

**NOIDA INTERNATIONAL UNIVERSITY**



**SCHOOL OF ENGINEERING & TECHNOLOGY**  
**EVALUATION SCHEME & SYLLABUS**

**FOR**

**BACHELOR OF TECHNOLOGY**

**Computer Science & Engineering/Information Technology**

**(3<sup>rd</sup> Year Syllabus)**

**(4 Year Course)**

**W.E.F Session 2021-22 onwards**

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**FIFTH SEMESTER**

COURSE		Contact Hours/Week			Credit	% of Total Marks				
Code	Course Title	L	T	P		CA	TA	Int. Total	Ext.	Total
ESC-501	Signal & Systems	3	0	0	3	20	20	40	60	100
PCC-CS501	Database Management Systems	3	0	0	3	20	20	40	60	100
PCC-CS502	Formal Language & Automata Theory	3	0	0	3	20	20	40	60	100
PCC-CS503	Object Oriented Programming	2	0	0	2	20	20	40	60	100
	Elective I	3	0	0	3	20	20	40	60	100
HSMC501	Management I(OB/F&A*)	3	0	0	3	20	20	40	60	100
<b>PRACTICALS</b>										
PCC-CS501P	Database Management Systems Lab	0	0	4	2	20	20	40	60	100
PCC-CS503P	Object Oriented Programming Lab	0	0	4	2	20	20	40	60	100
PROJ-CS50	Industrial Seminar**	0	0	6	3	20	20	40	60	100
<b>Total</b>		<b>17</b>	<b>0</b>	<b>14</b>	<b>24</b>					
<b>SIXTH SEMESTER</b>										
PCC-CS601	Compiler Design	3	0	0	3	20	20	40	60	100
PCC-CS602	Computer Networks	3	0	0	3	20	20	40	60	100
	Elective II	3	0	0	3	20	20	40	60	100
	Elective III	3	0	0	3	20	20	40	60	100
OEC001	Soft Skills & interpersonal Communication	3	0	0	3	20	20	40	60	100
MC601	Constitution of India/Essence of Indian traditional knowledge	0	0	0	0	20	20	40	60	100
<b>PRACTICALS</b>										
PCC-CS601P	Compiler Design	0	0	4	2	20	20	40	60	100
PCC-CS602P	Computer Networks	0	0	4	2	20	20	40	60	100
PROJ-CS60	Project –I**	0	0	6	3	20	20	40	60	100
<b>Total</b>		<b>15</b>	<b>0</b>	<b>14</b>	<b>22</b>					

\*OB/F&A- Organizational Behavior/ Finance & Accounting

\*\*The marks will be awarded on the basis of 06 weeks industrial training conducted after 4th semester

**Course Code:** ESC501

**Course Name:** Signals and System

**Course Credit:** 3

**Total Contact Hour:** 40hr

**Course Objective:**

- Understanding the fundamental characteristics of signals and systems.
- Understanding the concepts of vector space, inner product space and orthogonal series.
- Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
- Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

**Course Description:**

This course covers the fundamentals of signal and system analysis, focusing on representations of discrete-time and continuous-time signals (singularity functions, complex exponentials and geometrics, Fourier representations, Laplace and Z transforms, sampling) and representations of linear, time-invariant systems (difference and differential equations, block diagrams, system functions, poles and zeros, convolution, impulse and step responses, frequency responses). Applications are drawn broadly from engineering and physics, including feedback and control, communications, and signal processing.

**Course Content:-**

**UNIT 1** Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

**UNIT 2** Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input- output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response,

**UNIT 3** Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases,

**UNIT 4** The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior.

**UNIT 5** The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.

**UNIT 6** State-space analysis and multi- input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

**Course Learning Outcomes(CLO):-**

At the end of this course students will demonstrate the ability to

- CO1: Apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.
- CO2: Analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
- CO3: Classify systems based on their properties and determine the response of LSI system using convolution.
- CO4: Analyze system properties based on impulse response and Fourier analysis.
- CO5: Apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.
- CO6: Understand the process of sampling and the effects of under sampling.

**Text books:**

1. A.Anand Kumar, "Signals and Systems", Second edition, PHI Learning Private Limited,2012.
2. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

**Reference books:**

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
2. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
3. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
4. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
5. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.

6. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
7. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

**Course Code :** PCC CS 501

**Course Name :** Database Management System

**Course Credit Hour :** 3

**Total Contact Hour :** 55hr

### **Course Objective:**

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
- To understand and use data manipulation language to query, update, and manage a database
- To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data ware housing.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

### **Course Description:**

Focuses on concepts and structures necessary to design and implement a database management system. Various modern data models, data security and integrity, and concurrency are discussed. An SQL database system is designed and implemented as a group project.

### **Course Contents:**

**Module 1: Database system architecture:** DataAbstraction,DataIndependence,DataDefinition Language(DDL), Data Manipulation Language(DML).

**Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulationoperations.

**Module 2: Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver.

**Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Losslessdesign.

**Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

**Module 3: Storage strategies:** Indices, B-trees, hashing.

**Module 4: Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

**Module 5: Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

#### **Module 6:**

**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

### **Course Learning Outcomes (CLOs):**

CLO1. For a given query write relational algebra expressions for that query and optimize the developed expressions

CLO2. For a given specification of the requirement design the databases using E R method and normalization.

CLO3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.

CLO4. For a given query optimize its execution using Query optimization algorithms

CLO5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

CLO6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

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**Text books :**

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts" , 6th Edition, McGraw-Hill, 9780078022159, 0078022150.

**Reference books :**

- 1 J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol 1, Computer Science Press, 788175155459, 8175155450
- 2 R. Elmasri and S. Navathe, "Fundamentals of Database Systems" , 5th Edition, Pearson Education 9788131716250, 8131716252
- 3 Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley "Foundations of Databases", 9780201537710, 0201537710

**Online links for study & reference materials:**

<https://www.geektonight.com/database-management-systems-notes-pdf>

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Mid exam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

**Course Code:** PCC-CS502

**Course Name:** Formal Languages and Automata

**Course Credit Hour:** 3hr

**Total Contact Hour:** 35 hr

**Course Objective:**

- Develop a formal notation for strings, languages and machines.
- Design finite automata to accept a set of strings of a language.
- Prove that a given language is regular and apply the closure properties of languages.
- Design context free grammars to generate strings from a context free language and convert them into normal forms.
- Prove equivalence of languages accepted by Push down Automata and languages generated by context free grammars
- Identify the hierarchy of formal languages, grammars and machines.
- Distinguish between computability and non-computability and Decidability and Undecidability.

**Course Description:**

- The course introduces fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.

**Course Contents:**

**Unit – I** Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem

**Unit – II** Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen’s Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

**Unit – III** Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

**Unit – IV** Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA

**Unit – V** Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church’s Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

**Course Learning Outcomes (CLOs):**

On completion of the course students will be able to:

- **CLO-1:** Write a formal notation for strings, languages and machines.
  - **CLO-2:** Design finite automata to accept a set of strings of a language.
  - **CLO-3:** Determine whether the given language is regular or not.
  - **CLO-4:** Design context free grammars to generate strings of context free language.
  - **CLO-5:** Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars.
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**Text books:**

- Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education .
- K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.
- Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
- Y.N.Singh "Mathematical Foundation of Computer Science", New Age International.

**Reference books:**

- K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education.
- Harry R. Lewis and Christos H. Papadimitriou, Elements of the theory of Computation, Second Edition, Prentice-Hall of India Pvt. Ltd.
- Micheal Sipser, "Introduction of the Theory and Computation", Thomson Learning.

**Online links for study & reference materials:**

- <https://nptel.ac.in/courses/106/106/106106049/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment-1	- 05%
Assignment-2	- 05%
Assessment-3(Midexam	- 20%
Assignment-4	- 05%
Assignment-5/Quiz	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>



**Course Code :** PCC CS 503

**Course Name :** Object Oriented Programming

**Course Credit Hour :** 2

**Total Contact Hour :** 30

**Course Objective:** The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, and an appropriate framework for automated unit and integration tests.

**Course Description:** Object-oriented programming represents the integration of software components into a large-scale software architecture. The course focuses on the understanding and practical mastery of object-oriented concepts such as classes, objects, data abstraction, methods, method overloading, inheritance and polymorphism.

**Course Contents:**

**Module 1: Introduction:** The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, importance of modeling, principles of modeling, object oriented modeling, Introduction to UML, conceptual model of the UML, Architecture.

**Module II : Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams, depict a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages.

**Basic Behavioural Modeling:** Use cases, Use case Diagrams, Activity Diagrams, State Machine , Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram.

**Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams

**Module- III : Object Oriented Analysis:** Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations.

**Structured analysis and structured design (SA/SD):** Jackson Structured Development (JSD). Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance, associations encapsulation.

