The Curriculum Book

Bachelor of Technology

in

(Artificial Intelligence& Machine Learning)

4 YEAR-PROGRAMME

Choice Based Credit System
w. e. f. July 2021

Faculty of Engineering and Technology
Chaudhary Devi Lal University
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Preface

The overall well-being of a nation depends on the eminence of its human resource. Providing quality education plays a vital role in transforming people into valuable human resource. Well educated students of today will become innovators and leaders of tomorrow who are going to ensure a constructively competitive but sustainable and peaceful world for everyone. Keeping in the view the demand of the skills based on Artificial Intelligence (AI) and Machine Learning (ML), the university has introduced a Bachelor of Technology Programme in (Artificial Intelligence & Machine Learning)in the Department of Computer Science & Engineering.We have designed the curriculum for B.Tech. in (Artificial Intelligence & Machine Learning). The curriculum is designed around the framework of Outcome-Based Education (OBE) in which students are at the centre of teaching learning process. The salient features of the curriculum design are as follows:

1. To start with, four Programme Educational Outcomes are defined.
2. The twelve Programme Outcomes (POs) are taken from the Self Appraisal Report format of National Board of Accreditation (NBA) for undergraduate engineering programmes and two Programme Specific Outcomes (PSOs) are outlined to capture the specialisations of the B. Tech. (AI & ML) programme.
3. An induction programme of three weeks duration has been introduced to make the admitted students comfortable in their new environment. The induction programme continues in the form of participation in Sports club or Green club or Cultural, Literature and Film Club etc. for the remaining period of the programme. It is mandatory for every student to join in one of these clubs.
4. In addition to the professional core and elective courses, there is a provision for many courses from Basic Sciences, Engineering Sciences, Mathematics and Humanities. The non-credit mandatory courses are included to make students aware about constitution of India, issues related to environmental and sustainable development, and Indian traditional wisdom.
5. For every course, 4 to 6 Course Outcomes (COs)are defined which are concrete and measurable.
6. Guidelines for preparing sessional examination question papers and assignments have been framed for measuring the attainment levels of COs.
7. The internal and external evaluation criteria for various courses has been succinctly described.
8. The Course Outcomes (COs) are mapped to Programme Outcomes (POs) by defining a CO:PO articulation matrix for every course.
9. The methodology for computing the attainment levels for the Course Outcomes and Programme Outcomes is laid out.
10. The new curriculum has a focus on the problem solving and learning capabilities of the students. There are many laboratory courses which give students a hands-on experience in problem solving. Further, provisions for industry internship/training and project works make students ready to accept challenges and do research to solve difficult engineering problems.
11. Overall, the curriculum is made keeping in the view the continuous cycle of improvement in teaching learning process

Contents

Chapter 1: General Information

1.1. Vision and Mission of the Department of Computer Science and Engineering

1.1.1 Vision

The vision of the Department is to become a centre of excellence for education in Computer Science and Engineering,Information Technology and Computer Applications. We visualize ourselves as an agency to nurture young minds to be thefuture leaders in the field of higher education, research and development, and information technology industry. Our aim is to bring out creators and innovators who will work towards the overall well-being of the society.

1.1.2Mission

- Imparting state-of-the-artknowledge in Computer Science and Engineering, Information Technology and Computer Applications.
- Ensuring that our students graduate with a sound theoretical basis and wide-ranging practical experience.
- Fostering linkages between the Department and, public and private sectors, traversing research establishments as well as Information Technology industry.
- Promoting ethical research of high quality.
- Adopting the best pedagogical methods in order to maximize knowledge transfer.
- Inculcating a culture of free and open discussions in the Department.
- Engaging students in evolving original ideas and applying them to solve complex engineering problems.
- Inspiring a zest into students for lifelong learning.
- Infusing scientific temper, enthusiasm,professionalism, team spirit and leadership qualities in students.
- Sensitizing students to look for environmentally sustainable engineering solutions.
- Upholding democratic values and an environment of equal opportunity for everyone.

1.2B. Tech. (AI&ML): Programme Educational Objectives (PEOs)

The Programme Educational Objectives of the B. Tech. (Artificial Intelligence &Machine Learning) Programme are:

PEO1. To prepare responsible and ethical professionals to be successfully employed in Computer Science and Information Technology industry, who will be able to apply the principles of mathematics, science, and engineering to develop and deploy Artificial Intelligence (AI) and Machine Learning(ML) based solutions for real world problems after assessing their environmental, cultural and societal implications.

PEO2. To train students for analysing, evaluating and designing complex engineering AI and ML solutions individually or in teams by doing a systematic and in-depth research in the related problem domains, by using modern tools and by communicating effectively among the various stake holders.

PEO3. To groom the professionals and entrepreneurs of tomorrow with leadership qualities and deep societal concerns who can move up in their professional career or start their own ventures.

PEO4. To guide the graduates to develop a positive attitude towards learning and motivate them to take up higher studies and research.

1.3 B. Tech. (AI&ML): Programme Outcomes (POs)

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1 **Developing Computational Systems**: Use principles of various programming languages, data structures, database management systems, computer algorithms, theory of computation, networking and software engineering for designing and implementing computational systems.

PSO2 **Designing Intelligent Machine Learning Systems:** Utilize the principles and tools of artificial intelligence, soft computing, data mining and machine learning, data analytics, robotics, IoT, augmented reality etc. for designing and working with intelligent systems that learn from their environment.

Chapter 2: Scheme of syllabus B.Tech.(AI&ML)

2.1 General course structure andcredit distribution in various components of the curriculum

2.1.1 Definition of a Credit

Type of Teaching Learning Activity	No. of Credit
1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
2 Hours Practical (Lab) per week	1 Credit

2.2. B.Tech.(Artificial Intelligence &Machine Learning): Semester-wise Scheme

Induction Programme

It is mandatory to conduct an induction programme for newly admitted students right at the beginning of the first semester. The objective of the induction programme is to create a bond between the institution and the newly admitted students.

The new students enter an institution with diverse backgrounds and expectations. It is important to help them adjust to the new environment. To meet this purpose, there will be threeweek-long induction programme before the normal classes start. The induction program shall provide students the opportunity to settle down and be comfortable in the new environment. The new students will come to know their seniors, faculty members, department and university. The student would be engaged in the following activities.

1. Familiarization with the Department and the University
2. Physical activities like morning walks, cycling or playing one or the other games.
3. Creative arts like painting, music and dancing etc.
4. Talks and lectures by eminent people, and group discussion on universal Human values
5. Literary activities like reading writing or debating

The schedule for organizing the induction programme shall be prepared every year at university level.

Students will be engaged in diverse activities at the level of Department. Depending on the interest, every student must opt for one of the activities during all the semesters. For this purpose, the following clubs shall be established in the Department.

1. Sports Club
2. Green Club
3. Culture, Literature and Film Club
4. Social Service Club
5. Technology Innovation Club

Each student will spend 3 to 5 hours for these activities per week.

SEMESTER-III

Sr. No.	Course Codes	Nomenclature of the Courses	Hours per week			Credits	Internal	External
			L	T	P			
1.	BSC201-T	Mathematic III	3	0	0	3	30	70
2.	PCC-CSEAI201-T/ PCC-CSE201-T/ PCC-IT201-T	Data Structures and Algorithms	3	0	0	3	30	70
3.	PCC-CSEAI202-T/ PCC-CSE202-T/ PCC-IT202-T	Object Oriented Programming using C++	3	0	0	3	30	70
4.	PCC-CSEAI203-T	Data Analytics using R	3	0	0	3	30	70
5.	MC103-T	* Indian Constitution	3	0	0	0	30	70
6.	HSMC201-T	**Human Values and Personality Development	3	0	0	0	-	100
7.	PCC-CSEAI201-P/ PCC-CSE201-P/ PCC-IT201-P	Data Structures and Algorithms using C/C++ Lab	0	0	4	2	50	50
8.	PCC-CSEAI202-P/ PCC-CSE202-P/ PCC-IT202-P	Object Oriented Programming using C++ Lab.	0	0	4	2	50	50
9.	PCC-CSEAI203-P	Data Analytics using R Lab.	0	0	4	2	50	50
		Total				18	300	600

*** It is a non-credit qualifying course only.**

****It is a non-credit qualifying course only. The assessment will be completely internal.**

SEMESTER IV

Sr. No.	Course Codes	Nomenclature of the Courses	Hours per week			Credits	Internal	External
			L	T	P			
1.	PCC-CSEAI204-T /PCC-CSE204-T/ PCC-IT204-T	Computer Organisation and Architecture	3	0	0	3	30	70
2.	PCC-CSEAI205-T	Data Mining Techniques	3	0	0	3	30	70
3.	PCC-CSEAI206-T /PCC-CSE305-T/ PCC-IT206-T	Operating Systems	3	0	0	3	30	70
4.	PCC-CSEAI207-T/ PCC-CSE207-T/ PCC-IT207-T	Database Management System	3	0	0	3	30	70
5.	PCC-CSEAI208-T /PCC-CSE203-T/ PCC-IT203-T	Discrete Mathematics	3	0	0	3	30	70
6.	PCC-CSEAI209-T/PCC-CSE402-T/ PCC-IT304-T	Artificial Intelligence	3	0	0	3	30	70
7.	PCC-CSEAI205-P	Data Mining using R/Python/ WEKA Lab.	0	0	4	2	50	50
8.	PCC-CSEAI207-P/ PCC-CSE207-P/ PCC-IT207-P	Database Management System Lab.	0	0	2	1	50	50
9.	PCC-CSEAI210-P	Python Programming Lab.	0	0	3	1.5	50	50
		Total				22.5	330	570
*4-6 weeks Industrial Training/internship after completion of IV semester								

*** A 4-6 weeks industrial training/internship is mandatoryafter the completion of theIVthsemester.The training/internship will be evaluated in the Vth semester.**

Chapter 3: Detailed Syllabi

Mathematics-III

General Course Information

Course Code: BSC201-T Course Credits: 3 Type: Basic Sciences Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Pre-requisites: Mathematics I and Mathematics II

About the Course

This is an advanced mathematics course that offers the knowledge of Fourier Series, Fourier Transforms, Functions of Complex Variables. These concepts are essential for students to solve problems in image processing, digital signal processing and other related engineering fields.

Course Outcomes: By the end of the course studentswill be able to:

CO1. **define** concepts and terminology of Fourier Series and Fourier transforms, Functions of complex variables and Power Series etc. (LOTS: Level 1: Remember)

CO2. **solve** problems using Fourier transforms in domains like digital electronics and image processing. (LOTS: Level 3: Apply)

CO3. **apply** principles of functions of complex variables to solve computational problems. (LOTS: Level 3: Apply)

CO4. **compare** various concepts related to Fourier transforms and functions of complex variables. (HOTS: Level 4: Analyse)

CO5. **select** suitablemethod for given computational engineering problems and related domain. (HOTS: Level 4: Evaluate)

CO6. **integrate** the knowledge of Fourier Series and Fourier transforms, Functions of complex variables, and Power Series for solving real world problems. (HOTS: Level 6: Create)

Course Content

Unit I

Fourier Series and Fourier Transforms: Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.

Unit II

Fourier integrals, Fourier transforms, Shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac delta function.

Unit III

Functions of Complex Variable: Definition, Exponential function, Trigonometric and Hyperbolic functions, Logarithmic functions. Limit and Continuity of a function, Differentiability and Analyticity. Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations. Harmonic functions.

Unit IV

Complex integral, Cauchy Gaursat theorem (without proof), Cauchy integral formula (without proof), Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeroes and singularities of complex functions, Residues. Evaluation of real integrals using residues (around unit and semi-circle only).

Text and Reference Books:

1. F. Kreyszig, *Advanced Engineering Mathematics*, 10th edition, Wiley, 2015.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 44th edition, 1965.
3. R. K. Jain, S.R.K. Iyenger. *Advance Engineering. Mathematics*, 4th edition, Narosa Publishing House, 2012.
4. Michael D. Greenberg, *Advanced Engineering Mathematics*, 2nd edition, Pearson Education, 2002.
5. Johnson and Miller *Probability and statistics for Engineers*, 8th edition, Pearson Education India, 2015.

