on a linear array: (a) insert a new element at end as well as at a given position (b) delete an element whose value is given or whose position is given (c) to find the location of a given element (d) to display the elements of a linear array
12	To implement push and pop operations on a stack using linear array.
13	To evaluate a postfix expression using stacks.
14	To implement insertion and deletion operations in a queue using linear array.
15	Implement any one C++ project out of the following: 1. Calculator for scientific operations 2. Student Database Management System 3. Login and Registration System

Mini Project: Student has to do any one part from experiment no. 15 or any other as suggested by course coordinator independently as project.

Text Books

1. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill.
2. R. Lafore, "Object Oriented Programming in C++", Waite Group.
3. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, Tata McGraw-Hill.
4. Laboratory Manuals.

Reference Books

1. B. Stroustrup, "The C++ Programming Language", Addison Wesley, Reading Mass, USA, 4th Edition, May 2013.
2. Ashok N.Kamthane, "Object Oriented Programming with ANSI & Turbo C++",Pearson education, Fourth impression, 2008.
3. Herbert Schildt, "The Complete Reference to C++ Language", McGraw Hill-Osborne.
4. B.F.Lippman, "C++ Primer", Addison Wesley.
5. Michael T. Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", Wiley India,2011.
6. Y. Langsam, M. J. Augenstein, A. M. Tanenbaum, "Data Structures using C and C++", PrenticeHall of India.2016.

Online Learning Materials

1. 1 https://faculty.ksu.edu.sa/sites/default/files/ObjectOrientedProgramminginC4thEdition.pdf

Accessed on: 30-04-25

2. https://archive.nptel.ac.in/courses/106/101/106101208/ Accessed on: 30-04-25
3. https://archive.nptel.ac.in/courses/106/105/106105151/ Accessed on: 30-04-25
4. https://arctest.dev.nptel.ac.in/courses/106/103/106103069/ Accessed on: 30-04-25
5. https://www.youtube.com/watch?v=YWnBbNj_G-U Accessed on: 30-04-25

Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1.	Programming in Modern C++	Prof. ParthaPratim Das	IIT Kharagpur	https://nptel.ac.in/courses/106105234
2.	Fundamentals of Object-Oriented Programming	Prof. Balasubramanian Raman	IIT Roorkee	https://onlinecourses.nptel.ac.in/noc25_cs34/preview

Experiments to be performed through Virtual Labs

Sr. No.	Experiment Name	Experiment Link(s)
1	To learn how decision making is done while programming.	https://cse02-iiith.vlabs.ac.in/exp/advanced-control-flow/objective.html
2	To learn how to use arrays for storing large amount of data.	https://cse02-iiith.vlabs.ac.in/exp/arrays/
3	Gain a basic understanding of Stacks and Queues as an abstract data type	https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html

Guru Nanak Dev Engineering College, Ludhiana

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B.Tech. 2nd Year (ECE)

Course Code: CEC106
Course Title: Network Theory

Programme: B.Tech.	**L:** 3 **T:** 1 **P:** 0	**Credits:**4
Semester: 4	**Theory/Practical:** Theory	**Teaching Hours:** 45(L)+15(T)= 60 hrs
Total Max. Marks: 100	**Continuous Assessment (CA) Marks:** 40	**End Semester Examination (ESE) Marks:** 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 40%		
Duration of End Semester Examination (ESE): 3 hours		
Course Type: Professional Core Course		

Prerequisites (if any): NIL

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Describe different types of signals used in electrical systems
2	Analyze the circuits using various network theorems
3	Analyze the transient and steady state response of networks using Laplace transforms
4	Synthesize two terminal networks
5	Design basic cut set and tie set matrices for planar networks
6	Formulate and design filter networks for different systems

Contents

Part-A

Unit-1 Circuit Concepts and Network Theorems **9(L) hrs**

Independent and dependent sources, signals and wave forms, step, ramp, impulse, doublet, loop currents and loop equations, Voltage division, current division, voltage and current source transformation, node voltage and node equations, network theorems, Superposition, Thevenin's, Norton's, Maximum power transfer, and Reciprocity.