**Object oriented programming style:** reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation.

**Module- IV : Introduction to OOP language:** History, Features, Object Oriented concepts, Classes and Objects, Inheritance, Packages, Interface , abstract method and classes, Polymorphism, Inner classes, String Handling, I/O , Networking, Event Handling. Multithreading, Collection, APIs,

**Module –V: Swing:** Introduction to AWT, AWT v/s Swing, Creating a Swing Applet and Application. Utility of internet programming language, JDBC, The connectivity model, JDBC/ODBC Bridge, Introduction to servlets.

**Course Learning Outcomes (CLOs):**

CLO1. Specify simple abstract data types and design implementations, using abstraction functions to document them.

CLO2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.

CLO3. Name and apply some common object-oriented design patterns and give examples of their use.

CLO4. Design applications with an event-driven graphical user interface.

**Text books :**

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1. Liskov, John Guttag, *Program Development in Java*, Addison-Wesley, 2001, 780201657685, 0201657686
2. E Balagurusamy, *Programming with Java*, McGraw-Hill Education, 9789353162337, 9353162335

### Reference books :

1. James Rumbaugh et al, "Object Oriented Modeling and Design", PHI . 9788131711064, 8131711064
2. Mark Priestley "Practical Object-Oriented Design with UML", TMH .
3. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education . 9788177583724, 8177583727
4. Naughton, Schildt, "The Complete Reference JAVA2", TMH .

### Online links for study & reference materials:

<https://sites.google.com/a/mes.ac.in/oopm/lecture-notes>

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Mid exam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

**Course Code:** HSMC 501

**Course Name:** Organization Behavior

**Course Credit Hour:** 3Hr

**Total Contact Hour:** 30hr

**Course Objective:**

- The student will acquire knowledge of organizational behavior including workplace environment, leadership skills, and organization management.
- To enhance the understanding of the dynamics of interactions between individuals and the organization. To facilitate a clear perspective to diagnose and effectively handle human behavior issues in Organization and to develop greater insight into their behavior in interpersonal and groups and team.

**Course Description:**

- This course introduces the fundamental of organizational behavior includes important insights about motivation, leadership, perception, and learning theories.

**Course Contents:**

**Unit 1: Introduction of OB:** (6 lectures)

The concept and nature of OB, need to understand human behavior, Its significance, and impact, Challenges, and opportunities.

**Unit 2: Individual dimensions of behavior:** (8 lectures)

Individual characteristics, Ability, Values, Attitudes, Formation, Organization related attitude, Relationship between attitude and behavior, Personality, Types, Determinants and traits, learning and Learning theories, Motivation and Motivation theories.

**Unit 3: Group behavior and team development:** (8 lectures)

Concept of groups and group dynamics, Types of groups, Formal and Informal group, Stages of group development, Group cohesiveness, Group decision making, Concept of team vs group, Types of teams, Managing teams.

**Unit 4: Organizational culture and conflict management:** (8 lectures)

Organizational culture, Leadership: What is leadership, types of leaders and leadership styles, traits and qualities of an effective leader, managing conflicts, resolution of conflicts, Change management.

**Course Learning Outcomes (CLOs):**

CLO-1: Develop the basic concept of organization and types.

CLO-2: Inculcate skills and understand behavior.

CLO-3: To understand group behavior and emotional development.

CLO-4: To understand organization culture and management.

**Textbooks:**

- (i) Fred Luthans, —Organizational BehaviorI, 12th Edition, McGraw Hill International Edition
- (ii) Stephen P. Robbins, —Organizational BehaviorI, 12th Edition, Prentice Hall
- (iii) Aswathappa K, —Organizational Behavior (Text, Cases, and Games)I, Himalaya Publication

**Reference books:**

1. Udai Pareek, —Organizational BehaviorI, Oxford University Press

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

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Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%
Assignment-3/Quiz-1	- 05%
Assignment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

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<b>PCC-CS 501P</b>	<b>Database Management System Lab</b>	<b>0L:0T:4P</b>	<b>2 Credits</b>
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### **LIST OF PROGRAMS**

Software Required: Open Source Software - SQL

1. Introduction to MySQL, An exercise on data types in My SQL and DDL commands.
  2. Exercise on DML and TCL commands.
  3. Exercise on Types of Data Constraints.
  4. Exercise on single and multiple table join and using Normalization.
  5. Exercise on Order by and Group by Clause and Data arithmetic.
  6. Exercise on different functions(Aggregate, math, string)
  7. Exercise on Different types of Sub queries.
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PCC-CS5033P	Object Oriented Programming Lab	0L:0T:4P	2 Credits
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### **List Of Practical**