CO-PO Articulation Matrix: Mathematics-III (BSC201-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Define** concepts and terminology of Fourier Series and Fourier transforms, Functions of complex variables and Power Series. (LOTS: Level 1: Remember)	1	--	-		-	-	-	-	-	-	-	-	2	2
CO2. **Solve** problems using Fourier transforms in domains like digital electronics and image processing. (LOTS: Level 3: Apply)	2	2	2	2	-	-	-	-	-	-	-	-	3	2
CO3. **Apply** principles of functions of complex variables to solve computational problems. (LOTS: Level 3: Apply). (LOTS: Level 3: Apply)	2	2	2	2	-	-	-	-	-	-	-	-	3	2
CO4. **Compare** various concepts related to Fourier transforms and functions of complex variables (HOTS: Level 4: Analyse).	3	3	2	3	-	-	-	-	-	-	-	-	3	2
CO5. **Select** suitablemethod for given computational engineering problems and related domain. (HOTS: Level 4: Evaluate)	3	3	2	3	-	-	-	-	-	-	-	-	3	2
CO6. **Integrate** the knowledge of Fourier Series and Fourier transforms, Functions of complex variables and Power Series for solving real world problems. (HOTS: Level 6: Create)	3	3	2	3	-	-	-	-	-	-	-	-	2	2
Level of Attainments BSC201-T														

Data Structures and Algorithms

General Course Information

Course Code: PCC-CSEAI201-T/ PCC-CSE201-T/ PCC-IT201-T Course Credits: 3 Type: Professional Core Contact Hours: 3hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Pre-requisites: Programming in C

About the Course:

Data Structure and Algorithms is a core and an essential course for every graduate in Computer Science and Engineering. This course introduces data structures like arrays, linked lists, trees and graphs etc. and various operations to be implemented on these data structures for solving real world problems. It includes various sorting and searching algorithms as well. Further, it incorporates complexity analysis of algorithms implemented on various data structures.

Course Outcomes: By the end of the course studentswill be able to:

CO1. **describe**various types of data structures and operations that can be implemented on these data structures. (LOTS: Level 1: Remember)
CO2. **demonstrate** the use of various data structures and their related operations. (LOTS: Level 2: Understand)
CO3. **apply** data structure to solve computational problems. (LOTS: Level 3: Apply)
CO4. **compare** the suitability of alternative data structures and prescribed operations for various problem situations. (HOTS: Level 4: Analyse).
CO5. **defend** solutions with respect to effective storage of data and efficiency of the required operations for solving real world problems. (HOTS: Level 5: Evaluate)

Course Content

Unit I

Introduction to data structures and their types, Abstract data types, Linear lists: Arrays and linked lists: memory representations, implementing operations like traversing, searching, inserting and deleting etc. Applications of arrays and linked lists. Representing sets and polynomials using linked lists.

Unit II

Stack and Queue:Static and linked implementations, Operations and Applications. Circular queues, Tress, Binary trees and related terminology, Tree traversals (Recursive), Threaded Binary Trees, Binary Search Trees implementation and operations,Priority queues.

Unit III

Height Balanced or AVL treesand B trees. Graph definitions and related terminology, memory representations and related operations (traversal, insertion, deletion, search), Path Matrix, Warshall'sShortest path algorithmHashing, Hash tables, hash function and collisionresolution.

Unit IV

Sequential and binary search, Sorting algorithms: Bubble sort, Selection sort, Insertion sort,Quick sort, Merge sort, Count sort, Heap sort, Comparison of searching and sorting techniques based on their complexity analysis, Time and space complexity of algorithms: Asymptotic analysis, Big O, Omega, Theta notations.

Text and Reference Books:

1. Aho, A. V., Ullman, J. D., and Hopcroft, J. E., *Data Structures and Algorithms*, Addison-Wesley, 1983.
2. LangsamYedidyah, Augenstein J Moshe, Tenenbaum M Aaron, *Data Structures using C and C++*, 3rd edition, PHI, 2009.
3. Cormen, T. H., Leiserson, C. E., Rivest, R. L. and Stein, C., *Introduction to Algorithms*, MIT Press, 2009.
4. Robert L. Kruse, *Data Structure and Program Design in C*, Pearson Education India, 2007.
5. Weiss, M. A., *Data Structures and Algorithm Analysis in C++*, Addison-Wesley, 2007.
6. Sahni, S., *Data Structures, Algorithms, and Applications in C++*, WCB/McGraw-Hill, 2001.

CO-PO Articulation Matrix: Data Structures and Algorithms (PCC-CSEAI201-T)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Describe** various types of data structures and operations that can be implemented on these data structures. (LOTS: Level 1: Remember)	1	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2. **Demonstrate** the use of various data structures and their related operations. (LOTS: Level 2: Understand)	1	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3. **Apply** data structure to solve computational problems. (LOTS: Level 3: Apply)	2	2	-	-	2	-	-	-	-	-	-	-	3	2
CO4. **Compare** the suitability of alternative data structures and prescribed operations for solving a problem. (HOTS: Level 4: Analyse).	2	2	-	-	-	-	-		-	-	-	-	3	2
CO5. **Defend** solutions with respect to effective storage of data and efficiency of the required operations for solving computational problems. (HOTS: Level 5: - Evaluate)	3	3	-	1	-	-	-	-	-	-	-	-	3	2
Level of Attainments PCC-CSEAI201-T														

Object Oriented Programming using C++

General Course Information

Course Code: PCC-CSEAI202-T/ PCC-CSE202-T / PCC-IT202-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Pre-requisites: Knowledge of computer fundamentals and problemsolving using C programming

About the Course:

Objected Oriented Programming using C++ is an essential course for every graduate in Computer Science and Engineering. This course introduces the Object Orientedconceptssuch as data encapsulation, data hiding, data abstraction, reusability, exception handling etc., and their implementation using C++.

Course Outcomes: By the end of the course students will be able to:

CO1. **List**the concepts related to object oriented paradigms. (LOTS: Level 1: Remember)
CO2. **Distinguish** betweenstructured and object oriented approaches to programming. (LOTS: Level 2: Understand)
CO3. **Apply**object oriented constructs for problem solving. (LOTS: Level 3: Apply)
CO4. **Detect** logical and run time errors and suggest appropriate modifications. (HOTS: Level 4: Analyse)
CO5. **Justify** the design of a program for a given problem. (HOTS: Level 5: Evaluate)
CO6. **Design** solutions to programming problems usingmultipleobject oriented programming constructs together. (HOTS: Level 6: Create)

Course Content

Unit I

Introduction toobject oriented programming, C++ standard library, basics of a typical C++ environment, illustrative simple C++ programs, new features of ANSI C++ standard, OOPs concepts: Information hiding, encapsulation, data abstraction, access modifiers, controlling access to a class level, method, or variable (public, protected, private,

block level, scope and mutable), other modifiers. Structure of class and struct in memory, accessing members of structures, Class scope and accessing class members, separating interface from implementation, pre-processors directives, macro programs, header files and namespaces,default constructors, chained constructor, default arguments with constructors, constant object and const member functions, object as member of class, use of destructors, virtual destructors,controlling access function and utility functions, function overloading.

Unit II

Inline function, friend function and friend classes, using this pointer, dynamic memory allocation with new and delete, static class members, proxy class, polymorphism concepts, overloading, overriding methods, abstract classes, reusability, class's behaviors, inheritance,base classes and derived classes, protected members, casting base-class pointers to derived-class pointers, using member functions, overriding base-class members in a derived-class, public, protected and private inheritance, using constructors and destructors in derived classes, implicit derived-class object to base- class object conversion, composition vs. inheritance.

Unit III

Virtual functions, abstract base classes and concrete classes, new classes and dynamic binding, virtual destructors,fundamentals of operator overloading, restrictions on operators overloading, operator functions as class members vs. as friend functions, overloading, <<, >> overloading unary operators, overloading binary operators. I/O Streams,fileshandling, creating a sequential access file, reading data from a sequential access file, updating sequential access files, random access files, creating a randomaccess file, writing data randomly to a random access file, reading data sequentially from a random access file.

Unit IV

Managing Console I/O,stream input/output classes and objects, stream output, stream input, unformatted I/O (with read and write), stream manipulators, stream format states, stream error states, exception handling, basics of C++ exception handling(try, throw, catch), rethrowing an exception, specific exception, processing unexpected exceptions, stack unwinding, exception handling in constructors and destructors, inheritance with exceptionintroduction to generic classes, function templates, overloading template functions, class template, non-type parameters, templates and inheritance, templates and friends, templates and static members, container, iterator, algorithm and functional classes.

Text and Reference Books:

1. H. M.Deitel and P. J.Deitel, *C++ How To Program*, 6th Ed., Prentice Hall, 2008.
2. Robert Lafore, *Object-Oriented Programming in C++*, 3rd Ed., Sams Publishing, 2001.
3. D. Ravichandran, *Programming with C++*, 3rd Ed., T.M.H, 2011.
4. E.Balagurusamy, *Object oriented Programming with C++*, 6th Ed., Tata McGraw-Hill,2013.
5. Horstmann, *Computing Concepts with C++ Essentials*, 3rd Ed., John Wiley,2003.
6. Herbert Schildt , *The Complete Reference in C++*, 5th Ed., TMH, 2012.

CO-PO Articulation Matrix: Object Oriented Programming Using C++ (PCC-CSEAI202-T)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **list** the concepts related to object oriented paradigms. (LOTS: Level 1: Remember)	1	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2. **distinguish** betweenstructured and object oriented approaches to programming. (LOTS: Level 2: Understand)	1	1	-	-	-	-	-	-	-	-	-	-	3	-
CO3. **Apply** object oriented constructs for problem solving. (LOTS: Level 3: Apply)	2	1	-	-	2	-	-	-	-	-	-	-	3	-
CO4. **Detect** logical and run time errors and suggest appropriate modifications. (HOTS: Level 4: Analyse)	2	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5. **Justify** the design of a program for a given problem. (HOTS: Level 5: Evaluate)	2	3	-	-	-	-	-	-	1	-	-	-	3	-
CO6. **Design** solutions to programming problems using multiple object oriented programming constructs together. (HOTS: Level 6: Create)	3	3	1	-	2	-	-	-	1	-	-	-	3	-
Level of Attainments PCC-CSEAI202-T														

Data Analytics using R

General Course Information

Course Code: PCC-CSEAI203-T Course Credits: 3 Type: Professional Core Contact Hours: 3hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Pre-requisites: Basic programming skills, Probability and Statistics

About the Course:

In this course, the learners will be able to develop expertise in R programming for manipulating, exploring, visualizing, applying descriptive and inferential statistics. In addition, they will learn to implement predictive modelling.

Course Outcomes: By the end of the course students will be able to:

CO1. **define** the basic terms related to data analytics. (LOTS: Level 1: Remember)
CO2. **describe** data with statistical summaries and plots. (LOTS: Level 2: Understanding)
CO3. **build** predictive models. (LOTS: Level 3: Apply)
CO4. **analyse** the quality of a statistical and machine learning models. (HOTS: Level 4: Analyse)
CO5. **interpret** and evaluate statistical and predictive models. (HOTS: Level 5: Evaluate)
CO6. **conclude** the findings of predictive modelling. (HOTS: Level 5: Evaluate)

Course Content

Unit I

Data analytics preliminaries: Introduction to data analytics, scales of measurements (Data types) and their implementation in R. Working with vectors, matrices and tabular data (data frames), reading and writing tabular data from and to files (text and CSV). Describing data with statistical summaries (mean, median, mode, variance and standard deviation). Discriminating between sample and population, Quantile-Quantile plot. writing user-defined functions in R.

Unit II

Manipulating tabular data: Sorting, filtering cases, selecting variables, deriving new variables, grouping and summarizing data. working with packages (tidyverse) for data manipulations and transformations.