Unit-2 Time and Frequency Domain Analysis **13(L) hrs**

Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted functions, transient and steady response, time domain behaviors from poles and zeros, convolution theorem.

Part-B

Unit-3 Network Synthesis **13(L) hrs**

Network functions, impedance and admittance function, transfer functions, relationship between transfer and impulse response, poles and zeros and restrictions, network function for two terminal pair network, sinusoidal network in terms of poles and zeros, realizability conditions for impedance synthesis of RL and RC circuits, network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Unit-4 FilterSynthesis **8(L) hrs**

Classification of filters, characteristics impedance and propagation constant of pure reactive network, ladder network, T-section, π-section, terminating half section, pass bands and stop bands, design of constant-K, m-derived filters, composite filters.

Unit-5 Network Topology **2(L) hrs**

Definitions, graph, tree, twigs, basic cut-set and basic tie set matrices for planar network.

Tutorial hours will be used for practice sessions for design/numerical problems/programming/case-studies etc. (as the case may be).

Text Books

1. A. Chakraborty, "Circuit Theory", Dhanpat Rai.
2. Sudhaker A. and Shyam Mohan S.P, "Circuits and Network Analysis and Synthesis" Tata McGrew Hill Co. Ltd., New Delhi, 1994.
3. Hyatt W.H. and Kemmerlay J.E., Engineering Circuits Analysis, McGrew Hill International Editions,1993.

Reference Books

1. J. Bird, "Electrical Circuit Theory and Technology", Newnes.
2. M. Nahvi, J. A. Edminister, "Electric Circuits (Schaum's outline series)", Tata McGraw Hill.
3. M. E. Van Valkenberg, "Network Analysis and Synthesis", PHI Learning.

Online Learning Materials

1. https://archive.org/details/NetworkAnalysisSynthesis

Accessed on April 3, 2025

Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Circuit Theory	Prof. SC Dutta Roy	IIT Delhi	http://nptel.ac.in/courses/108102042/

Guru Nanak Dev Engineering College, Ludhiana

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B.Tech. 2nd Year (ECE)

Course Code: CEC107
Course Title: VLSI Design with VHDL

Programme: B.Tech.	**L:** 3 **T:** 0 **P:** 2	**Credits:** 4
Semester: 4	**Theory/Practical:** Theory	**Teaching Hours:** 45(L)+30(P) = 75 hrs
Total Max. Marks: 150	**Continuous Assessment (CA) Marks:** 90	**End Semester Examination (ESE) Marks:** 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 30%		
Duration of End Semester Examination (ESE): 3 hours		
Course Type: Professional Core Course		

Prerequisites (if any): CEC203

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Comprehend the need of hardware description language and its features.
2	Make use of hardware description language VHDL to represent digital circuits.
3	Demonstrate the use of various architecture modelling styles of VHDL to design digital circuits.
4	Create digital circuit design at various levels of abstraction in VHDL.
5	Categorize and estimate various types of delays in the design of digital circuits.
6	Design and simulate combinational and sequential circuits using HDLs.

Contents

Part-A

Unit-1 Introduction to HDL **6(L) hrs**

Evolution of Computer-aided Digital Design, Emergence of HDLs, Typical VLSI design flow, Importance of Hardware description languages, VHDL vs Verilog, History of VHDL.

Unit-2 Basics of VHDL **10(L)hrs**

Features, Keywords, Identifiers, Entity declaration, Architecture body, Configuration declaration, Package declaration and body, Data Types, Data Object, Data Class, Operators.

Unit-3 Behavioral Modeling **7(L) hrs**

Process statement, Variable assignment statement, Signal assignment statement, statements: If-else, case, null, wait, loop, exit, next, inertial and transport delay.