1. To become familiar with classes that represents entities that can interact with the user.
  2. To successfully write simple programs that involve if statements.
  3. To gain practice in the use of Boolean operators like && and ||.
  4. Write a program to implement 4 types of pyramid.
  5. Write a new program called Options that will request that the user enter an integer and then will display the message positive, negative or zero. If the value that was entered was greater than zero, less than zero, or equal to zero, respectively.
  6. Write a simple program implement constructor.
  7. Write a program to implement inheritance.
  8. Write a program to implement function overloading.
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**Course Code:** PCC-CS601

**Course Name:** Compiler Design

**Course Credit Hour:** 3hr

**Total Contact Hour:** 42hr

**Course Objective:**

- To understand and list the different stages in the process of compilation.
- Identify different methods of lexical analysis
- Design top-down and bottom-up parsers
- Identify synthesized and inherited attributes
- Develop syntax directed translation schemes
- Develop algorithms to generate code for a target machine

**Course Description:**

- The aim is to learn how to design and implement a compiler and also to study the underlying theories. The main emphasis is for the imperative language. Introduction: Phases of compilation and overview.
- Compilers and translators. Algorithms and implementation techniques for type-checking, code-generation and optimization. Students will implement static analysis type checking, and optimization.

**Course Contents:**

**Module 1: Introduction to Compiling:** Compilers, Analysis-synthesis model, The phases of the compiler, Cousins of the compiler. **Lexical Analysis :** The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, lexical analyzer generator (Lex).

**Module II : Syntax Analysis:** The role of a parser, Top down Parsing, Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR, CLR), Parser generators (YACC). Error Recovery strategies for different parsing techniques. **Syntax directed translation:** Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions.

**Module III: Type checking :** Type systems, Specification of a simple type checker.

**Run time environments:** Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables.

**Module IV: Intermediate code generation :** Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples). **Code optimization :** Introduction, Basic blocks & flow graphs, Transformation of basic blocks, DAG representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization. **Code generations :** Issues in the design of code generator, Register allocation & assignment.

**Course learning outcomes:**

1. For a given grammar specification develop the lexical analyser
2. For a given parser specification design top-down and bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine

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**Suggested books:**

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman.- Compilers Principles, Techniques, and Tools, 2nd Edition, Pearson Education, New Delhi, 2006

**Suggested reference books:**

1. A.I.Holub -Compiler Design in C, Prentice Hall of India, New Delhi, 1995
  2. J.P. Tremblay - The Theory and Practical of Compiler Writing, McGraw Hill, Singapore, 1993.
  3. K.C. Louden- Compiler Construction: Principles and Practice, Thomson Learning, New Delhi, 2005.
  4. Chattopadhyay , S- Compiler Design ( PHI)
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**Online links for study & reference materials:**

1. NPTEL

**Assessment method :**(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

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**Course Code:** PCC-CS602

**Course Name:** Computer Networks

**Course Credit Hour:** 3hr

**Total Contact Hour:** 35hr

**Course Objective:**

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do network programming
- To provide a WLAN measurement ideas.

**Course Description:**

- The course covers the basic and advanced concepts and techniques of Computer Networks from both theoretical and practical perspective. The material includes Data communication Components, Data Link Layer and Medium Access Sub Layer, Network Layer, Transport Layer and Application Layer. The students will be able to understand almost all algorithms required to understand real world network issues.

**Course Contents:**

**Unit-1**

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

**Unit-2**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA.

**Unit-3**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP– Delivery, Forwarding and Unicast Routing protocols.

**Unit-4**

**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

**Unit-5:**

**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

**Course Learning Outcomes (CLOs):**

- **CLO-1:** Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
- **CLO-2:** For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component.
- **CLO-3:** For a given problem related TCP/IP protocol developed the network programming.
- **CLO-4:** Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

**Text books:**

- BehrouzA. Frozen, Data Communication and Networking, 4th Edition, McGraw- Hill.
  - William Stallings, Data and Computer Communication, 8th Edition, , Pearson Prentice Hall India.
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**Reference books:**

- Andrew S. Tanenbaum , Computer Networks, 8th Edition, , Pearson New International Edition.
- Douglas Comer , Internetworking with TCP/IP, Volume 1, 6th Edition , Prentice Hall of India.
- Richard Stevens , TCP/IP Illustrated, Addison-Wesley, United States of America.