Exploratory data analysis: random and normally distributed variables, skewed normal distribution, z-score, detecting outliers in data, handling missing values.

Visualizing data through various plots and charts: bar charts, histogram, frequency polygon, density plots, scatter plots, box & whisker plots, heat and contour plots, plotting the above graphs in R, plotting with package ggplot2.

Unit III

Predictive modelling: what is predictive modelling, estimating a function, the trade-off between model accuracy and prediction accuracy and model interpretability, regression versus classification, measuring the quality of fit, The bias and variance trade- off.

Simple and multiple linear regression modelling: estimating the coefficients, assessing the accuracy of the coefficient estimates, assessing the accuracy of the model. Building regression models in R.

Unit IV

Classification Modeling: The process of classification, decision tree, Bayesian, k-nearest neighbor, support vector machine classification models and their implementation in R. evaluating a classification model: confusion matrix, accuracy, sensitivity, specificity, f-measure, kappa statistics, ROC and area under curve. accuracy and interpretability of classification models.

Evaluating the accuracy of a classifier: holdout or random sampling methods, cross-validation, bootstrap methods.

Text and Reference Books:

1. W. N. Venables, D. M. Smith and the R core Team, *An introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics*, version 3.3.2, 2016.
2. Saroj Dahiya Ratnoo and Himmat Singh Ratnoo, *Essentials of R for Data Analytics*, Wiley, 2021.
3. Hadley Wickham and Garrett Grolemund, *R for Data Science Import, Tidy, Transform and model Data*, O'Reilly, 2017.
4. Paul Teeter, *R Cookbook*, O'Reilly, 2011.
5. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, *An Introduction to Statistical Learning with Applications in R*, Springer, 2013.
6. Han, J., Kamber, M, Pei, J., *Data Mining Concepts and Techniques*, Third edition, Morgan Kaufmann, 2012.

CO-PO Articulation Matrix: Data Analytics using R (PCC-CSEAI203-T)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Define** the basic terms related to data analytics. (LOTS: Level 1: Remember)	1	-	-	-	1	-	-	-	-	-	-	-	-	2
CO2. **Describe** data with statistical summaries and plots. (LOTS: Level 2: Understanding)	2	2	-	-	2	-	-	-	-	-	-	-	1	3
CO3. **Build** predictive models (LOTS: Level 3: Apply).	2	2	-	-	3	-	-	-	-	-	-	-	1	3
CO4. **Analyse** the quality of a statistical and machine learning models (HOTS: Level 4: Analyse).	2	2	-	-	3	-	-		-	-	-	-	1	3
CO5.**Interpret** and evaluate statistical and predictive models. (HOTS: Level 5: Evaluate).	2	3	-	2	3	-	-	-	-	-	-	-	-	3
CO6. **Conclude** the findings of predictive modelling. (HOTS: Level 5: Evaluate).	2	3	-	2	3	-	-	-	-	-	-	-	-	3
Level of Attainments PCC-CSEAI203-T														

Indian Constitution

Course code	**MC103-T**			
Category	**Mandatory Courses**			
Course title	**Indian Constitution**			
Scheme and Credits	**L**	**Tu**	**Credits**	
	3	**0**	**0.0**	
Course Assessment Methods	**Internal Examination (30 marks):** • Three minor tests each of 20 marks including third minor in open book mode will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. • Class Performance will be measured through percentage of lectures attended (04 marks) • Assignments, quiz etc. will have weightage of 06 marks **End semester examination (70 marks):** • Nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Two questions are to be set from each unit. All questions will carry equal marks. • A candidate is required to attempt 05 questions in all, one compulsory and remaining four questions selecting one from each of the four units.			

Course Contents

UNIT I

Basic features and fundamental principles
Meaning of the constitution law and constitutionalism
Historical perspective of the Constitution of India
Salient features and characteristics of the Constitution of India
Scheme of the fundamental rights
The scheme of the Fundamental Duties and its legal status

UNIT II

The Directive Principles of State Policy – Its importance and implementation
Federal structure and distribution of legislative and financial powers between the Union and the States
Parliamentary Form of Government in India – The constitution powers and status of the President of India

UNIT III

Amendment of the Constitutional Powers and Procedure
The historical perspectives of the constitutional amendments in India
Emergency Provisions: National Emergency, President Rule, Financial Emergency
Local Self Government – Constitutional Scheme in India

UNIT IV

Scheme of the Fundamental Right to Equality
Scheme of the Fundamental Right to certain Freedom under Article 19
Scope of the Right to Life and Personal Liberty under Article 21

Human Values and Personality Development

General Course Information

Course Code: HSMC201-T Course Credit: Non- Credit Type: Humanities and Social Sciences Contact Hours: 03 hours/week Mode: Lectures (L), Group Discussions, Workshops	**Course Assessment Methods: Total Marks: 100 (Internal evaluation only)** **Minor Examinations + Class Performance: 20+10=30** **Interview/VIVA-VOCE=70** It is a non-credit qualifying course only. The assessment will be completely internal divided into two components (30+70). Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The assessment for 70 marks will be made through Interview/VIVA-VOCE mode by a committee of two faculty members including the course coordinator and a faculty member appointed by the Chairperson of the concern Department.

Pre-requisites: None

About the Course: This course is designed to develop a holistic perspective based on self-exploration and co-existence in society and nature. The focus is on to understand harmony and being in harmony with the society and the environment around us. The students will nurture a habit of self-reflection and courage to act. This course includes practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking).

Course Outcomes: By the end of the course students will be able to:

CO1: **exhibit** awareness about oneself, one's surroundings and goals in one's life.
CO2: **stay** in harmony with society and nature.
CO3: **develop** healthy and harmonious relationships.
CO4: **work in** groups and develop team spirit.
CO5: **exhibit** leadership qualities.
CO6: **excel** in personal and professional life.

Course Content

Unit I

Understanding the concept of self. Exploration of self with JOHARI-Window. Self-Esteem, Characteristics of individuals with low and high self-esteem. Self Confidence, strategies of building self-confidence.

Personality: Definition &Types & Traits; Relevance and Importance of nature and nurture in the development of personality.

Unit II

Nature of Socialization; Socialization Process, Contributions to Society and Nation. Importance of discipline and hard work. Ecologically responsibility of Engineers.
Professional Ethics: Competencies in professional values and ethics
Personal and Professional Excellence: Identifying long term choice and goals.

Unit III

Importance of Interpersonal relationships: Role and relationships, Maintaining healthy relationships. Importance and Steps to improve Interpersonal Communication.
Meaning and nature of teams, Internal and external factors affecting team building.
Leadership Meaning, Nature and functions. leadership styles in organization.
Meaning and nature of stress, causes, effect and management.

Unit IV

Meaning and importance of human rights, Human right awareness.

Harmony in nature, understanding coexistence, harmony at all levels of coexistence, Human being as cause of imbalance in nature, Understanding the concept of happiness and well-being. Role and importance of positive emotions, Gratitude, hope and optimism.

Text and Reference Books:

1. Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour.
2. Dressler, David and Cans, Donald: The Study of Human Interaction.
3. Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
4. Organizational Behaviour, Davis, K.
5. Hoover, Judhith D. Effective Small Group and Team Communication, 2002, Harcourt College Publishers
6. Dick, McCann &Margerison, Charles: Team Management, 1992 Edition, viva books
7. Pestonjee, D.M.; Stress and Coping: The Indian Experience
8. Clegg, Brian; Instant Stress Management – Bring calm to your life now.

CO-PO Articulation Matrix:Human Values and Personality Development(HSMC201-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **exhibit** awareness about oneself, one's surroundings and goals in one's life	-		-	-	-	-	-	2	-	-	-	3	_	_
CO2. **stay** in harmony with society and nature. (LOTS: Level 2: Understand)	-	-	-	-	-	2	3	2	1	-	-	2	_	_
CO3. **developing** healthy and harmonious relationships. (LOTS: Level 3: Apply)	-	-	-	-	-	-	-	2	2	2	-	2	_	_
CO4. **understand** groups and develop team spirit. (HOTS: Level 4: analyze)	-	-	-	-	-	-	-	-	3	2	-	1	_	_
CO5. **exhibit** leadership qualities. (HOTS: Level 6: design)	-	-	-	-	-	-	_	-	3	-		-	_	_
CO6. **excel** in personal and professional life	-	-	-	-	-	-	-	-	-	2	-	-	_	_
Level of Attainments HSMC201-T														

Data Structures and Algorithmsusing C/C++Lab.

General Course Information

Course Code: PCC-CSEAI201-P/ PCC-CSE201-P/ PCC-IT201-P Course Credits: 2 Type: Professional Core Lab. Course Contact Hours: 4 hours/week Mode: Lab practice and assignments	**Course Assessment Methods :** **Total Marks: 100 (internal: 50; external:50)** The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. For implementing the spirit of continuous evaluation, the course coordinators will maintain the experiment-wise record of the performance of students for the laboratory courses as a part of their lab course file. The course coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the prescribed proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the course outcomes of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Programming in C language.

About the Course:

This lab. course involves implementation of basic and advance data structures and various operations on these data structures. The objective of the lab course is to train the students to solve the problems related to data structures and choose the appropriate data structure for solvingcomputational problem efficiently.

Course Outcomes: By the end of the lab course a student would be able to:

CO1. **Implement**various data structuresand the related operations. (LOTS: Levels 3: Apply)
CO2. **Analyse**space and time complexity of algorithms. (HOTS: Level 4: Analyse)
CO3. **Compare** solutions on the basis of the appropriateness of data structure used and the efficiency of the operations implemented. (HOTS: Level 5: Evaluate)
CO4. **Integrate** knowledge of data structures to solve real world problems related to data structure and algorithms. (HOTS: Level 6: Create)
CO5. **Create**written records for the given assignments with problem definition, design of solution and conclusions. (HOTS: Level 6: Create)
CO6. **Demonstrate** ethical practices while solving problems individually or in groups (LOTS: Level 3: Apply).

List of experiments/assignments

1. Two assignments related to creating and manipulating matrices and linear lists.
2. Two assignments associated with linked list, operations on linked lists and their applications.
3. Two assignments on array and linked implementation of stacks and queues.
4. Two assignments on trees and their applications.
5. Two assignments on graphs and their applications.
6. Two assignments on different searching and sorting methodsalong with their complexity analysis.
7. One assignment on challenging problems on data structuresto be given in groups.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix: Data Structures and Algorithms using C/C++Lab. (PCC-CSEAI201-P)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Implement** various data structures and the related operations. (LOTS: Levels 3: Apply)	2	-	-	-	2	-	-	-	2	-	-	-	3	-
CO2. **Analyse** space and time complexity of algorithms. (HOTS: Level 4: Analyse)	2	2	-	-	2	-	-	-	1	-	-	-	3	-
CO3. **Compare** solutions on the basis of the appropriateness of data structure used and the efficiency of the operations implemented. (HOTS: Level 5: Evaluate)	2	2	-	-	3	-	-	-	1	-	-	-	3	-
CO4. **Integrate** knowledge of data structures to solve real world problems related to data structure and algorithms. (HOTS: Level 6: Create)	3	2	3	-	3	-	-	-	3	-	-	-	3	-
CO5. **Create** written records for the given assignments with problem definition, design of solution and conclusions. (HOTS: Level 6: Create)	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO6. **Demonstrate** ethical practices while solving problems individually or in groups (LOTS: Level 3: Apply).	-	-	-	-	-	-	-	3	-	-	-	3	-	-
Level of Attainments: PCC-CSEAI201-P														

Object Oriented Programming using C++ Lab.

General Course Information

Course Code: PCC-CSEAI202-P/ PCC-CSE202-P/ PCC-IT202-P Course Credits: 2 Type: Professional Core Lab. Course Contact Hours: 4hours/week Mode: Lab practice and assignments	**Course Assessment Methods :** **Total Marks: 100 (internal: 50; external:50)** The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. For implementing the spirit of continuous evaluation, the course coordinators will maintain the experiment-wise record of the performance of students for the laboratory courses as a part of their lab course file. The course coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the prescribed proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the course outcomes of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Problem solving using C Lab.