Part-B

Unit-4 Dataflow Modeling **7(L)hrs**

Concurrent Signal Assignment Statement, Conditional Signal Assignment Statement, Selected Signal Assignment Statement, Block, Assert, Report Statement.

Unit-5 Structural Modeling **7(L) hrs**

Component Declaration, Component Instantiation, Programming examples: 9-bit parity generator, decade counter, 3-bit up-down counter.

Unit-6 Applications of VHDL **8(L)hrs**

Combinational Circuit Design such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc., Sequential Circuit Design such as Shift registers, Counters, Flip-flops etc.

Laboratory Work

Experiment No.	Experiment Title
1	To design basic gates using VHDL.
2	To design universal gates using VHDL.
3	To design half adder using VHDL.
4	To design full adder using VHDL.
5	To design half subtractor using VHDL.
6	To design full subtractor using VHDL.
7	To design encoder using VHDL.
8	To design decoder using VHDL.
9	To design 4:1 multiplexer using VHDL.
10	To design 1:4 demultiplexer using VHDL.
11	To design 4-bit binary to gray code converter using VHDL.
12	To design 2-bit magnitude comparator using VHDL.
13	To design flip-flops using VHDL.
14	To design counter using VHDL.
15	To design digital circuits using Boolean expression (Open ended experiment)

Text Books

1. J. Bhasker, "A VHDL Primer", 3rd Edition, Prentice Hall PTR, 2004.

Reference Books

1. D.L.Perry, "VHDL: Programming by Example", The McGraw-Hill Companies, Inc., 2002.
2. S.Brown and Z. Vranesic, "Fundamentals of Digital Logic with VHDL Design", 3rd Edition The McGraw-Hill Companies, Inc., 2009.
3. S. Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2nd Edition, Prentice Hall PTR, 2003.
4. S.Brown and Z. Vranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition The McGraw-Hill Companies, Inc., 2014.

Online Learning Materials

1. https://www.tutorialspoint.com/vlsi_design/vlsi_design_tutorial.pdf

   Accessed on 7April, 2025

2. https://www.eng.auburn.edu/~strouce/elec4200.html

   Accessed on 7April, 2025

Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Digital Circuits	Prof. Santanu Chattopadhyay	IIT Kharagpur	https://nptel.ac.in/courses/108105113

Guru Nanak Dev Engineering College, Ludhiana

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B.Tech. 2nd Year (ECE)

Course Code: CEC108
Course Title: Computer Networks

Programme: B.Tech.	**L:** 2 **T:** 0 **P:** 2	**Credits:** 3
Semester: 4	**Theory/Practical:** Theory	**Teaching Hours:** 30(L) = 30hrs
Total Max. Marks: 150	**Continuous Assessment (CA) Marks:** 90	**End Semester Examination (ESE) Marks:** 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 50%		
Duration of End Semester Examination (ESE): 3 hours		
Course Type: Professional Core Course		

Prerequisites (if any): Basic Information of computer networks

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Describe the concepts of networking and classify the different networks and their topologies.
2	Comprehend various flow and error control mechanism in networking.
3	Discuss the network protocols and apply this knowledge to make efficient networks
4	Demonstrate and analyze the impact of congestion in the network and apply appropriate techniques for congestion avoidance.
5	Design solutions for routing issues in the network.
6	Assess the security issues in the network and apply ethical principles to address them.

Contents

Part-A

Unit 1. Introduction **7(L) hrs**

Introduction to networking concepts, Network topologies: Bus, Ring, Star Mesh, Tree, Hybrid Categories of networks: LAN, MAN, WAN, Network Connecting Devices:Repeaters, Bridges, Hubs, Routers and Switches, OSI and TCP/IP reference Model.

Unit 2. Data Link Layer **6(L) hrs**

Framing and its methods, Error detection and correction codes: checksum, CRC, hamming code, sliding window protocols: One-Bit Sliding Window Protocol, Protocol Using Go Back n, Protocol Using Selective Repeat.