**Online links for study & reference materials:**

<https://nptel.ac.in/courses/106/105/106105183/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assignment-1	- 05%
Assignment-2	- 05%
Assessment-3(Mid-Term Exam)	- 20%
Assignment-3	- 05%
Assignment-1/Quiz	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

**Course Code:** OEC 001

**Course Name:** Soft skills and interpersonal Communication

**Course Credit Hour:**3Hr

**Total Contact Hour:**20hr

**Course Objective:**

- The student will acquire knowledge of soft skills including motivation, leadership and interview skills.

**Course Description:**

- This course introduces the fundamental of soft skills and hard skills, it includes important insights about motivation, leadership, attitude, stress management and interpersonal communication.

**Course Contents:**

**Unit 1: Soft Skills: An Introduction:**

Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. **Self-Discovery:** Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. Positivity and Motivation:

**UNIT -2: Interpersonal Communication:**

Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. **Public Speaking:** Skills, Methods, Strategies and Essential tips for effective public speaking. Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. **Non-Verbal Communication:** Importance and Elements; Body Language. **Teamwork and Leadership Skills:** Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills.

**UNIT -3: Interview Skills: Interviewer and Interviewee:**

Resume writing in-depth perspectives. Before, During and After the Interview. Tips for Success. Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. Etiquette and Manners – Social and Business. Time Management – Concept, Essentials, Tips.

**UNIT – 4: Decision-Making and Problem-Solving Skills:**

Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills. **Conflict Management: Conflict** - Definition, Nature, Types and Causes; Methods of Conflict Resolution. **Stress Management: Stress** - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress. **Leadership and Assertiveness Skills:** A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behavior; Assertiveness Skills.

**Course Learning Outcomes (CLOs):**

CLO-1: Develop the basic concept of soft skills

CLO-2: Inculcate leadership and motivational skills.

CLO-3: To understand perception, emotional development and interview skills.

CLO-4: To understand group development and leadership skills

**Text books:**

- (i) Managing Soft Skills for Personality Development –edited by B.N. Ghosh, McGraw Hill India, 2012.
- (ii) English and Soft Skills – S.P. Dhanavel, Orient Black swan

**Reference books:**

- (i) Raman, Singh – Business communication – Oxford Press
- (ii) Spoken English for India, R.K. Bansal & J.B. Harrison, Orient Longman, Delhi.

**Assessment method:**(Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%
Assignment-3/Quiz-1	- 05%
Assignment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

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<b>PCC-CS601 P</b>	<b>Compiler Design</b>	<b>0L:0T: 4P</b>	<b>2 credits</b>
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### **LIST OF EXPERIMENTS**

1. Write a program to check whether string is accepted or not for entered grammar.
  2. Write a program to convert infix to postfix notation.
  3. Write a program to convert infix to prefix notation.
  4. Write a program to convert regular expression of NFA.
  5. Write a program to convert NFA to DFA.
  6. Write a program to calculate LEADING and TRAILING of a grammar.
  7. Write a program to calculate FIRST and FOLLOW of a grammar.
  8. Write a program to implement shift reduce parser.
  9. Write a program to implement top down parser.
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<b>PCC-CS602 P</b>	<b>Computer Networks</b>	<b>0L:0T: 4P</b>	<b>2 credits</b>
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### **List of Experiments**

1. Study of different types of Network cables and practically implements the cross wired cable and straight through cable using clamping tool.
  2. To implement & study the peer to peer connection using Cisco packet tracer.
  3. To implement & study the bus topology using Cisco packet tracer.
  4. To implement & study the star topology using Cisco packet tracer.
  5. To implement & study the ring topology using Cisco packet tracer.
  6. To implement & study the mesh topology using Cisco packet tracer.
  7. To implement and configuration the given network topology having single router through graphical user interface using Cisco Packet Tracer.
  8. To implement and configuration the given network topology having single router through command line interface using Cisco Packet Tracer.
  9. To implement and configuration the given network topology having multiple routers through graphical user interface using Cisco Packet Tracer.
  10. To implement and configuration the given network topology having multiple routers through command line interface using Cisco Packet Tracer.
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**Course Code:** OEC-002

**Course Name:** Human Resource Development

**Course Credit Hour:**3Hr

**Total Contact Hour:**30hr

**Course Objective:**

- The objective of the course is to make student aware of the concepts, techniques and practices of human resource development. This course is intended to make students capable of applying the principles and techniques as professionals for developing human resources in an organization.