About the course:

The lab course provides the opportunity to students to solve problems using Object Oriented Framework in C++ language. This includes implementing the concepts of data abstraction, data hiding, and encapsulation, reuse of code and, compile and runtime polymorphism.

Course Outcomes: By the end of the course studentswill be able to:

CO1. **implement**problems with object oriented framework. (LOTS: Level 3: Apply)
CO2. **analyse** the structure of programs for modular design. (HOTS: Level 4: Analyse)
CO3. **evaluate** robustness of a program by testing it on test/use cases. (HOTS: Level 5: Evaluate)
CO4. **design** class hierarchies for implementing inheritance/polymorphism. (HOTS: Level 6: Create)
CO5. **create** a lab record of assignments including problem definitions, design of solutions and conclusions. (HOTS: Level 6: Create)
CO6. **demonstrate** ethical practices and solve problems individually or in a group. (LOTS: Level 3: Apply)

List of assignments

1. Create two classes **DM** and **DB** which store the value of distances. **DM** stores distances in meters and centimeters and **DB** in feet and inches. Write a program that can read values for the class objects and add one object of **DM** with another object of **DB**. Use a friend function to carry out the addition operation. The object that stores the results maybe a **DM** object or **DB** objects, depending on the units in which the result is required. The display should be in the format of feet and inches or meters and centimeters depending on the object on display.
2. Create a class rational which represents a numerical value by two double values- NUMERATOR & DENOMINATOR. Include the following public member Functions:
    - constructor with no arguments (default).
    - constructor with two arguments.
    - void reduce () that reduces the rational number by eliminating the highest common factor between
    - the numerator and denominator.
    - Overload + operator to add two rational number.
    - Overload >> operator to enable input through cin.
    - Overload << operator to enable output through cout.

    Write the main () function to test all the functions in the class.
3. A hospital wants to create a database regarding its indoor patients. The information to be stored includes
    a) Name of the patient b) Date of admission c) Disease d) Date of discharge
    Create a structure to store the date (year, month and day as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).
4. Make a class **Employee** with a name and salary. Make a class **Manager** inherited from **Employee**. Add an instance variable named department of type string. Supply a method to **toString**that prints the manager's name, department and salary. Make a class **Executive** inherited from **Manager**. Supply a method

toStringthat prints the string **"Executive"** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

5. Imagine a tollbooth with a class called 'tollBooth'. The two data items are of type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both to 0. A member function called 'payingCar()' increments the car total and adds 0.50 to the cash total. Another function, called 'nopayCar ()', increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.
6. Write a function called 'revers_it()' that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to 'revers_it ()' as an argument. Write a program to exercise 'revers_it ()'. The program should get a string from the usercallof'revers_it () function and print out the result. Use an input method that allows embedded blanks. Test the program with phrase, "*Guru Jambheshwar University of Science & Technology, Hisar*".
7. Write a program related to file handling with all the exception handling provisions.
8. C++ program to write and read time in/from binary file using fstream. Use exception handling wherever possible.
9. Write a program to implement string classusing STL.
10. Write a program to implement run time polymorphism.

Note:

The experiments/assignments may vary from session to session and will be designed by the course coordinator. The assignments must meet the objective of the course and the levels of the given course outcomes. The course coordinator will provide the schedule for submission of the assignment.

CO-PO Articulation Matrix:Object Oriented Programming using C++ Lab. (PCC-CSEAI202-P)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Implement** problems with object oriented framework. (LOTS: Level 3: Apply)	2	2	-	-	1	-	-		2	-	-	2	3	-
CO2. **Analyse** the structure of programs for modular design. (HOTS: Level 4: Analyse)	2	2	-	-	2	-	-	-	-	-	-	-	3	-
CO3. **evaluate** robustness of a program by testing it on test/use cases. (HOTS: Level 5: Evaluate)	2	2	-	-	2	-	-	-	-	-	-	-	3	-
CO4. **Design** class hierarchies for implementing inheritance/polymorphism. (HOTS: Level 6: Create)	3	-	1	-	2	-	-	-	-	-	-	2	3	-
CO5. **Create** a lab record of assignments including problem definitions, design of solutions and conclusions. (HOTS: Level 6: Create)	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO6. **Demonstrate** ethical practices and solve problems individually or in a group. (LOTS: Level 3: Apply)	-	-	-	-	-	-	-	3	3	-	-	3	-	-
Level of Attainments: PCC-CSEAI202-P														

Data Analytics using R Lab.

General Course Information

Course Code: PCC-CSEAI203-P Course Credits: 2 Type: Professional Core Lab. Course Contact Hours: 4 hours/week Mode: Lab practice and assignments	**Course Assessment Methods:** **Total Marks: 100 (internal: 50; external:50)** The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. For implementing the spirit of continuous evaluation, the course coordinators will maintain the experiment-wise record of the performance of students for the laboratory courses as a part of their lab course file. The course coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the prescribed proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the course outcomes of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Basic programming skills.

About the Course:
The objective of this lab is to enable students to apply advanced data analytics tools for manipulating data, applying statistics, regression and classification.

Course Outcomes: By the end of the course students will be able to:

CO1. **apply** pre-processing techniques to real world data. (LOTS: Level 3: Apply)
CO2. **solve** problemsof predictive analytics. (LOTS: Level 3: Apply)
CO3. **evaluate** the performance ofpredictive models. (LOTS: Level 5: Evaluate)
CO4. **design** completedata analytics experiments. (LOTS: Level 6: Create)
CO5. **create** lab assignment record that includes problem definitions, solutions, results and conclusions. (HOTS: Level 6: Create).
CO6. **demonstrate** ethical practices, self-learning and team spirit.

List of experiments/assignments using R:

1. Four Assignments on descriptive statistics
2. Four Assignment on visualizing data
3. Four Assignments on Pre-processing Data
4. Two assignments to solve linear and non-linear regression problems.
5. Two assignments on classification problems.
6. Two assignment on different sampling techniques.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix:Data Analytics using R Lab. (PCC-CSEAI203-P)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Apply** pre-processing techniques to real world data. (LOTS: Level 3: Apply)	2	1	_	_	2	_	_	_	_	_	_	_	_	3
CO2. **Solve** problemsof predictive analytics. (LOTS: Level 3: Apply)	3	2	_	_	3	_	_	_	_	_	_	_	_	3
CO3. **Evaluate** the performance ofpredictive models. (LOTS: Level 5: Evaluate)	3	2	1	_	3	_	_	_	_	_	_	_	_	3
CO4. **Design**completedata analytics experiments. (HOTS: Level 6: Create)	3	2	2	3	3	_	_	_	_	_	_	_	_	3
CO5. **Create** lab assignment record that includes problem definitions, solutions, results and conclusions. (HOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	3
CO6. **Demonstrate** ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)	_	_	_	_	_	_	_	3	3	_	_	3	_	_
Level of Attainments PCC-CSEAI203-P														

Computer Organisation and Architecture

General Course Information

Course Code: PCC-CSEAI204-T/ PCC-CSE204-T/ PCC-IT204-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures Examination Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Pre-requisites: Fundamental of Computer Systems.

About the Course:

Computer Architecture and organization describes the role of instruction set architecture in digital computer, main memory, and input/output devices. It illustrates the simple data path and control design for processors. It helps to understand the different operations and concept of instructions. It would enable the students to learn the basic function and architecture of modern computer systems.

Course Outcomes: By the end of the course students will be able to:

CO1. **outline** the general concepts of digital electronics and computer organisation and architecture. (LOTS: Level 1: Remember)
CO2. **discuss** the basic components and their interfacing.(LOTS: Level 2: Understand)
CO3. **apply**instructions for performing different operations. (LOTS: Level 3: Apply)
CO4. **analyse** the effect of addressing modes on the execution time of a program.(HOTS: Level 4: Analyse)
CO5. **contrast** different types of memory, their architecture and access methods. (HOTS: Level 5: Evaluate)
CO6. **Design** of simple computer with different instruction sets. (HOTS: Level 6: Create)

Course Content

Unit I

Basic Principles: Boolean algebra and Logic gates, Combinational logic blocks (Adders, Subtractors, Multiplexers, Encoders, decoders, demultiplexers, KMaps), Sequential logic blocks (Flip-Flops, Registers, Counters); Flynn's classification of computers (SISD, MISD, MIMD); Performance metrics: MIPS, MFLOPS; CPU Architecture types: computer register, (accumulator, register, stack, memory/ register) detailed data path of a typical register based CPU.

Unit II

Computer Organization: Store program control concept, Instruction codes, timing and control, instruction cycle; type of instructions: memory reference, register reference, I/O reference; Basics of Logic Design, accumulator logic, Control memory; Micro Programmed Control: address sequencing, micro-instruction formats, micro-program sequencer, Implementation of control unit.

Unit III

Instruction Set Architecture & Parallelism: Instruction set based classification of processors (RISC, CISC, and their comparison); Stack Organization, Instruction Formats; addressing modes: register, immediate, direct, indirect, indexed; Operations in the instruction set: Arithmetic and Logical, Data Transfer, Control Flow; Types of interrupts; Introduction to Parallelism: Goals of parallelism (Exploitation of concurrency, throughput enhancement); Amdahl's law; Instruction level parallelism (pipelining, super scaling –basic features); Processor level parallelism (Multiprocessor systems overview).

Unit IV

Memory Hierarchy & I/O Techniques: The need for a memory hierarchy (Locality of reference principle, Memory hierarchy in practice: Cache, main memory and secondary memory, Memory parameters: access/ cycle time, cost per bit); Main memory (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types); Cache memory (Associative & direct mapped cache organizations; input-output interface, mode of transfer, DMA (Direct memory transfer).

Text and Reference Books:

1. Mano, M. Morris, *Digital Logic and Computer Design*, Prentice Hall of India Pvt. Ltd., 1981.
2. M. Morris Mano, *Computer System Architecture*, Prentice Hall of India Pvt. Ltd., 1993.
3. Milles J. Murdocca, Vincent P. Heuring, *Computer Architecture and Organization, An Integrated Approach*, JohnWiley& Sons Inc., 2007.
4. William Stallings, 10th edition, *Computer Organization and Architecture*, Prentice Hall, 2016.
5. Heuring, V.P., Jordan, H.F., *Computer Systems Design and Architecture*, Addison Wesley,1997.
6. R.P Jain, *Modern Digital Electronics*, 3rd Edition , Tata McGraw Hill,, 2003.

CO-PO Articulation Matrix:Computer Organisation and Architecture (PCC-CSEAI204-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **outline** the general concepts of digital electronics and computer organisation and architecture. (LOTS: Level 1: Remember)	1	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2. **discuss** the basic components and their interfacing. (LOTS: Level 2: Understand)	1	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3. **Apply** instructions for performing different operations. (LOTS: Level 3: Apply)	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4. **Analyse** the effect of addressing modes on the execution time of a program. (HOTS: Level 4: Analyse)	2	2	-	1	-	-	-	-	-	-	-	1	3	-
CO5. **Contrast** different types of memory, their architecture and access methods. (HOTS: Level 5: Evaluate)	2	2	-	1	-	-	-	-	-	-	-	1	3	-
CO6. **Design** of simple computer with different instruction sets. (HOTS: Level 6: Create)	3	2	-	-	2	-	-	-	-	-	-	-	3	-
Level of Attainments PCC-CSEAI204-T														

Data Mining Techniques

General Course Information

Course Code: PCC-CSEAI205-T Course Credits: 3 Type: Contact Hours: Mode: Examination Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Pre-requisites: Knowledge of database systems, elementary knowledge of statistics and probability.

About the Course:

Today's era is the era of information. Data is growing exponentially day by day. There is a need to process and analyse the data to extract knowledge from it, so that one can use that knowledge for decision making. This course provides introductory concepts of data mining and data warehousing. The course will be taught with a database as well as machine learning perspectives. The objective of the course is to provide a comprehensive understanding of data mining tasks and evaluation of results obtained out of data mining processes.