Unit 3. Network layer and switching technologies **6(L)hrs**

Internet Protocol & IP Addresses, Structure of IP, Logical addressing IPV4, IPV6, Multiple Access

Protocols: ALOHA, Carrier Sense Multiple Access, Switching technologies: Circuit switching, Message Switching and Packet switching.

Part-B

Unit-4 Congestion Control in Data Networks **5(L) hrs**

Congestion, causes of congestion, Effects of Congestion, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets.

Unit-5 Routing Technologies **6(L) hrs**

The optimality principle, sink tree formation, shortest path routing and solution of network problems using Dijkstra's Algorithm, Routing protocols: Distance Vector Routing, Hierarchical Routing,Routing for Mobile Hosts.

Laboratory Work

Experiment No.	Experiment Title
1.	To connect the computers in local area network
2.	To implement basic network commands and network configuration commands (ping, tracert, ipconfig, hostname, pathping, nslookup, arp)
3.	To Perform an Initial Switch Configuration.
4.	To Perform an Initial Router Configuration
5.	To Connect a Switch in a network.
6.	To implement the Cisco IOS show Commands.
7.	To Examine WAN Connections.
9.	To Implement an IP Addressing Scheme.
10	To Observe Static and Dynamic Routing.
11	To Configure Ethernet and Serial Interfaces
12	To Configure a Cisco Router as a DHCP Server

Text Books

1. B. A. Forouzan, "Data Communications and Networking", Tata Mcgraw-Hill, 5th edition, 2004.
2. A.S. Tanenbaum, "Computer Networks", Pearson Education, 4th edition, 2011.

Reference Books

1. W.Stallings, "Data and Computer Communication", Prentice Hall, 6th edition, 2002.
2. D. P. Bertsekas, "Data Networks", Prentice Hall, 2nd edition, 1992.
3. K. C. Mansfield and J. L. Antonakos , "An Introduction to Computer Networking", PHI.2001

Online learning material

1.http://cnp3book.info.ucl.ac.be/2nd/cnp3bis.pdf Accessed on 12 June, 2025
2. https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf Accessed on 12 June, 2025

Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Computer Networks and Internet Protocol	Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty	IIT Kharagpur	https://nptel.ac.in/courses/106105183

Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

B.Tech. 2nd Year (ECE)

MCEC101

Course Title: Environmental Science and Sustainability

Programme: B.Tech.	**L:** 2 **T:** 0 **P:** 0	**Credits:** Non-Credit
Semester: 4	**Theory/Practical:** Theory	**Teaching Hours:** 30(L) = 30hrs
Total Max. Marks: 50	**Continuous Assessment (CA) Marks:** 50	**End Semester Examination (ESE) Marks:** 0
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 0%		
Duration of End Semester Examination (ESE): NA		
Course Type: Mandatory Course (Non-Credit)		

Prerequisites (if any): NIL

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Evaluate local, regional and global environmental topics related to resource use and management.
2	Recognize and understand the natural resources, ecosystem and their conservation.
3	Interpret the causes, effects and control measures of environmental pollution and natural disaster.
4	Analyze the renewable energy sources, their working principles, benefits, challenges, and applications for sustainable development and climate change mitigation.
5	Illustrate different goals of sustainable development and apply them for suitable technological advancement and societal development.
6	Describe the implication of e-waste on environment and its potential solutions.

Contents

Part-A

Unit-1 Natural Resources and Eco Systems **4(L) hrs**

Natural resources: Introduction, classification, conservation and human impact. Ecosystem: Structure and function of an ecosystem, Producers, consumers, decomposers, Energy flow in the ecosystems, Ecological succession, Food chains, food webs and ecological pyramids.

Unit-2 Environmental Pollution **5(L) hrs**

Definition, causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Unit-3 Renewable Sources of Energy: **5(L) hrs**

Energy management and conservation, New energy sources: Need of new sources, different types of new energy sources, Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion, solar energy, biomass energy, geothermal energy, concept of energy harvesting.