**Course Description:**

- This course introduces the fundamental of human resource development includes important insights about the human resource process, Organization development, Training methods, and training development.

**Course Contents:**

**Unit 1:HRD-Macro Perspective:(6 lectures)**

HRD Concept, Origin, and Need, HRD as a Total System; Approaches to HRD; Human Development and HRD; HRD at Macro and Micro Climate.

**Unit 2:HRD–Micro Perspective: (6 lectures)**

Areas of HRD; HRD Interventions Performance Appraisal, Potential Appraisal, Feedback and Performance Coaching, Training, Career Planning, OD or Systems Development, Rewards, Employee Welfare and Quality of Work Life and Human Resource Information; Staffing for HRD: Roles of HR Developer; Physical and Financial Resources for HRD

**Unit 3:Instructional Technology for HRD:(6 lectures)**

Learning and HRD; Models and Curriculum; Principles of Learning; Group and Individual Learning; Transactional Analysis; Assessment Centre; Behavior Modeling and Self-Directed Learning; Evaluating the HRD

**Unit 4: Human Resource Training and Development: (6 lectures)**

Concept and Importance; Assessing Training Needs; Designing and Evaluating T&D Programs; Role, Responsibilities, and challenges to Training Managers.

**Unit 5:Training Methods:(6 lectures)**

Training within Industry (TWI): On the Job & Off the Job Training; Management Development: Lecture Method; Role Play; In-basket Exercise; Simulation; Vestibule Training; Management Games; Case Study; Programmed Instruction; Team Development; Globalization challenges and Strategies of Training Program, Review on T&D programs in India.

**Course Learning Outcomes (CLOs):**

CLO-1: Develop the basic concept of human resources.

CLO-2: Inculcate cultural and learning skills.

CLO-3: To understand learning methods and their importance.

CLO-4:To understand the need for training.

CLO-5:To develop training methods.

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**Textbooks:**

1. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi, 2005.
2. Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi: Tata McGraw Hill.
3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi, 2004.
4. Aamodt, M.G. (2007) Human/Organizational Psychology: An Applied Approach (5th edition) Wadsworth/Thompson: Belmont, C.A.

**Reference books:**

1. Miner J.B. (1992) Organizational Psychology. N Y: McGraw Hill.
2. Virmani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi.

**Assessment method:**(Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%
Assignment-3/Quiz-1	- 05%
Assignment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>



**Course Code:** OEC003

**Course Name:** Cyber Security & Ethics

**Course Credit Hour:** 3hr

**Total Contact Hour:** 34hr

**Course Objective:**

- To understand Cyber Laws and its evolution in Computer Technologies
- To Understand and analyze Information Technology Act.
- To understand cyber laws and related Legislation.
- To understand electronics business and legal issues associated with it.
- Study based on Cyber crime.

**Course Description:**

- Write a brief summary indicating how this will be conducted specifying the key topics of the whole course.
- Write about 4 to 5 lines or till 7 lines, if some course description demands.

**Course Contents:**

**UNIT – I**

**Introduction to Cyber Law Evolution of Computer Technology :** Emergence of Cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

**UNIT – II**

**Information technology Act :** Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

**UNIT – III**

**Cyber law and related Legislation :** Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

**UNIT – IV**

**Electronic Business and legal issues:** Evolution and development in E- commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. **Application area:** Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

**UNIT – V**

**Case Study On Cyber Crimes:** Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS), Cyber-Stalking.

**Course Learning Outcomes (CLOs):**

At the end of this course students will be able to

- CLO-1: Understand the concept of cyber law and its evolution in computer technology
- CLO-2: Understand Information Technology Act in detail.
- CLO-3: Understand cyber laws and related Legislation.
- CLO-4: Relate electronics business with its legal issues associated with cyber laws.
- CLO-5: Understand real problems through case studies based on cyber law incidents.

**Text books:**

- K.Kumar “Cyber Laws :Intellectual Property & E Commerce Security, Dominant Publisher
- Rondey D. Ryder, Guide to Cyber Laws, Wadhwa & Company, New Delhi.
- Information Security Policy & Implementation Issues, NIIT, PHI.