Course Outcomes: By the end of the course students will be able to:

CO1. **outline** various types of data mining and data warehouse concepts and techniques. (LOTS: Level 1: Remember)
CO2. **explain** association of patterns, data mining functionalities, tasks of data mining,. (LOTS: Level 2: Understand)
CO3. **apply** various classification, clustering correlation and association mining for extracting valuable information from data. (LOTS: Level 3: Apply)
CO4. **evaluate** the descriptive and predictive data mining models. (HOTS: Level 5: Evaluate)
CO5. **plan** a data mining process for discovering knowledge from real-world databases. (HOTS: Level 6: Create)

Course Content

Unit I

Introduction to Data Mining: Kind of data to be mined, Data Mining Functionalities, Technologies used in Data Mining, Applications of data Mining, Major Issues in Data Mining.

Data Warehouse: Introduction, Data Warehouse and Database Systems, Data Warehouse Architecture, Data Warehouse Models, Data Cube and OLAP, Multidimensional data Model, Concept Hierarchies, OLAP operations
Pattern Mining:Mining Frequent Patterns, Associations and Correlations, Frequent Itemset Mining using Apriori Algorithm, Generating Association Rules from Frequent Itemsets. Pattern Growth Approach for Mining Frequent Itemsets, Pattern evaluation Methods

Unit II

Classification: Introduction, Classification using Decision Tree Induction, Bayesian Classification Methods, Rule Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy.
Introduction to advanced classifiers: k-Nearest Neighbor, Support Vector Machine, Artificial Neural Network.

Unit III

Cluster Analysis: Introduction, overview of Basic Clustering Methods,
Partitioning Methods: k-mean, k-medoids,
Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering,Distance Measures in Algorithmic Methods,Balanced Iterative Reducing and Clustering using Hierarchies (BIRCH), Chameleon: Multiphase Hierarchical ClusteringUsing Dynamic Modeling, Probabilistic Hierarchical Clustering,
Density-based methods: DBSCAN, OPTICS, DENCLUE,
Grid-based Methods: STING, CLIQUE, **Evaluation of Clustering.**

Unit IV

Outlier Detection: Introduction, types of outliers, challenges of outlier detection.
Outlier detection methods: statistical approaches, proximity-based approaches, clustering based approaches, classification-based approaches, Outlier detection in high dimensional data.

Text and Reference Books:

1. Jiawei Han, Micheline Kamber and Jian Pei, *Data Mining Concepts and Techniques*, Morgan Kaufmann Publishers,Third Edition, July 2011.
2. Alex Berson, Stephen J. Smith, *Data Warehousing, Data Mining & OLAP*, Tata McGraw Hill, 2004.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, *Introduction to Data Mining*, Pearson Education, 2014.
4. K. P. Soman, Shyam Diwakar and V. Ajay, *Insight into Data Mining Theory and Practice*, Easter Economy Edition, Prentice Hall of India, 2009.
5. G. K. Gupta, *Introduction to Data Mining with Case Studies*, Prentice Hall of India, 2006.
6. Daniel T. Larose, *Data Mining Methods and Models*, Wiley, 2006.
7. W. H. Inman, *Building the Data Warehouse*, Wiley India, 2005

CO-PO Articulation Matrix:Data Mining Techniques (PCC-CSEAI205-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Outline** various types of data mining and data warehouse concepts and techniques. (LOTS: Level 1: Remember)	1	_	_	_	2	_	_	_	_	_	_	_	_	1
CO2. **Explain** characteristics, architecture of a data warehouse, OLAP operations and data mining tasks. (LOTS: Level 2: Understand)	1	_	_	_	3	_	_	_	_	_	_	_	_	2
CO3. **Apply** various pre-processing and data mining techniques for extracting valuable information from data. (LOTS: Level 3: Apply)	2	1	_	_	3	_	_	_	_	_	_	_	_	3
CO4. **Evaluate** the descriptive and predictive data mining models. (HOTS: Level 5: Evaluate)	3	2	2	3	3	_	_	_	_	_	_	_	_	3
CO5. **Plan** a data mining process for discovering knowledge from real-world databases. (HOTS: Level 6: Create)	3	3	3	3	3	_	_	_	_	_	_	_	_	3
Level of Attainments PCC-CSEAI205-T														

Operating Systems

General Course Information

Course Code:PCC-CSEAI206-T/ PCC-CSE305-T/ PCC-IT206-T Course Credits: 3 Type: Professional Core Contact Hours: 3hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Pre-requisites: Programming in C and knowledge of computer fundamentals.

About the Course:

The objective of this course is to help students become familiar with the fundamental concepts of operatingsystems and provide them with enough understanding of operating system design.

Course Outcomes: By the end of the course studentswill be able to:

CO1. **list** various functions and design characteristics of operating systems (LOTS: Level 1: Remember)
CO2. **explain** fundamental concepts of operating systems. (LOTS: Level 2: Understand)
CO3. **apply** operating system design concepts for solving problems regarding scheduling, memory management, disk management and deadlocks etc.(LOTS: Level 3: Apply)
CO4. **analyze** the issues related to various operating systems. (HOTS: Level 4: Analyse)
CO5. **design** solutions for the memory and process management problems. (HOTS: Level 6: Create)

Course Content

Unit I

Introductory Concepts: Operating systems functions and characteristics, operating system services and systems calls, system programs, operating system structure. operating systems generation, operating system services and systems calls. Types of Operating systems: Batch operating system, Time-sharing OS, Distributed operating system, Realtime systems.

File Systems: Types of Files and their access methods, File allocation methods, Directory Systems: StructuredOrganizations, directory and file protection mechanisms, disk scheduling and its associated algorithms.

Unit II

Processes: Process concept, Process Control Block, Operations on processes, cooperating processes.CPU scheduling: Levels of Scheduling, scheduling criteria, Comparative study of scheduling algorithms, Algorithmevaluation, multiple processor scheduling. Critical-section problem, Semaphores.

Unit III

Storage Management: Storage allocation methods: Single contiguous allocation, non-contiguous memory allocation,Paging and Segmentation techniques, segmentation with paging, Virtual memory concepts, Demand Paging, PagereplacementAlgorithms, Thrashing.

Unit IV

Deadlock: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention,Deadlock avoidance, Deadlock detection, Recovery from deadlock

Case Studies: Comparative study of WINDOW, UNIX & LINUX system.

Text and Reference Books:

1. Silberschatz, Peter B. Galvin and Greg Gagne, *Operating System Concepts*, 8th Edition, WileyIndian Edition, 2010.
2. Andrew S Tanenbaum, *Modern Operating Systems*, Third Edition,Prentice Hall India, 2008.
3. Naresh Chauhan, *Principles of Operating Systems*, Oxford Press, 2014.
4. D.M. Dhamdhere, *Operating Systems*, 2nd edition, Tata McGraw Hill, 2010.
5. William Stallings, *Operating Systems– Internals and Design Principles*, 5th Edition,Prentice Hall India, 2000.

CO-PO Articulation Matrix:Operating Systems (PCC-CSEAI206-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **List** various functions and design characteristics of operating systems (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	3	–
CO2. **Explain** fundamental concepts of operating systems. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	3	–
CO3. **Apply** operating system design concepts for solving problems regarding scheduling, memory management, disk management and deadlocks etc. (LOTS: Level 3: Apply)	3	1	–	–	2	–	–	–	–	–	–	1	3	–
CO4. **Analyze** the issues related to various operating systems. (HOTS: Level 4: Analyse)	3	2	3		2	–	–	–	–	–	–	1	3	–
CO5. **Design** solutions for the memory and process management problems. (HOTS: Level 6: Create)	3	2	3	2	2	–	–	–	–	–	–	–	3	–
Level of Attainments PCC-CSEAI206-T														

Database Management System

General Course Information

Course Code:PCC-CSEAI207-T/ PCC- CSE207-T/ PCC-IT207-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Exam Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Prerequisite: Knowledge of UNIX/ Windows, programming language and data structures

About the Course:

This course includes a detailed coverage of principles of database design and models. Students learn querying a database using SQL, normalization techniques, transaction processing etc.

Course Outcomes: By the end of the course students will be able to:

CO1. **describe** fundamental elements of Database Management System. (LOTS: Level 1: Remember)
CO2. **discuss**principles of relational Database modelling. (LOTS: Level 2: Understanding)
CO3. **apply** SQL for designing queries for Relational Databases. (LOTS: Level 3: Apply)
CO4. **contrast** various concurrency control and recovery techniques with concurrent transactions in DBMS. (HOTS: Level 5: Evaluate)
CO5. **design** models of databases using ER modelling and normalization for real life applications.(HOTS: Level 6: Create)

Course Content

Unit I

Overview: Overview of File Systems and Database Systems, Characteristics of the Data Base Approach, Database users, Advantages and Disadvantages of a DBMS, Responsibility of Database Administrator.

Data Base Systems Concepts and Architecture: DBMS architecture and various views of Data, Data Independence, Database languages, Data Models: Relational Database Model, Hierarchical Data Model, Network Data Model, Schemas and Instances.

Unit II

E-R Model: Entity Types, Attributes & Keys, Relationships, Roles and Structural Constraints, E-R Diagrams, Reduction of an E-R Diagram to Tables. Relational Model and Query Language: Overview of Relational Database, Key Integrity Constraints, Relational Algebra, Relational Calculus, SQL fundamentals, Basic Operators, Missing information and NULL values, Advanced SQL features

Unit III

Relational Database Design: Overview of normalization, Database Anomalies, Candidate and Super Key, Functional Dependencies, Integrity Constraints, Decomposition, Normal forms: First, Second, Third Normal, Boyce Codd, Normal Form, Multi-valued Functional Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Denormalization.

Unit IV

Concurrency Control Techniques: Overview of database Transactions, Transaction states, ACID properties of a Transaction, Transaction Recovery, Concurrency Control, Locking Techniques, Time-stamp ordering, Multi-version Techniques, Deadlock, Recovery Techniques in centralized DBMS.

DDBMS Design: Replication and Fragmentation Techniques.

Text and Reference Books:

1. Elmasri, R., and Navathe,S. B., *Fundamentals of Database Systems*, 3rd Edition, Addison Wesley, 2002.
2. Silberschatz, A., Korth, H. F., and Sudarshan, S., Database *System Concepts*, McGraw Hill, 2011.
3. Pannerselvam R., *Database Management Systems*, 2ndEdition, PHI Learning, 2011.
4. Desai, B. C., *An Introduction to Database System*,Galgotia Publication, 2010.
5. Leon, A., and Leon, M.,*Database Management Systems*,Ist Edition,Vikas Publishing, 2009.
6. Mata-Toledo, R., Cushman, P., Sahoo, D., *Database Management Systems*, Schaums'Outline series, TMH, 2007.

CO-PO Articulation Matrix:Database Management System (PCC-CSEAI207-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Describe** fundamental elements of Database Management System. (LOTS: Level 1: Remember)	1	--	--	--	--	--	--	--	--	--	--	--	3	--
CO2. **discuss** principles of relational Database modeling. (LOTS: Level 2: Understanding)	1	--	--	--	--	--	--	--	--	--	--	--	3	--
CO3. **Apply** SQL for designing queries for Relational Databases. (LOTS: Level 3: Apply)	1	--	--	_	2	--	--	--	--	--	--	--	3	--
CO4. **Contrast** various concurrency control and recovery techniques with concurrent transactions in DBMS. (HOTS: Level 5: Evaluate)	1	2	--	--	--	--	--	--	--	--	--	--	3	--
CO5. **Design** models of databases using ER modelling and normalization for real life applications.(HOTS: Level 6: Create)	3	2	3	1	2	--	--	--	--	--	--	--	3	--
Level of Attainments PCC-CSEAI207-T														

Discrete Mathematics

General Course Information

Course Code:PCC-CSEAI208-T/ PCC-CSE203-T/ PCC-IT203-T Course Credits: 3 Type: Professional Core Contact Hours: 3hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Pre-requisites: Basic knowledge of Number Theory, Calculus and Algebra

About the Course:

Discrete Mathematics is a core and an essential course for every graduate in Computer Science and Engineering. This branch of mathematics mainly deals with discrete objects (as computer runs on discrete steps). It provides a mathematical language for computer science to resolve many realworld problems by incorporating different methods applicable tovarious discrete structures.This course introduces set theory, propositional calculus, algebraic structures, recurrence relations and graph theory.