Part-B

Unit-4 Sustainability and Management **9(L) hrs**

Sustainability: concept needs and challenges. Sustainable Development Goals: targets, indicators and policies. Sustainable resource management, Climate change- Global, regional and local environment issues and possible solutions-case studies. Concept of carbon credit, carbon footprint. Concept of sustainable smart cities, role of IoT, Artificial intelligence and robotics, Artificial intelligence in sustainable smart cities, green manufacturing.

Unit-5 E-Waste Management **7(L) hrs**

Meaning of e-waste, composition of e-waste and its generation, pollutants from e-waste, impact of e-waste on humans and environment, different approaches for collection and management of e-waste, e-waste management guidelines of government of India.

Text Books

1. W.P Cunningham and M.A. Cunningham, "Principles of Environmental Science: Inquiry and Applications", McGraw-Hill Education, 10th Edition, 2019.
2. R.E. Hester and R.M. Harrison, "Electronic Waste Management: Design, Analysis and Application,Issues in Environmental Science and Technology, Volume 27, Royal Society of Chemistry (RSC Publishing), 2009.
3. David T. Allen and David R. Shonnard, "Sustainability Engineering: Concepts, Design and Case Studies",Pearson Education, 1stEdtion, 2011.
4. Bradley A. Striebig, Adebayo A. Ogundipe, and Maria Papadakis, "Engineering applications in sustainable design and development, Cengage Learning, 1st Edition, 2015.
5. Majeti Narasimha Vara Prasad, Meththika Vithanage, Anwesha Borthakur, "Handbook of Electronic Waste Management International Best Practices and Case Studies", Butterworth-Heinemann (an imprint of Elsevier).

Reference Books

1. D D Mishra, "Fundamental concepts in Environmental Studies", S Chand & Co Ltd, 2nd Edition, 2010.
2. Anubha Kaushik and C.P. Kaushik, "Perspectives in Environmental Studies", New Age International Publishers, 7th Edition, 2023.
3. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2016.
4. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Prentice Hall, 2004.
5. K.M. Mackenthun, "Basic Concepts in Environmental Management", Lewis Publication, London, 1998.

Online Learning Materials

1. edu.in/academics/mech/LectureNote/GE3451-LN.pdf Accessed on April 22, 2025
2. https://drive.google.com/file/d/1pg1dOKjAeFoKrnwLzKpl-hkyCA2ZOdml/view Accessed on April 22, 2025
3. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://vardhaman.org/wp-content/uploads/2021/03/ENVIRONMENTAL-SCIENCE-1.pdf Accessed on April 22, 2025
4. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.pietech.edu.in/doc/Lecture%20Notes/Civil/IV%20Sem/GE3451%20EVSS%20Civil.pdf Accessed on April 22, 2025

5. https://www.indiacode.nic.in/handle/123456789/1362/simplesearch?query=S.O.%201533%20(E)%20dated%2014.09.2006%20%20Environment%20Impact%20Assessment%20Notification,%202006&searchradio=notification#:~:text=(1)%20Subject%20to%20the%20provisions,controlling%20and%20abating%20environmental%20pollution Accessed on April 22, 2025

Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1.	Environmental Science	Prof. Sudha Goel, Prof. Shamik Chowdhury	IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2.	Environmental Studies	Dr. Monica Jain	Devi AhilyaViswavidyalaya, Indore	https://onlinecourses.swayam2.ac.in/cec24_ge05/preview
3.	Introduction to Environmental Engineering and Science - Fundamental and Sustainability Concepts	Prof. Brajesh Kumar Dubey	IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc22_ge06/preview
4.	Environmental Science	Dr. T.V. Ramachandra	IISc Bangalore	https://archive.nptel.ac.in/courses/120/108/120108004/#
5.	Electronic Waste Management - Issues and Challenges	Prof. Brajesh Kumar Dubey	IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc21_ce03/preview