**Reference books:**

- Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, Edition, PHI.
- Sharma, S.R., “Dimensions Of Cyber Crime”, Annual publications Pvt. Ltd-2004

**Online links for study & reference materials:**

<https://nptel.ac.in/courses/106/106/106106129/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment-1	- 05%
Assignment-2	- 05%
Assessment-3(Midexam)	- 20%
Assignment-3	- 05%
Assignment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

**Thread 3:Data Science & Machine Intelligence**

<b>Elective(s)</b>	<b>Subject Code</b>	<b>Subject Name</b>
Elective I	PEC-CS-D 501	Artificial Intelligence
Elective II	PEC-CS-D 601	Machine Learning
Elective III	PEC-CS-D 602	**Data Mining
Elective IV	PEC-CS-D 701	Soft Computing
Elective V	PEC-CS-D 702	Speech and Natural Language Processing
Elective VI	PEC-CS-D 703	**Data Analytics

**Course Code:** PEC-CS-D 501

**Course Name :** Artificial Intelligence

**Course Credit Hour:** 3

**Total Contact Hour :** 42hr

**Course Objective:** The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Emphasis will be placed on the teaching of these fundamentals, not on providing a mastery of specific software tools or programming environments.

**Course Description:** Artificial intelligence (AI) is a research field that studies how to realize the **intelligent** human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously.

**Course Contents:**

**Module 1: Introduction:** Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Processing.

**Module II: Introduction to Search :** Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.

**Module III: Knowledge Representation & Reasoning:** Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

**Module IV: Machine Learning :** Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data – EM algorithm, Reinforcement learning,

**Module V: Pattern Recognition :** Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.

**Course Learning Outcomes (CLOs):**

- 1) Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
- 2) Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
- 3) Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- 4) Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
- 5) Demonstrate proficiency in applying scientific method to models of machine learning.
- 6) Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

**Text books :**

1. Elaine Rich and Kevin Knight, “Artificial Intelligence”, McGraw-Hill
2. E Charniak and D McDermott, “Introduction to Artificial Intelligence”, Pearson Education Dan W. Patterson, “Artificial Intelligence and Expert Systems”, Prentice Hall of India,

**Reference books :**

1. A Modern Approach Third Edition Stuart Russell and Peter Norvig, 2010. Pearson Education, Inc. ISBN: 978-0-13-604259-4
2. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson Education

**Online links for study & reference materials:**

1. NPTEL

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Mid exam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

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**Course Code:** PEC-CS-D601

**Course Name:** Machine Learning

**Course Credit Hour:** 3hr

**Total Contact Hour:** 40hr

**Course Objective:**

- The course aims to provide basic understanding of issues and challenges of Machine Learning. It aims to train the student to the basic and advanced models and algorithms of the core field of machine learning. This course also involves understanding of the strengths and weaknesses of many popular machine learning approaches.

**Course Description:**

- The course covers the basic concepts and techniques of Machine Learning from both theoretical and practical perspective. The material includes Introduction to machine learning and different types of learning, Linear Regression, Decision Trees, Instance based learning, Feature Selection, Neural Network, Clustering and Support Vector Machines. The students will be able to understand almost all algorithms required to develop ML applications.

**Course Contents:**

**Unit-1: Introduction to machine learning and different types of learning:** Brief Introduction to Machine Learning; Definition, Components of a learning problem, Applications, Choosing a Model Representation, Types of learning: Supervised Learning, Unsupervised Learning, Semi-supervised learning, Reinforcement Learning, Inductive Learning or Prediction,

**Unit-2: Linear Regression and Decision Trees, Instance based learning and Feature Selection:** Regression, Types of Regression Models (Linear Classification, Logistic Regression, Components Regression, Bias – Variance Linear Regression Multivariate Regression etc), Dimensionality Reduction Subset Selection, Shrinkage Methods, Principle Linear Discriminant Analysis Optimization, Classification-Separating Hyperplanes Classification, LMS Algorithm, Decision Tree, Over fitting, Instance- Based Learning, Basic k-nearest neighbor classification, kNN, Euclidean Distance, Feature Reduction in ML, Subset selection, Feature extraction, PCA

**Unit-3: Probability and Bayes Learning, Support Vector Machines, Clustering:** Probability for Learning, Bayes Theorem, MAP Learner, Naïve Bayes, Bayesian Network, Logistic Regression for classification, Support Vector Machines, Unsupervised learning, Partitioning Algorithms, Hierarchical Clustering, Density based Clustering, K-means algorithm.

**Unit-4: Neural Network:** Neuron, ANNs, Perceptrons, Gradient Descent, Early models, Back propagation, Initialization, Training & Validation, Parameter Estimation (Maximum Likelihood Estimation, Bayesian Parameter Estimation) Decision Trees Evaluation Measures, Hypothesis Testing Ensemble Methods, Graphical, Deep Learning, Deep Neural Network, Hierarchical Representation, Unsupervised Pre-training, Activation Functions.