Course Outcomes: By the end of the course a student would be able to:

CO1. **outline** various discrete structures and the related operations. (LOTS: Level 1: Remember)
CO2. **illustrate** different discrete structures with the help of examples. (LOTS: Level 2: Understand)
CO3. **apply** appropriate techniques to solve problems related to discrete structures.(LOTS: Level 3: Apply)
CO4. **justify** the solutions with the help of proofs. (HOTS: Level 5: Evaluate)
CO5. **combine** techniques related to discrete structuresfor solving real world problems. (HOTS: Level 6: Create)

Course Content

Unit I

Set Theory: Introduction to Set Theory, Venn Diagrams, Set Operations, Algebra of Sets, Duality, Finite, Infinite Sets and Counting Principle, Classes of Sets, Power Sets, Partitions, Multi Sets, Relations: Cartesian Product, Representation of Relations, Types of Relation, Equivalence Relations and Partitions, Partial Ordering Relations,

Functions:Definition, Types of Functions, Composition of Functions, Inverse Function, Recursively Defined Functions.

Unit II

Logic and Propositional Calculus: Introduction, Propositions and Compound Propositions, Basic Logical Operations, Propositions and Truth Tables, Tautologies and Contradictions, Logical Equivalence, Algebra of Propositions, Conditional and Bi-conditional Statements, Algebraic Structures:Group Axioms, Monoid, Semi-Groups, Subgroups, Abelian Group, Cosets, Normal Subgroup, Cyclic Group, Permutation Group, Lagrange's Theorem, Homomorphism, Isomorphism, Automorphism, Rings, Integral Domains and Fields (Also, some basic and standard results related to Groups, Rings, ID and Fields).

Unit III

Recursion and Recurrence Relation: Polynomials and their evaluation, Sequences, Introduction to AP, GP and AG Series, Partial Fractions, Recurrence Relation,Linear Recurrence Relations with Constant Coefficients, Linear Homogeneous Recurrence Relations with Constant Coefficients, Particular Solution- Homogeneous Linear Difference Equations, Non-Homogeneous Linear Difference Equations, Total Solution, Generating Functions.

Unit IV

Graphs Theory:Introduction to Graphs, Multi Graph, Directed and Undirected Graphs, Subgraphs, Bipartite Graphs, Regular Graphs, Connected Graphs, Homomorphic and Isomorphic Graphs,Cut points and Bridges, Paths and Circuits, Euler Graph, Hamiltonian Graph, Planar Graph, Euler Formula, Weighted Graphs,Dijkstra's ShortestPath Algorithm forWeighted Graphs, Trees, Spanning Trees, Minimum Spanning Tree (Prim's and Kruskal's Algorithm).

Text and Reference Books:

1. J.P. Trembley and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill – 13th reprint, 2012.
2. Kenneth H. Rosen, *Discrete Mathematics and its applications*, 6th Edition, Tata McGraw Hill, 2011.
3. Richard Johnsonbaugh, *Discrete Mathematics*, 6th Edition, Pearson Education Asia, 2011.
4. S. Lipschutz and M. Lipson, *Discrete Mathematics*, Tata McGraw Hill, 3rd Edition, 2010.
5. B. Kolman, R. C. Busby and S. C. Ross, *Discrete Mathematical structures*, 6th Edition, PHI, 2010.
6. C. L. Liu, *Elements of Discrete Mathematics*, Tata McGraw Hill, 3rd Edition, 2008.

CO-PO Articulation Matrix:Discrete Mathematics (PCC-CSEAI208-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Outline** various discrete structures and the related operations. (LOTS: Level 1: Remember)	1	--	--	--	--	--	--	--	--	--	--	--	1	--
CO2. **Illustrate** different discrete structures with the help of examples. (LOTS: Level 2: Understand)	1	--	--	--	--	--	--	--	--	--	--	--	2	--
CO3. **Apply** appropriate techniques to solve problems related to discrete structures. (LOTS: Level 3: Apply)	2	--	--	--	1	--	--	--	--	--	--	--	3	2
CO4. **Justify** the solutions with the help of proofs. (HOTS: Level 5: Evaluate)	3	1	--	--	2	--	--	--	--	--	--	--	3	--
CO5. **Combine** techniques related to discrete structures for solving real world problems. (HOTS: Level 6: Create)	3	2	--	--	2	--	--	--	1	--	--	1	3	2
Level of Attainments: PCC-CSEAI208-T														

Artificial Intelligence

General Course Information

Course Code:PCC-CSEAI209-T/ PCC-CSE402-T/ PCC-IT304-T Course Credits: 3 Type: Professional Core Contact Hours: 3hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. All questions carry equal marks. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. The remaining eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt five questions in all, one compulsory and any other four questions by selecting one from each unit.

Pre-requisites: Basic Knowledge of Algorithms and Probability.

About the Course:

Artificial Intelligence is a core and an essential course for every graduate in Computer Science and Engineering. This course introduces the concepts of Artificial Intelligence and challenges inherent in building intelligent systems. It includes the role of knowledge representation in problem solving and how these are used in making intelligent machine. Further it incorporates the concepts of expert system and its applications.

Course Outcomes: By the end of the course students will be able to:

CO1. **outline** various Artificial Intelligence techniques. (LOTS: Level 1: Remember)
CO2. **illustrate** reasoning under uncertainty. (LOTS: Level 2: Understand)
CO3. **apply** search and knowledge representation techniques to solve AI problems.(LOTS: Level 3: Apply)
CO4. **compare** strengths and weaknesses of AI algorithms (HOTS: Level 4: Analyse).
CO5. **combine** various AI techniques to solve intelligent systems' problems. (HOTS: Level 6: Create)

Course Content

Unit I

Introduction to AI: Introduction, Turing Test, AI problems, State Space Search, production system

Problem Solving Using Search: Blind search techniques - Breadth first search, Depth first search. Heuristic search techniques - Generate and test, Hill Climbing, Best first search, A* Algorithm, AO* Algorithm, The Minimax Search Procedure, Adding Alpha-Beta Cut-offs.

Unit II

Knowledge Representation: Introduction, Knowledge Representation- Representation and Mappings, Symbolic Logic - Propositional logic, Predicate logic- Representing simple facts in logic, Representing Instances and ISA Relationship, Computable functions and Predicates, Unification, Resolution.

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching, Control Knowledge.

Unit III

Reasoning Under Uncertainty: Introduction to Nonmonotonic Reasoning, Probability and Baye's Theorem, Certainty Factors and Rule-based Systems, Bayesian Networks.

Fuzzy logic system: Introduction, Crisp Set, Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations.

Unit IV

Planning: Introduction, Components of Planning System, Goal Stack Planning, Nonlinear Planning using Constraint Posting, Hierarchical Planning.

Expert System and Applications: Introduction, Architecture, Rule based Expert Systems, Applications of Expert Systems.

T**ext and Reference Books:**

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, *Artificial intelligence*, McGraw Hill Education. 3rd edition, 2009.
2. Stuart Russel and Peter Norvig, *Artificial intelligence: A modern Approach*, Pearson Education, 3rd edition, 2015.
3. Dan W. Patterson, *Introduction to Artificial Intelligence and Expert System*, Pearson Education.1st edition, 2007.
4. Deepak Khemani, *A first course in Artificial Intelligence*, McGraw Hill Education. 3rd edition, 1st edition, 2013.
5. George F. Luger, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, Pearson Education, 5th edition, 2009.

CO-PO Articulation Matrix:Artificial Intelligence(PCC-CSEAI209-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Outline** various Artificial Intelligence techniques. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	–	3
CO2. **Illustrate** reasoning under uncertainty. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	–	3
CO3. **Apply** search and knowledge representation techniques to solve AI problems. (LOTS: Level 3: Apply)	2	2	–	2	2	–	–	–	–	–	–	–	–	3
CO4. **Compare** strengths and weaknesses of AI algorithms (HOTS: Level 4: Analyse).	2	2	2	2	–	–	–	–	–	–	–	–	–	3
CO5. **Combine** various AI techniques to solve intelligent systems' problems. (HOTS: Level 6: Create)	3	3	3	3	2	2	–	–	–	–	–	3	–	3
Level of Attainments PCC-CSEAI209-T														

Data Mining using R/Python/WEKA Lab.

General Course Information

Course Code: PCC-CSEAI205-P Course Credits: 2 Type: Professional Core Lab. Course Contact Hours: 4 hours/week Mode: Lab practice and assignments	**Course Assessment Methods:** **Total Marks: 100 (internal: 50; external:50)** The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. For implementing the spirit of continuous evaluation, the course coordinators will maintain the experiment-wise record of the performance of students for the laboratory courses as a part of their lab course file. The course coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the prescribed proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the course outcomes of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Basic Programming skills.

About the Course:
The objective of this lab is to enable students to use tools for applying advanced data reduction, classification and clustering techniques.

Course Outcomes: By the end of the course students will be able to:

CO1. **apply** advanced data mining algorithms. (LOTS: Level 3: Apply)
CO2. **usages** of modern data mining tools such as WEKA, R/Python packages. (LOTS: Level 3: Apply)
CO3. **evaluate** the performance ofdata mining models. (LOTS: Level 5: Evaluate)
CO4. **design** advanced data mining experiments. (LOTS: Level 6: Create)
CO5. **create** lab assignment record that includes problem definitions, solutions, results and conclusions. (HOTS: Level 6: Create).
CO6. **demonstrate** ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)

List of experiments/assignments: (WEKA/R/Python packages etc.)

1. Five assignments on advanced classification algorithms (Advanced Classifiers).
2. Five assignment on clustering problems
3. Four assignment on data reduction and attribute selection
4. Two assignment on discovering association rules.

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix:Data Mining using R/Python/WEKA Lab. (PCC-CSEAI205-P)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Apply** advanced data mining algorithms. (LOTS: Level 3: Apply).	2	3	3	–	3	–	–	–	–	–	–	–	–	3
CO2. **Usages** of modern data mining tools such as WEKA, R/Python packages. (LOTS: Level 3: Apply)	1	-	–	–	3	–	–	–	–	–	–	–	–	3
CO3. **Evaluate** the performance ofdata mining models (LOTS: Level 5: Evaluate)	3	2	–	–	3	–	–	–	–	–	–	–	–	3
CO4. **Design** advanced data mining experiments. (LOTS: Level 6: Create)	3	3	–	3	3	–	–	–	–	–	–	–	–	3
CO5. **Create** lab assignment record that includes problem definitions, solutions, results and conclusions. (HOTS: Level 6: Create)	–	–	–	–	–	–	–	–	–	3	–	–	–	3
CO6. **Demonstrate** ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)	–	–	–	–	–	–	–	3	3	–	–	3	–	–
Level of Attainments PCC-CSEAI205-P														

Database Management System Lab.

General Course Information

Course Code: PCC-CSEAI207-P/ PCC-CSE207-P/ PCC-IT207-P Course Credits: 2 Type: Professional Core Lab. Course Contact Hours: 2 hours/week Mode: Lab practice and assignments.	**Course Assessment Methods:** **Total Marks: 100 (internal: 50; external:50)** The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. For implementing the spirit of continuous evaluation, the course coordinators will maintain the experiment-wise record of the performance of students for the laboratory courses as a part of their lab course file. The course coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the prescribed proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the course outcomes of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Exposure to programming language, MS Access.