**Unit-5:** Clustering, Gaussian Mixture Models, Spectral Clustering Ensemble Methods Learning Theory, Reinforcement Learning.

**Course Learning Outcomes (CLOs):**

On completion of the course students will be expected to

- **CLO-1:** Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity etc,
- **CLO-2:** Have an understanding of the strength and weaknesses of many popular machine learning approaches.
- **CLO-3:** Appreciate the underlying mathematical relationship within and across Machine Learning Algorithms and the paradigm of supervised and un-supervised learning.
- **CLO-4:** Be able to design various machine learning algorithms in a range of real world applications.

**Text books:**

- Alpaydin E, Machine Learning, MIT Press.
  - Bishop C, Pattern Recognition and Machine Learning, Springer-2006.
  - Duda R, Hart E and Stork D, Pattern Classification, Wiley-Interscience.
  - Mitchell T, Machine Learning, McGraw-Hill.
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**Reference books:**

- Hastie T, Tibshirani R and Friedman J, Elements of Statistical Learning, Springer-2017.
- T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e,
- Christopher Bishop. Pattern Recognition and Machine Learning. 2e.

**Online links for study & reference materials:**

[https://onlinecourses.nptel.ac.in/noc21\\_cs24/preview](https://onlinecourses.nptel.ac.in/noc21_cs24/preview)

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assignment-1	- 05%
Assignment-2	- 05%
Assessment-3(Mid-Term Exam)-	20%
Assignment-3	- 05%
Assignment-1/Quiz	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

**Course Code:** PEC-CS-D 602

**Course Name:** Data Mining

**Course Credit Hour:** 3hr

**Total Contact Hour:** 42hr

**Course Objective:**

- To identify the scope and essentiality of Data Mining.
- To analyze data, choose relevant models and algorithms for respective applications.
- To study spatial and web data mining.
- To develop research interest towards advances in data mining.

**Course Description:**

- Data mining refers to a set of techniques that have been designed to efficiently find interesting pieces of information or knowledge in large amounts of data.
- In this course we explore how this interdisciplinary field brings together techniques from databases, statistics, machine learning, and information retrieval

**Course Contents:**

**Module 1: FUNDAMENTALS:** Relation to Statistics – Databases – Data Mining Functionalities – Steps in Data Mining Process– Architecture of Typical Data Mining Systems –Classification of Data Mining Systems– Overview of Data Mining Techniques.

**Module 2: DATA PREPROCESSING AND ASSOCIATION RULES**

Data Preprocessing – Data Cleaning – Integration – Transformation – Reduction –Discretization Concept Hierarchies – Concept Description Data Generalization and Summarization Based Characterization – Mining Association Rules in Large Databases.

**Module 3: PREDICTIVE MODELING**

Classification and Prediction Issues Regarding Classification and Prediction –Classification by Decision Tree Induction – Bayesian Classification – Other Classification Methods– Prediction –Clusters Analysis – Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical Methods.

**Module 4: DATA WAREHOUSING**

Data Warehousing Components – Multi Dimensional Data Model – Data Warehouse Architecture – Data Warehouse Implementation – Mapping the Data Warehouse to Multiprocessor Architecture – OLAP – Need – Categorization of OLAP Tools.

**Course learning outcomes:**

- Understand Data Mining data warehouse Principles
- Identify appropriate data mining algorithms to solve real world problems
- Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
- Describe complex data types with respect to spatial and web mining.
- Benefit the user experiences towards research and innovation. integration.

**Suggested books:**

1. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, 2002.

**Suggested reference books:**

1. Alex Berson, Stephen J Smith, "Data Warehousing, Data Mining & OLAP", Tata Mcgraw Hill, 2004.
  2. Usama M. Fayyad, Gregory Piatetsky , Shapiro, Padhraí Smyth and Ramasamy Uthurusamy," Advances In Knowledge Discovery And Data Mining", The M.I.T Press, 1996.
  3. Ralph Kimball, "The Data Warehouse Life Cycle Toolkit", John Wiley& Sons Inc., 1998.
  4. Sean Kelly, "Data Warehousing In Action", John Wiley & Sons Inc., 1997.
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**Online links for study & reference materials:**

1. NPTEL

**Assessment method :**(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
<b>Total Internal Assessment</b>	<b>- 40%</b>

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