About the Course:

This lab. course on DBMS involves a rigorous training on Oracle programming. It provides a strong formal foundation in database concepts, technology and practice to the students to groom them into well-informed database application developers. The objective of the lab course is to develop proficiency in the execution of commands of the database design and query using Oracle.

Course Outcomes: By the end of the course students will be able to:

CO1. **implement** database problems using Oracle DML/DDL commands. (LOTS: Level 3: Apply)
CO2. **enforce** integrity constraints on a database using a state-of-the-art RDBMS. (LOTS: Level 3: Apply)
CO3. **analyse** the design of a relational database. (HOTS: Level 4: Analyse)
CO4. **design** a relational database for a given schema. (HOTS: Level 6: Create)
CO5. **create** lab assignment record that includes problem definitions, solutions, results and conclusions. (HOTS: Level 6: Create)
CO6. **demonstrate** ethical practices, self-learning and team spirit.

List of experiments/assignments:

1. Use oracle software and login with valid user id and password. Explore its GUI and practice some basic commands of it.
2. Three assignments related to creation of database with tables having different fields and datatypes.
3. Two assignments on the creation of table with different types of constraints.
4. Two assignments on insert, delete and modify records from the tables.
5. Two assignments on modifying the table using the alter command.
6. Two assignments on exploring select statement using various clauses like where, order by, group by, having and aggregate functions.
7. Two assignments on the use of set operations to query the tables.
8. Two assignments on creating joins and views on the tables.
9. One assignment on generating sub-queries.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation: Matrix Database Management System Lab. (PCC-CSEAI207-P)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Implement** database problems using Oracle DML/DDL commands. (LOTS: Level 3: Apply)	2	1		_	2	_	_	_	_	_	_	_	3	_
CO2. **enforce** integrity constraints on a database using a state-of-the-art RDBMS. (LOTS: Level 3: Apply)	2	2	_	_	2	_	_	_	_	_	_	_	3	_
CO3. **Analyse** the design of a relational database. (HOTS: Level 4: Analyse)	3	3	1	_	2	_	_	_	_	_	_	_	3	_
CO4. **Design** a relational database for a given schema. (HOTS: Level 6: Create)	3	3	2	3	3	_	_	_	_	_	_	_	3	_
CO5. **Create** lab assignment record that includes problem definitions, solutions, results and conclusions. (HOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_
CO6. **Demonstrate** ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)	_	_	_	_	_	_	_	3	3	_	_	3	_	_
Level of Attainments PCC-CSEAI207-P														

Python Programming Lab.

General Course Information

Course Code: PCC-CSEAI210-P Course Credits: 1.5 Type: Professional Core Lab. Course Contact Hours: 3 hours/week Mode: Lab practice and assignments	**Course Assessment Methods:** **Total Marks: 100 (internal: 50; external:50)** The internal and external assessment is based on the level of participation in laboratory sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. For implementing the spirit of continuous evaluation, the course coordinators will maintain the experiment-wise record of the performance of students for the laboratory courses as a part of their lab course file. The course coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the prescribed proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the course outcomes of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Basic programming skills

About the Course:

Python is a scripting programming language known for both its simplicity and wide breadth of applications. For this reason it is considered one of the best languages for beginners. Used for everything from web development to scientific computing Python is referred to as a general purpose language by the greater programming community. The major objective of Python language is to make the students solve real word problem efficiently using python library.

Course Outcomes: By the end of the coursestudentswill be able to:

CO1. **implement** solutions to the given assignments in Python. (LOTS: Level 3: Apply)
CO2. **use**various Python packages for solving different programming problems. (LOTS: Level 3: Apply)
CO3. **devise** solutions for complex problems of data analysis and machine learning. (HOTS: Level 6: Create)
CO4. **Evaluate** the output of data analysis and machine learning models. (HOTS: Level 5: Evaluate)
CO5. **create** lab records of the solutions for the given assignments. (HOTS: Level 6: Create)
CO6. **demonstrate** use of ethical practices, self-learning and team spirit.. (LOTS: Level 3: Apply)

List of experiments/assignments

1. Running instructions in Interactive interpreter and a Python Script.
2. Write a program to purposefully raise Indentation Error and correct it.
3. Three to Four programs on scientific problem solving using decision making and looping.
4. Two to Three programs on simple programming for one dimensional and two-dimensional arrays.
5. Two to Three programs on python Programming to explore string functions.
6. Two to three programs to implement various data structures like Lists, Dictionaries, tuple, dictionaries, Sets, Frozen sets.
7. Three to Four programs to understand the utilization of Functions and modules in Python.
8. Two to three programs for Building a Classical Data Structure using Python Programming.
9. Programs to implement Searching and sorting Operations: Linear & Binary Search, Selection Sort & Merge sort.
10. Two to Three Programs on file handling.
11. Two to Three Programs to Demonstrate Exceptions in Python.
12. Two to three Programs implementing basic concepts of object oriented programming.
13. Programs to illustrate basic concept behind Python Database connectivity, Python regular expressions.
14. Two to three programs on Numpy.
15. Two to three programs on Python Imaging Library.
16. Two to three programs on Pandas
17. Two to three programs on MatPlotlib.
18. Two to three programs on Scrapy.
19. Two to three programs on any Library of python.

Reference Books:

1. Allen B. Downey , " Think Python: How to Think Like a Computer Scientist", Second Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Shroff "Learning Python: Powerful Object-Oriented Programming; Fifth edition, 2013.
3. David M.Baezly "Python Essential Reference". Addison-Wesley Professional; Fourth edition, 2009.
4. David M. Baezly "Python Cookbook" O'Reilly Media; Third edition (June 1, 2013) by.
5. http://www.edx.org

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix:Python Programming Lab. (PCC-CSEAI210-P)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Implement** solutions to the given assignments in Python. (LOTS: Level 3: Apply)	2	1	–	–	3	–	–	–	–	–	–	–	–	3
CO2. **Use** various Python packages for solving different programming problems. (LOTS: Level 3: Apply)	2	3	–	3	3	–	–	–	–	–	–	–	–	3
CO3. **Devise** solutions for complex problems of data analysis and machine learning. (HOTS: Level 6: Create)	3	3	1	3	3	–	–	–	–	–	–	–	–	3
CO4. **Evaluate** the output of data analysis and machine learning models. (HOTS: Level 5: Evaluate)	3	3		3	3	–	–	–	–	–	–	–	–	3
CO5. **Create** lab records of the solutions for the given assignments. (HOTS: Level 6: Create)	–	–	–	–	–	–	–	–	–	3	–	–	–	–
CO6. **Demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)	–	–	–	–	–	–	–	3	3	–	–	3	–	–
Level of Attainments PCC-CSEAI210-P														

Industrial Training/Internship

General Course Information

Course Code: INT-CSEAI301 Course Credits: 2 Mode: Industrial Training / Internship	**Course Assessment Methods (100 Marks)** An internal evaluation is done by a faculty member appointed by the Chairperson of the Department. Significance and originality of the problem addressed and the solution provided: 20 Knowledge of the problem domain and tool used (VIVA-VOCE):25 Report Writing: 20 Judgement of the skill learnt and system developed: 20 Level of ethics followed: 15

About the Industrial training:

Students do an Industrial Training of 4 to 6 weeks after fourth semester. They are expected to learn novel skills and develop some software application during the training period.

After doing training students will be able to:

CO1. **Address** novel problems in an original manner using latest skills. (HOTS: Level 6: Create)
CO2. **select and apply** modern engineering tools. (LOTS: Level 3: Apply)
CO3. **Prepare** training report by organising ideas in an effective manner. (HOTS: Level 6: Create)
CO4. **Engage** in lifelong learning. (HOTS: Level 6: Create)
CO5. **Apply** ethical practices while doing the training and writing report. (LOTS: Level 3: Apply)

CO-PO Articulation Matrix:Industrial Training (INT-CSEAI301)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
CO1. **Address** novel problems in an original manner using latest skills (HOTS: Level 6: Create)	_	3	3	2		1	_	_	2	_	1	_	3	3
CO2. **Select and apply** modern engineering tools. (LOTS: Level 3: Apply)	2	_	_	_	3	_	_	_	3	_	_	_	3	2
CO3. **Prepare** training report by organising ideas in an effective manner. (HOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CO4. **Engage** in lifelong learning. (HOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	_	_	3	_	_
CO5. **Apply** ethical practices while doing the training and writing report. (LOTS: Level 3: Apply	_	_	_	_	_	_	_	3	_	3	_	_	_	_
Level of Attainments INT-CSEAI301														

Chapter 5: Guidelines for Assessment of Theory Courses

5.1 Assessment tools for theory courses

The overall direct and indirect tools of assessment for theory courses are given below.

Assessment Tools for Theory Courses		
Direct Tools		
Sr No.	**Description of the tool**	**COs Covered**
1	Minor Examination I	Questions must cover at least first three Levels of COs. (Remember, Understand, Apply)
2	Minor Examination II	Questions must cover at least four Levels of COs including the first three levels (Remember, Understand, Apply).
3	Minor Examination III (Open Book Mode)	Last four levels of COs (Apply, Analyse, Evaluate, Create)
4	Assignment I	Last Three Levels of COs (Analyse, Evaluate, Create)
6	Assignment II	Last Two Levels of COs (Evaluate and Create)
7.	Attendance/Level of Participation in Class	Learning Curve and Communication
	Final Examination	Possibly Covering all levels of COs
Indirect Tools		
1.	End-Semester Survey	Covering all levels of COs
2.	Exit Survey	Covering all POs

5.2 Guidelines for internal evaluation

1. All the teachers are required to set questions sessional/minor exams according to the COs and the level of CO needs to be mentioned against each question.
2. The three minor examinations together must cover all the levels of COs.
3. It is compulsory to give two assignments during the semester pertaining to the last three levels of COs.
4. The sessional/minor examination answer sheet must be evaluated as per the COs.
5. All the teachers are required to maintain the internal evaluation record according the COs
6. All the teachers are required to submit the internal evaluation record along with the computation of attainment levels of COs.
7. The respective proformas for making sessional/ minor question papers, maintaining CO-wise evaluation record of the course and submitting the CO attainment levels are given next in this chapter.
8. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered.Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks).

Department of Computer Science and Engineering
Chaudhary Devi Lal University, Sirsa-125055

Sample Detailed Direct Tools for Internal Assessment

<table>
<tr><td>Minor 1</td><td>The sessional exams must contain four questions.
<table>
<tr><td>Question No.</td><td>Question No. 1</td><td>Question No. 2</td><td>Question No. 3</td><td>Question No. 4</td></tr>
<tr><td>Levels of Bloom's Taxonomy</td><td>First level: Remember</td><td>Second level: Understand</td><td>Third Level: Apply</td><td>Any of these levels (3, 4, 5) Apply, Analyse, Evaluate</td></tr>
<tr><td>Marks Distribution</td><td>4</td><td>4</td><td>6</td><td>6</td></tr>
</table></td></tr>
<tr><td>Minor 2</td><td>
<table>
<tr><td>No. of Questions</td><td>Question No. 1</td><td>Question No. 2</td><td>Question No. 3</td><td>Question No. 4</td></tr>
<tr><td>Levels of Bloom's Taxonomy</td><td>First level: Remember</td><td>Second level: Understand</td><td>Third Level: Apply</td><td>Any of these levels: (4, 5, 6) Analyse, Evaluate, Create</td></tr>
<tr><td>Marks Distribution</td><td>4</td><td>4</td><td>6</td><td>6</td></tr>
</table></td></tr>
<tr><td>Minor 3</td><td>
<table>
<tr><td>No. of Questions</td><td>Question No. 1</td><td>Question No. 2</td><td>Question No. 3</td><td>Question No. 4</td></tr>
<tr><td>Levels of Bloom's Taxonomy</td><td>Third level: Apply</td><td>Any one out of fourth and fifth levels: Analyse, Evaluate</td><td>Any one out fifth and sixth levels: Evaluate</td><td>Last level: Create</td></tr>
<tr><td>Marks Distribution</td><td>4</td><td>4</td><td>6</td><td>6</td></tr>
</table></td></tr>
<tr><td>Assignment 1</td><td>Must be based on the last three levels
For purpose of computing CO attainment level only (10 Marks)</td></tr>
<tr><td>Assignment 2</td><td>Must be based on the last two levels
For purpose of computing CO attainment level only (10 Marks)</td></tr>
<tr><td>Industrial Training</td><td>Based on the last four levels</td></tr>
<tr><td>Industrial Training/Mini Project</td><td>Based on the last four levels</td></tr>
<tr><td>Major Project</td><td>Based on the last four levels</td></tr>
</table>

Note: The course coordinator may make slight modification in the style of minor examinations as per the requirement the course. The due weightage to higher level COs must be maintained in all respects.

	Department of Computer Science and Engineering Chaudhary Devi Lal University, Sirsa-125055																					
	Record of CO-wise Internal Assessment																					
	Name of the Programme:																Semester:					
	Nomenclature of the Course:																Course Code:					
Details of Students		Minor I					Minor II						Minor 3				AI (CO5)	AII (CO6)	Overall Attainment			
Roll. No.	Name	Q1 CO1 4	Q2 CO2 4	Q3 CO3 6	Q4 CO4 6	- CO5	Q1 CO1 4	Q2 CO2 4	Q3 CO3 6	Q4 CO4 6	- CO5 6	- CO6	Q1 C03 4	Q2 CO4 4	Q3 CO5 6	Q4 CO6 6	10	10	CO1	CO2	CO3	CO4	CO5
101	-	3	3	4	4	-	4	3	5		4		3	2	4	3	5	4	7/8 0.85	6/8 0.80	12/16 0.75	6/110 0.73	4/6 0.77
102	-																		-	-	-	-	-
103	-																		-	-	-	-	-
104	-																		-	-	-	-	-
% student getting more than 55 % marks																			0.82	0.78	0.72	0.65	0.60
Attainment Levels																			3	3	3	2	1
Name of the Course Coordinator																			Signature of the Course Coordinator				

Max marks for COs: CO1:8; CO: 8; CO3=16; CO4=10; CO5=22, CO6=16.

Criteria for Computing Attainment Level

Attainment Level - (None): Below 60% of students score more than 55% marks out of the maximum relevant marks.

Attainment Level 1 (low): 60% of students score more than 55% marks out of the maximum relevant marks.

Attainment Level 2 (Medium): 70% of students score more than 55% marks out of the maximum relevant marks.

Attainment Level 3 (high): 80% of students score more than 55% marks out of the maximum relevant.

Sample Overall Attainment Level of COs for Data Structures and Algorithms Course	
List of Course Outcomes	**Level of attainment**
CO1. list or describe types of data structures and operations that can be implemented on these data structures.	**3**
CO2. Demonstrate the use of various data structure and their related operations	**3**
CO3. Apply appropriate data structures with respect to effective storage of data and efficiency of the required operations on data for solving real world problems.	**3**
CO4. Analyse the time complexity of searching and algorithms.	**2**
CO5. formulate data structures and prescribe operations for given real world situations.	**1**

Note: The class coordinators needs to submit the course outcome attainment levels as given in the table above.

Chapter 6: Guidelines Internal and external Assessment of Lab. Courses

6.1 Assessment Tools for Lab. Courses

The assessment tools for evaluating lab. courses are given below. The total lab evaluation marks: 100 (Internal: 50; External 50)

Assessment Tools for Lab. Courses		
Direct Tools		
Sr No.	**Description of the tool**	**COs Covered**
1	Assignments	10 to 15 assignments based on the last four levels of COs (Apply, Analyse, Evaluate, Create)
2.	Group Assignment (s)	Last three levels of COs (Analyse, Evaluate, Create)
3.	Minor Laboratory Evaluations (MLE) I and II (Each of 50 marks)(implementing a problem, lab. record, VIVA-VOCE, use of ethical practices, self-learning and group spirit	Last four levels of COs (Apply, Analyse, Evaluate, Create)
4.	External Examination (50 Marks) (implementing a problem, lab. record, VIVA-VOCE, use of ethical practices	Last four levels of COs (Apply, Analyse, Evaluate, Create)
Indirect Tools		
1.	End-Semester Survey	Covering all levels of COs
2.	Exit Survey	Covering all POs

6.2. Guidelines for internal and external evaluation of lab. courses:

1. The internal evaluation MEA I and MEA II will be conducted in the week before or after the internal minor examinations for the theory courses by the course coordinator.
2. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable.
3. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations.
4. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations.
5. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations.
6. The internal lab practical examination is to be conducted strictly on the pattern of external practical examination.
7. The evaluation must be conducted to measure the attainment level of COs
8. The proforma for break-up of marks for internal and external lab. course evaluations are given next in this chapter.
9. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department.
10. For implementing the spirit of continuous evaluation, the course coordinators will maintain the experiment-wise record of the performance of students for the laboratory courses as a part of their lab course file.
11. The course coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the prescribed proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch.
12. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the course outcomes of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

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Internal Laboratory Course Evaluation Proforma

Minor Laboratory Course Evaluation-I (MLE-I) / Minor Laboratory Course Evaluation-II (MLE-II)

Name of the Programme:
Semester:
Nomenclature of the Course:
Course Code:

SR. No.	Roll. No.	Written work and/or conduct of experiment(s)	(VIVA-VOCE) based on laboratory course outcomes from CO2 to CO4			Laboratory Record/ File.	Class Performance (Attendance/ Ethical practices followed, Self-Learning and Team Spirit)	Total
		CO1	CO2	CO3	CO4	CO5	CO6	50
1								
2								
3								
.								
.								
Total No. of Students			Present:			Absent		

Name of the Course Coordinator	Signature of the Course Coordinator

Note: The CO-wise weightage be decided as per the requirement of the Lab Course by the Course Coordinator in consultation with the Chairperson.

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External Laboratory Course Evaluation Proforma

Nomenclature of the Course:
Course Code:
Name of the Internal Examiner:
Name of the External Examiner:

SR. No.	Roll. No.	Written work and /or Conduct of Experiment(s) (20)	(VIVA-VOCE) (20)			Laboratory Record/File (10)	Total Marks (50)
1							
2							
3							
.							

Total No. of Students:	Present:	Absent:
Name and signature of the Internal Examiner	Name and signature of the External Examiner	

Chapter 6: Evaluating Training and Project Reports

6.1 Evaluation of Industrial Training/Internship

It is mandatory for all the students to go for industrial training or internship after fourth semester and sixth semester. The students internship work is evaluated as per the criteria given in the evaluation proforma given below.

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Name of the Programme:_____ Credits:

Semester:_____ Total Marks: 100

Session:_____

Evaluation of Industrial Training (INT-CSE301)

SR. No.	Roll. No.	Significance and originality of the problem addressed and the solution provided CO1+CO2 (20)	Knowledge of the problem domain and the tool used (VIVA-VOCE) CO3 (25)	Judgement of the skill learnt and system developed CO4 (20)	Quality of Report Writing CO5 (20)	Level of ethics followed CO6 (15)	Total 100
1							
2							
3							
.							
.							

Name (s) and Signature of the Internal/External Examiner(s):

Date:

Name and Signature of the Chairperson

Total Candidates:

No. of Candidates Present:

No. of Candidates Absent:

6.2. Guidelines for Preparing Industrial Training (INT-CSE301) Report

All the students are required to follow these guidelines for preparing their industrial training report.

6.2.1. General Guidelines

1. The industrial training report must include a declaration by the student that he/she has followed ethical practices while doing the industrial training work. Any violation of ethical practices will lead to rejection of the industrial training report. For instance, a plagiarized report or a readymade report purchased from market will be rejected straight away.
2. Industrial training work carried out in groups of two students must include the individual contribution of the students.
3. The industrial training report must be submitted to the internal guide in soft binding at least 7 days before the final submission so that he/she can suggest changes.

6.2.2 Formatting Instructions

The formatting instructions are given in Table below.

Formatting Instructions		
Sr. No.	**Item**	**Formatting**
1.	No. of pages	Minimum 20 and maximum 40
2.	Paper size	A4
3.	Font Type	Times New Roman
4.	Normal text size	12
5.	Page numbering	Place: Centre Bottom Type: Front material in Roman numbers
6.	Margins	Left margin: 3.75 cms (1.5 inch) Right, bottom, top= 2.5 cms (1 inch)
7.	References/Bibliography	IEEE format
8.	Binding	soft binding of good quality

6.2.3. Contents of the Industrial Training Report

The contents of the industrial training report should be organised as described below.

1. Declaration that the students has carried out his work on his own. It is his/her original creation, not plagiarised from any other source and due credit has been given to the source material used in the industrial training report through references and citations.
2. Acknowledgement
3. List of figures
4. List of Tables
5. List of Abbreviations
6. Contents

Contents in the Body of the industrial training report

The report must be written in English. The ideas must be organised in a clear and concise fashion.

S. No	Content	Tentative No. of pages
1.	Profile of the Company	At most 2 pages
2.	Introduction	2-4 pages
3.	Description of skills learned	4-6 pages
4.	Application developed (if any) based on skills learnt	10-18 pages
5.	Scope of the training/ Application developed	1 paragraph

The industrial training report should not no way exceed 40 pages and should be submitted in soft binding of good quality.

6.2.4. Format of the title page

The format of the title page is given is given on next page.

TITLE OF THE INDUSTRIAL TRAINING REPORT

(Write in Times New Roman, 16-point size, Bold and Centred and Uppercase font)

Training report submitted to

Chaudhary Devi Lal University, Sirsa-125055 for the partial award of the degree

(Write in Times New Roman, 12-point size font, Bold, Italics and Centred style after 4 lines gap with 12 font size from the title of the project)

of

(Write in Times New Roman, 12-point size font, Bold, Italics and Centred style after 1 lines gap with 12 fontsize from the text above in three lines)

Bachelor of Technology
in

(Artificial Intelligence and Machine Learning)

(Write in Times New Roman, 14-point size, Bold, Centred style after "***of***" after 1 line gap with 12 font size)

By

(Write in Times New Roman 12-point size, Bold, Italics, and Centred style after the name of the degree with 1 line gap with 12 font size)

Your Name

(Enrolment Number)

(Write in Times New Roman, 14-point size font, Bold, Centred style after1 line gap with 12 font from "***By***")

Department of Computer Science and Engineering

Chaudhary Devi Lal University, Sirsa-125055

Month, Year

(Write in Times New Roman, 14-point size font, Bold, Centred style, after 2 lines gap from logo)

6.2.5. Declaration to be submitted for training report

DECLARATION

I, *Your Name*, *Your Roll No*., certify that the work contained in this industrial training report is original and has been carried by me in the ---------- company name.This work has not been submitted to any other institute for the award of any degree and I have followed the ethical practices and other guidelines provided by the Department of Computer Science and Engineering in preparing the industrial training report.

Signature

Name of Student

Registration Number

Department of Computer Science and Engineering
Chaudhary Devi Lal University, Sirsa-125055

Signature

Supervisor/Mentor

Designation

Department of Computer Science and Engineering
Chaudhary Devi Lal University, Sirsa-125055

6.3. Evaluation of mini-project

The proforma for evaluating the mini-project using open source tools is given on the next page.

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Name of the Programme:_____ Semester:_____ Session:_____	Credits: Total Marks: 100

Evaluation of Industrial Training/Internship Report(INT-CSEAI301)

SR. No.	Roll. No.	Significance of the problem addressed CO1 (15)	Knowledge of the problem domain CO2 (15)	Knowledge of the techniques and tools used CO3 (15)	Quality of the solution provided CO4 (20)	Quality of the Report Writing CO5 (20)	Level of engagement with ethical practices and self-learning CO6 (15)	Total (100)
1								
2								
3								
.								
.								

Name of the examiner(s): Signature of the Examiner(s): Date: Signature of Chairperson	Total Candidates: No. of Candidates Present: No. of Candidates Absent: