DPU

Dr. D. Y. PATIL VIDYAPEETH, PUNE

(Deemed to be University)

Syllabus for First Year of Bachelor of Science (Computer Science)

(2023-24)

Semester 1 & 2

INDEX

REGULATION FOR THE BATCHLOR OF SCIENCE (Computer Science)
(2023 -24 Course)

1. **Eligibility**

   A candidate seeking admission to the B.Sc. Course must have passed 10+2 (any stream) securing not less than 45% marks in aggregate(candidate belonging to open category and 40% candidate belonging to any reserved category) from the Central Board of Secondary Education/state boards or any other equivalent examination recognized by the Dr D. Y. Patil Vidyapeeth, Pune preferably with Physics, Chemistry and Mathematics as one of compulsory or optional course, or any other vocational course related to the computer stream having either Computer Science or Computer Engineering as compulsory/optional course.

2. **Duration of the course**
   - The BSc program is of Four years (Total Eight Semesters) degree program.
   - Duration of the course: 4 years i.e. 8 semesters.
   - Semesters - An academic year consists of two semesters,Odd Semester: June/July to November/December
   - Even Semester: November/December to April/May

Type of award	Stage of exit	Mandatory credits to be secured
Certificate in the computer science	After the successful completion of semester II	44
Diploma in the field of computer science	After the successful completion of semester IV	88
Bachelor of Computer Science	After the successful completion of semester VI	132
Bachelor of Computer Science (**Honors**)	After the successful completion of semester VIII	164

3. **Medium of instruction:**
   English shall be the medium of instruction for all the subjects of study and for examination of the course.

4. **Attendance:**
   A candidate has to secure minimum-
   1. 75% attendance in theory
   2. 80% in practical for qualifying to appear for the final examination.

6. Scheme of Examination

(a) Internal Examinations (Theory + Practical + Project)

1. There shall be two internal examinations (also called internal assessment tests I and II) of one hour duration for each course to be held as per the schedule fixed in the Academic Calendar.

2. A student can take for supplementary re-internal exam of a specific subject or all the subjects for the betterment of performance in case of scoring of less mark in previous internal assessment exams only after successful submission of an application to the class teacher which will be approved by Director/Principal of the institute.

3. Project and Seminar will be evaluated on the basis of 50% internal assessment and 50% end semester assessment in the form of project

demonstration and PPT.

4. Value added courses (VA) and ability/skill enhancement courses(AEC) will be evaluated through the continuous internal assessment(CIA) will be graded.

b). University Examination

University Theory Examination Pattern		
Section A		
MCQs	15 x 1 Mark each	15 Marks
Section B		
1)Very short and short Qs (Any 5out of 7) 2)short question (Any 2 out 0f 3)	03 x 05 Marks each 02 x 05 Marks each	15 Marks 10 Marks
Section C		
Long Questions (Any 2 out of 3)	02 x 10 Marks each	20 Marks
	Total	**60 Marks**

Total 100 Marks Combined Head of Passing

1. External Theory will carry 60 marks
2. Internal Assessment (Theory) will carry total of 40 marks

Practical Examination scheme

1. External Practical will carry 60% marks
2. Internal Assessment (Practical) will carry total of 40 % marks

Break –Up

1. Final Theory University Exams 60 Marks
2. Internal Assessment Exams 40 Marks
3. Grand Total = 100 Marks (Each Subject)
4.

Note: for any subject examination scheme will be

Internal exam/evaluation for Theory and lab : 40 %
(Unit Test 1, Unit Test 2 and continuous assessment over the semester)
External exam/evaluation for Theory and lab : 60%

(c) Standard of Passing:

1. The standard of passing shall be minimum 50% in each subject.
2. The marks of all heads combined (University Theory Exam + Internal Assessment Theory + Practical / Viva) shall be considered together for Passing of the candidate.

(d) Grace Marks

The grace marks up to a maximum of 1 percentage of total marks may be awarded to a student who has failed in not more than two subjects in the respective semester. Provided that these grace marks shall be awarded only if the student passes after awarding these marks.

(e) Grading System

UGC 10-point Grading Scale

Marks	Letter Grade	Grade Point
90 To 100	**O** : Outstanding	10
80 To 89	**A+** : Excellent	9
70 To 79	**A** : Very Good	8
60 To 69	**B+** : Good	7
55 To 59	**B** : Average	6
50 To 54	**P** : Pass	5
00 To 49	**F** : Fail	0
-	**AB** : Absent	0

Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.
   SGPA (Si) = Σ(Ci x Gi) / ΣCi
   where Ci is the number of credits of the course and Gi is the grade point scored by the student in the course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.
   CGPA = Σ(Ci x Si) / Σ Ci where Si is the SGPA of the semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
   Illustration of Computation of SGPA and CGPA and Format for Transcripts

(i) Criteria for appointment of Examiner (Internal & External) andterms of their appointment.

1. Adhoc Board of Studies of BSc shall submit, to the Committee constituted by Board of Examinations, a panel of examiner names, along with their addresses, suitable for appointment as Internal and External Examiners.

2. Examiners shall be appointed by the Academic Council as per section 8(b) (viii) of the Rules of Dr. D. Y. Patil University on the recommendations of the Board of Examinations.

3. In case of refusal from the person so appointed, the Controller of Examinations shall appoint substitute examiners from the panel approved.

4. Internal and External Examiners: An "Internal Examiner" means a person who is a teacher in the constituent college(s) / institute(s) of the University. The teachers in other universities or recognized teacher of other University in the state or outside the state shall be referred to as the “External Examiner".

5. Intimation of appointment as the examiner shall be accompanied by a copy of the instructions/guidelines relating to the examination for he/she is appointed, as also the information regarding the remuneration he/she shall be entitled to draw, if he/she acts as examiner. He/ She is expected to attend to and shall be required to send to the Controller of Examinations.

6. Examiners shall be appointed for examinations to be held in that academic year; however they shall be eligible for reappointment.

7. Relatives, Close Friends or next to the kin which are directly or indirectly related to the candidates shall not to be included.

Dr D. Y. Patil School of Science &Technology, Dr D. Y. Patil Vidyapeeth, Pimpri, Pune Bachelor of Technology		
Program Outcomes (POs)		
Learners are expected to know and be able to–		
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 analyze 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 ToolUsage**	Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
PO6	**The Engineer andSociety**	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 practices.
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 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 Skills**	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 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 (PSO)		
A graduate of the Computer Engineering Program will demonstrate-		
PSO1	**Professional Skills**-The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexities.	
PSO2	**Problem-Solving Skills**- The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	
PSO3	**Successful Career and Entrepreneurship**- The ability to employ modern computer languages, environments and platforms in creating innovative career paths to be an entrepreneur and to have azest for higher studies.	

COURSE STRUCTURE FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

Program: BSc (Basic and Honors) Subject: Computer Science

Track : 1: Cloud Computing / 2: Data Science/ 3: Cyber Security

Undergraduate Certificate in Computer Science after securing 44 credits

SEMESTER I

Course Code	Course Type as per NEP	Course Name	L	T	P	Hr	Cr
BSC-BCS-101	Major	Problem solving using Computer	3	0	4	7	5
BSC-BCS-102	Major	Mathematics for Computing	4	0	0	4	4
BSC-BCS-103	Major	Computer System Architecture	4	0	0	4	4
PCC-BCS-101	VA	Value Added Course	1	0	2	3	2
PEC-BCS-101	DSE	Discipline Specific Elective -1	3	0	4	7	5
HSMC-BCS-101	AEC	Ability/Skill Enhancement Course	1	0	2	3	2
Total			16	0	12	28	22

DSE - 1:
Track1:Introduction to Cloud Computing
Track 2:Introduction to Data Science
Track 3:Introduction to Cyber Security
VA : Professional Communication Skills
AEC : Yoga for Well-Being/ Health and Wellness/ Office Automation/ Human Values And Professional Ethics

SEMESTER II

Course Code	Course Type as per NEP	Course Name	L	T	P	Hr	Cr
BSC-BCS-201	Major	Object Oriented Programming	3	0	4	7	5
BSC-BCS-202	Major	Discrete Mathematics	4	0	0	4	4
BSC-BCS-203	Major	Database Management System	3	0	4	7	5
PCC-BCS-201	VA	Value Added Course	1	0	2	3	2
PEC-BCS-201	DSE	Discipline Specific Elective -2	2	0	4	6	4
HSMC-BCS-201	AEC	Ability/Skill Enhancement Course	1	0	2	3	2
	Total		14	0	16	30	22

DSE - 2:
Track 1: Cloud Computing and Virtualization Foundation
Track 2: Descriptive Statistics
Track 3: Mobile and Web Application Security
VA : Environmental Studies
AEC : Centre for Social Activities, Department Specific Community Engagement Programme,, Literary and Culture, National Cadet Corps,

		National Service Scheme, Unnat Bharat Abhiyan, Youth Red Cross						
Undergraduate Diploma in Computer Science after securing 88 credits		**SEMESTER III**						
		Course Type as per NEP	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
	BSC-BCS-301	Major	Data Structures	3	0	4	7	5
	BSC-BCS-302	Major	Computer Networks	4	0	0	4	4
	BSC-BCS-303	Major	Theory of Optimization & Graph Theory	4	0	0	4	4
	PCC-BCS-301	VA	Value Added Course	1	0	2	3	2
	PEC-BCS-301	DSE	Discipline Specific Elective -3	2	0	4	6	4
	HSMC-BCS-301	AEC	Ability/Skill Enhancement Course	2	0	2	4	3
		Total		**16**	**0**	**12**	**28**	**22**
		DSE-3: Track 1: Public Cloud –AWS, AZURE and GOOGLE, Track 2: Regression Analysis Track 3:Firewall and Internet Security **VA** : Project Management **AEC** : Sports-I / Language-I (French/German/Japanese/Marathi) Internship / Apprenticeship						
		SEMESTER IV						
		Course Type as per NEP	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
	BSC-BCS-401	Major	Design and Analysis of Algorithms	3	0	4	7	5
	BSC-BCS-402	Major	Theory of Computation	4	0	0	4	4
	BSC-BCS-403	Major	Software Engineering	4	0	0	4	4
	PCC-BCS-401	VA	Value Added Course	1	0	2	3	2
	PEC-BCS-401	DSE	Discipline Specific Elective -4	2	0	4	6	4
	HSMC-BCS-401	AEC	Ability/Skill Enhancement Course	2	0	2	4	3
		Total		16	0	12	28	22
		DSE-4: Track 1:Cloud Developer tools and Ecosystem Track 2:Data Wrangling with Python Track 3:Applied Cryptography **VA** : Organizational Behavior **AEC** : Sports-II/ Language-II (French/German/Japanese/Marathi)/ Intern ship / Apprenticeship						

	SEMESTER V							
	Course Code	**Course Type as per NEP**	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
	BSC-BCS-	Major	Artificial Intelligence	3	0	4	7	5

Bachelor in Computer Science after securing 110 credits	501							
	BSC-BCS-502	Major	Data warehousing and Mining	4	0	0	4	4
	BSC-BCS-503	Major	Mobile Applications and Development Using Android	4	0	0	4	4
	PCC-BCS-501	VA	Value Added Course	1	0	2	3	2
	PEC-BCS-501	DSE	Discipline Specific Elective -1	2	0	4	6	4
	HSMC-BCS-501	AEC	Ability/Skill Enhancement Course	2	0	2	4	3
	Total			16	0	12	28	22
	DSE- 5: Track 1:Cloud Migration and Disaster Recovery Track 2:Multivariate Analysis, Track 3:Intrusion Detection and Prevention System **VA :** Financial Education and Investment Awareness **AEC :** Internship / Apprenticeship							
		SEMESTER VI						
	Course Code	**Course Type as per NEP**	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
	BSC-BCS-601	Major	Intelligent Systems	3	0	4	7	5
	BSC-BCS-602	Major	Big Data Analytics	4	0	0	4	4
	BSC-BCS-603	Major	Compiler Design	4	0	0	4	4
	PCC-BCS-601	VA	Value Added Course	1	0	2	3	2
	PEC-BCS-601	GE	Generic Elective -1	2	0	4	6	4
	HSMC-BCS-601	AEC	Ability/Skill Enhancement Course	2	0	2	4	3
		Total		16	0	12	28	22
		DSE- 6: Track 1:DevOps Track 2: Data Visualization and Modelling, Track 3:Cyber Crime Investigation and Digital Forensics **VA :** Research Methodology & Ethics						

		AEC : Intern ship / Apprenticeship						
Bachelor in Computer Science (Honors) after securing 142 credits		**SEMESTER VII**						
		Course Type as per NEP	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
	PCC-BCS-701	Major	Research Project -I	0	0	32	32	16
		Total				32	32	16
		SEMESTER VIII						
	PCC-BCS-702	**Course Type as per NEP**	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
		Major	Research Project -II	0	0	32	32	16
		Total				32	32	16

SEMESTER - I

Dr D. Y. Patil School of Science &Technology,
Dr D. Y. Patil Vidyapeeth, Pimpri, Pune

BSC-BCS-102: Mathematics for Computing

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 04 Hours/Week	04	Internal Assessment (TH): 40 Marks END_Semester(TH): 60 Marks

Course Objective: On completion of the course, students will be able to understand the basic concepts of matrices, differentiation, integration and vector algebra.

Course Outcomes:
Students will be able to:

CO 1: Understand the concept of Matrices and its types. This will help students to understand the concept of data structures.
CO 2: Solve the problems on limit & continuity
CO 3: Solve the problems on differentiation
CO 4: Understand the fundamental theorem of calculus and Solve the problems on integration.
CO 5: Understand the concept of vector algebra.
CO 6: Students will be able to demonstrate basic knowledge of key topics in vector algebra.

Course Contents

Unit I	**DETERMINANTS**	**(08 Hours)**
Definition, Minors, Cofactors, Properties of Determinants MATRICES: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Cramers Rule, Rank of Matrix Dependence of Vectors, Eigen Vectors of a Matrix, Caley-Hamilton Theorem (without proof).		
Mapping of Course Outcomes	CO 1	
Unit II	**LIMITS & CONTINUITY**	**(08 Hours)**
Limit at a Point, Properties of Limit, Computation of Limits of Various Types of Functions, Continuity at a Point, Continuity Over an Interval, Intermediate Value Theorem, Type of Discontinuities		
Mapping of Course Outcomes	CO 2	
Unit III	**DIFFERENTIATION**	**(08 Hours)**
Derivative, Derivatives of Sum, Differences, Product & Quotients, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation, Rolle's Theorem, Mean Value Theorem, Expansion of Functions (Maclaurin's & Taylor's), Indeterminate Forms, L' Hospitals Rule, Maxima & Minima, Curve Tracing, Successive Differentiation & Liebnitz Theorem.		
Mapping of Course Outcomes	CO 3	
Unit IV	**INTEGRATION**	**(08 Hours)**
Integral as Limit of Sum, Fundamental Theorem of Calculus(without proof.), Indefinite Integrals, Methods of Integration Substitution, By Parts, Partial Fractions, Reduction Formulae for Trigonometric Functions, Gamma and Beta Functions(definition).		
Mapping of Course Outcomes	CO 4	

Unit V	VECTOR ALGEBRA	(08 Hours)
Definition of a vector in 2 and 3 Dimensions; Double and Triple Scalar and Vector Product and physical interpretation of area and volume.		
Mapping of Course Outcomes	CO 5,CO6	

Reference Books:

1. B.S. Grewal, “Elementary Engineering Mathematics”, 34th Ed., 1998.
2. Shanti Narayan, “Integral Calculus”, S. Chand & Company, 1999
3. H.K. Dass, “Advanced Engineering Mathematics”, S. Chand & Comp

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-

Dr D. Y. Patil School of Science &Technology,
Dr D. Y. Patil Vidyapeeth, Pimpri, Pune

BSC-BCS-103: Computer System Architecture

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 04 Hours/Week	04	Internal Assessment (TH): 40 Marks
		END_Semester(TH): 60 Marks

Course Objective:

The educational Objectives of this Course are:

1. To have a thorough understanding of the basic structure and operation of a digital computer.
2. To study the different ways of communicating with I/O devices and standard I/O interfaces.
3. To learn the architecture and assembly language programming of 8085 microprocessor.
4. To study peripherals and their interfacing with 8085 microprocessor.

Course Outcomes:

CO 1: Understanding Logic gates, flip flops and counter.
CO 2. Clear Understanding of Computer Architecture
CO 3. Pipeline processing RISC and CISC architectures.
CO 4. Develop a base for advance micro-processors**.**
CO 5. To notice how to perform computer arithmetic operations
CO 6. To be clear with pipeline procedure and multi processors.

Course Contents

Unit I	**Boolean Algebra and Logic Gates**	**(06 Hours)**
Basic definition, Axiomatic Definition, Basic theorem and Properties of Boolean algebra, Minterms and Maxterms, Logic Operations, Digital logic gates, IC digital logic families		
Mapping of Course Outcomes	CO1	
Unit II	**Simplification of Boolean functions:**	**(06 Hours)**
Different types map method, product of sum simplification, NAND or NOR implementation, Don't care condition, Tabulation method, Adder, subtractor, Code Conversion, Universal Gate		
Mapping of Course Outcomes	CO2	
Unit III	**Sequential Logic:**	**(06 Hours)**
Flip-flops, Triggering of Flip-flops, Analysis of clocked sequential circuits, State reduction and Assignment, Flip-flop excitation, Design of counters, Design with state equations		
Mapping of Course Outcomes	CO3	
Unit IV	**Overview Of Register Transfer And Microoperations**	**(06 Hours)**
Register Transfer Language, Register transfer. Bus and Memory transfer Arithmetic Micro-operations. Logic Micro-operations Shift Micro-operations, Arithmetic Logic Shift Unit.		

Mapping of Course Outcomes	CO4

Unit V	**Basic Computer Organization And Design**	**(07 Hours)**

Instruction codes, Computer registers, Computer instructions. Timing and Control, Instruction cycle. Memory-Reference Instructions, Input-output and interrupt. Design of Basic computer, Design of Accumulator Unit.

Mapping of Course Outcomes	CO5

Unit VI	**Programming the Basic Computer**	**(09 Hours)**

Introduction, Machine Language, Assembly Language, the Assembler. Program loops. Programming Arithmetic and logic operations. Subroutines. I-O Programming.

Central Processing Unit Introduction: General Register Organization, Stack Organization Instruction format. Addressing Modes Data transfer and manipulation Program Control, Reduced Instruction Set Computer (RISC).

Mapping of Course Outcomes	CO6

Reference Books:

1. Computer System Architecture: By M. Morris Mano.
2. Structured Computer Organization: By Tanenbaum.
3. Computer Organization: By Stallings.
4. Computer Architecture and Organization: By Hayes.

@The CO-PO Mapping Matrix

CO\ PO	PO 1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO2	1	2	_	2	_	_	_	_	_	_	_	_
CO3	2	1	2	1	_	_	_	_	_	_	_	_
CO4	1	2	_	2	_	_	_	_	_	_	_	_
CO5	-	_	2	_	_	_	_	_	_	_	_	_
CO6	-	2	1	2	_	_	_	_	_	_	_	_

SEMESTER - II

Dr D. Y. Patil School of Science &Technology,
Dr D. Y. Patil Vidyapeeth, Pimpri, Pune

BSC-BCS-201: Object Oriented Programming

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	05	Internal Assessment (TH): 40 Marks END_Semester(TH): 60 Marks

Course Objective:

- introduce the student to the concepts of C++ in computer science.
- Acquire knowledge to make functions , Files etc.

Course Outcomes:

Upon successful completion of this course, students will be able to acquire:

CO 1: Student will understand how to model the real world scenario using class diagram and be able to exhibit communication between objects using sequence diagram.
CO2: Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
CO 3: Use overloading methodology on methods and constructors to develop application programs
CO 4: Demonstrate the user defined exceptions by exception handling keywords (try, catch, throw, throws and finally).
CO5: Demonstrate the implementation of inheritance (multilevel, hierarchical and multiple) by using extend and implement keywords.
CO 6: Build the internet-based dynamic applications using the concept of OOPs

Course Contents

Unit I	**Introduction to OOPs**	**(08 Hours)**
Object Oriented Methodology: Introduction, Advantages and Disadvantages of Procedure Oriented Languages, what is Object Oriented? What is Object Oriented Development? Object Oriented Themes, Benefits and Application of OOPS. Principles of OOPS: OOPS Paradigm, Basic Concepts of OOPS: Objects, Classes, Data Abstraction and Data Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing		
Mapping of Course Outcomes	CO1	
Unit II	**Classes and Objects**	**(08 Hours)**
Classes and Objects: Simple classes (Class specification, class members accessing), Defining member functions, passing object as an argument, Returning object from functions, friend classes, Pointer to object, Array of pointer to object Constructors and Destructors: Introduction, Default Constructor, Parameterized Constructor and examples, Destructors		
Mapping of Course Outcomes	CO2	
Unit III	**Polymorphism and Virtual Functions**	**(08 Hours)**
Polymorphism: Concept of function overloading, overloaded operators, overloading unary and binary operators, overloading comparison operator, overloading arithmetic assignment operator, Data Conversion between objects and basic types, Virtual Functions: Introduction and need, Pure Virtual Functions, static Functions, this Pointer, abstract classes, virtual destructors.		
Mapping of Course Outcomes	CO3	
Unit IV	**Inheritance**	**(08Hours)**

Program development using Inheritance: Introduction, understanding inheritance, Advantages provided by inheritance, choosing the access specifier, Derived class declaration, derived class constructors, class hierarchies, multiple inheritance, multilevel inheritance, containership, hybrid inheritance.

Exception Handling: Introduction, Exception Handling Mechanism, Concept of throw & catch with example

Mapping of Course Outcomes	CO4, CO5

Unit V	**Templates & Files**	**(08 Hours)**

Templates: Introduction, Function Template and examples, Class Template and examples.

Working with Files: Introduction, File Operations, Various File Modes, File Pointer and their Manipulation

Mapping of Course Outcomes	CO6

Text Books:

1. 1 Object Oriented Analysis and Design, Timothy Budd, TMH
2. Mastering C++, K R Venugopal, Rajkumar Buyya, T Ravishankar, Tata McGraw Hill

Reference Book:

1. Object oriented Programming with C++ by E Balagurusamy, 2001, Tata McGraw-Hill
2. Computing Concepts with C++ Essentials by Horstmann, 2003, John Wiley,
3. The Complete Reference in C++ By Herbert Schildt, 2002, TMH

1	**Classes and methods**
a	Design an employee class for reading and displaying the employee information, the getInfo() and displayInfo() methods will be used respectively. Where getInfo() will be private method
b	Design the class student containing getData() and displayData() as two of its methods which will be used for reading and displaying the student information respectively.Where getData() will be private method.
c	Design the class Demo which will contain the following methods: readNo(), factorial() for calculating the factorial of a number, reverseNo() will reverse the given number, isPalindrome() will check the given number is palindrome, isArmstrong() which will calculate the given number is armStrong or not.Where readNo() will be private method.
d	Write a program to demonstrate function definition outside class and accessing class members in function definition.
2	**Using friend functions**
a	Write a friend function for adding the two complex numbers, using a single class
b	Write a friend function for adding the two different distances and display its sum, using two classes.
c	Write a friend function for adding the two matrix from two different classes and display its sum.

3	**Constructors and method overloading**
a	Design a class Complex for adding the two complex numbers and also show the use of constructor.
b	Design a class Geometry containing the methods area() and volume() and also overload the area() function
c	Design a class StaticDemo to show the implementation of static variable and static function.
4	**Operator Overloading**
a	Overload the operator unary(-) for demonstrating operator overloading
b	Overload the operator + for adding the timings of two clocks, And also pass objects as an argument.
c	Overload the + for concatenating the two strings. For e.g “Py” + “thon” = Python
5	**Inheritance**
a	Design a class for single level inheritance using public and private type derivation.
b	Design a class for multiple inheritance.
c	Implement the hierarchical inheritance
6	**Virtual functions and abstract classes**
a	Implement the concept of method overriding.
b	Show the use of virtual function
c	Show the implementation of abstract class
7	**String handling**
a	String operations for string length , string concatenation
b	String operations for string reverse, string comparison,

c	Console formatting functions.
8	**Exception handling**
a	Show the implementation of exception handling
b	Show the implementation for exception handling for strings
c	Show the implementation of exception handling for using the pointers.
9	**File handling**
a	Design a class FileDemo open a file in read mode and display the total number of words and lines in the file.
b	Design a class to handle multiple files and file operations
c	Design a editor for appending and editing the files
10	**Templates**
a	Show the implementation for the following
b	Show the implementation of template class library for swap function
c	Design the template class library for sorting ascending to descending and viceversa

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-

Dr D. Y. Patil School of Science &Technology,
Dr D. Y. Patil Vidyapeeth, Pimpri, Pune

BSC-BCS-202: Discrete Mathematics

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 04 Hours/Week	04	Internal Assessment (TH): 40 Marks END_Semester(TH): 60 Marks

Course Objective

The course objective is to provide students with an overview of discrete mathematics. Student will learn about topics such as Set Theory and functions, Propositional Logic, Relations, Algebraic Structures, Graph Theory and other important discrete math concepts.

Course Outcomes:

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

CO 1: To identify set, discrete numerical functions.

CO 2: To apply proposition in problem solving.

CO 3: Determine properties of relations, identify equivalence and partial order relations, sketch relations

CO 4: To understand the various properties of algebraic structures.

CO 5: To determine critical thinking, analytical reasoning, and problem-solving abilities.

CO 6: Investigate graphs, digraphs and trees, and identify their main properties.

Course Contents

Unit I	**Set Theory**	**(09 Hours)**
Basic Concepts of Set Theory: Definitions, Inclusion, Equality of Sets, Cartesian product, The Power Set, Some operations on Sets, Venn Diagrams, Some Basic Set Identities **Functions**: Introduction & definition, Co-domain, range, image, value of a function; Examples, surjective, injective, bijective; examples; Composition of functions, examples; Inverse function, Identity map, condition of a function to be invertible, examples; Inverse of composite functions, Properties of Composition of functions; **Counting**: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations		
Mapping of Course Outcomes	CO1	
Unit II	**Propositional Logic**	**(07 Hours)**
Definition, Statements & Notation, Truth Values, Connectives, Statement Formulas & Truth Tables, Well-formed Formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Examples Predicate **Logic**: Definition of Predicates; Statement functions, Variables, Quantifiers, Predicate Formulas, Free & Bound Variables; The Universe of Discourse, Examples, Valid Formulas & Equivalences, Examples		
Mapping of Course Outcomes	CO2	
Unit III	**Relations**	**(08 Hours)**
Definition, Binary Relation, Representation, Domain, Range, Universal Relation, Void Relation, Union, Intersection, and Complement Operations on Relations, Properties of Binary Relations in a Set: Reflexive, Symmetric, Transitive, Anti-symmetric Relations, Relation Matrix and Graph of a Relation; Partition and Covering of a Set, Equivalence Relation, Equivalence Classes, Compatibility Relation, Maximum Compatibility Block, Composite Relation, Converse of a Relation, Transitive Closure of a Relation R in Set X		

Mapping of Course Outcomes	CO3

Unit IV	**Algebraic Structures**	**(07 Hours)**

Algebraic structures with one binary operation- Semigroup, Monoid, Group, Subgroup, normal subgroup, group Permutations, Coset, homomorphic subgroups, Lagrange's theorem, Congruence relation and quotient structures. Algebraic structures (Definitions and simple examples only) with two binary operation- Ring, Integral domain and field.

Mapping of Course Outcomes	CO4

Unit V	**Graphs**	**(09 Hours)**

Introduction, definition, examples; Nodes, edges, adjacent nodes, directed and undirected edge, Directed graph, undirected graph, examples; Initiating and terminating nodes, Loop (sling), Distinct edges, Parallel edges, Multi-graph, simple graph, weighted graphs, examples, Isolated nodes, Null graph; Isomorphic graphs, examples; Degree, Indegree, out-degree, total degree of a node, examples; Subgraphs: definition, examples; Converse (reversal or directional dual) of a digraph, examples; Path: Definition, Paths of a given graph, length of path, examples; Simple path (edge simple), elementary path (node simple), examples; Cycle (circuit), elementary cycle

Mapping of Course Outcomes	CO5,CO6

Reference Book:

1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill,1997.

2. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,1999.

3. K. H. Rosen, Discrete Mathematics and its applications, Tata McGraw-Hill, 6th Ed., 2007.

4. David Liben-Nowell, Discrete Mathematics for Computer Science, Wiley publication, July 2017.

5. Eric Gossett, Discrete Mathematics with Proof, 2nd Edition,Wiley publication, July 2009.

@The CO-PO Mapping Matrix

CO\ PO	PO 1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO2	1	2		2								
CO3	2	1	2	1								
CO4	1	2		2								
CO5	-		2									
CO6	-	2	1	2								

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BSC-BCS-203: Database Management Systems

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	05	Internal Assessment (TH): 40 Marks END_Semester(TH): 60 Marks

Course Objective

1. To understand the fundamental concepts and the applications of Database Management Systems.
2. To acquire the skillset to use flexible databases for real applications.
3. To get familiar with Data Collection and Design techniques.
4. To design a Database Management Systems for scalable projects.
5. To relate different DB languages like MySQL, Noe4J, Riak, MongoDB.
6. To understand the relational database design principles.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1. To analyze and design the basic elements of a relational database management system.

CO2. To learn to normalize the databases using single value normalization.

CO3. To identify the relevant data models for problems.

CO4. To design and evaluate entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data.

CO5. To interpret the query evaluation and optimization techniques.

CO6. Apply Nosql development tools on different types of NoSQL Databases

Course Contents

Unit I	**Introduction to Database**	**(08 Hours)**
Database Concepts, Database System Architecture and Data Modeling: Data Models, Basic Concepts, entity, attributes, relationships, constraints, keys. E-R and EER diagrams: Components of E-R Model, conventions, converting E-R diagram into tables, EER Model components, converting EER diagram into tables, legacy system model. Relational Model: Basic concepts, Attributes and Domains, Codd's Rules. Relational Integrity: Domain, Entity, Referential Integrities, Enterprise Constraints, Schema Diagram. Relational Algebra: Basic Operations, Selection, projection, joining, outer join, union, difference, intersection, Cartesian product, division operations (examples of queries in relational algebraic using symbols).		
Mapping of Course Outcomes	CO1	
Unit II	**Data Collection**	**(08 Hours)**
Data Processing - Data collection; Data preparation; Training a model on the data; Evaluation of the model performance ; Data visualization techniques and inferences - scatter plot, scatter matrix, histogram, box plot		
Mapping of Course Outcomes	CO2	
Unit III	**Database Design & SQL**	**(08 Hours)**
Functional Dependency, Purpose of Normalization, Data Redundancy and Update Anomalies, Single Valued Normalization: 1NF, 2NF, 3NF, BCNF. Decomposition: lossless join decomposition and dependency preservation, Multi valued Normalization (4NF), Join Dependencies and the Fifth Normal Form. Introduction to SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML,		

DCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, Nulls SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries

Mapping of Course Outcomes	CO3

Unit IV	**Query Processing and Database transactions**	**(08 Hours)**

Algebraic structures with one binary operation- Semigroup, Monoid, Group, Subgroup, normal subgroup, group Permutations, Coset, homomorphic subgroups, Lagrange's theorem, Congruence relation and quotient structures. Algebraic structures (Definitions and simple examples only) with two binary operation- Ring, Integral domain and field.

Mapping of Course Outcomes	CO4

Unit V	**Concurrency Control**	**(08 Hours)**

Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, and Optimistic Techniques. Recovery Methods: Shadow-Paging and Log-Based Recovery, Checkpoints, Performance Tuning, Query Optimization

Mapping of Course Outcomes	CO5

Unit VI	**NoSQL databases**	**(08 Hours)**

Introduction, Overview, and History of NoSQL Databases – The Definition of the Four Types of NoSQL Databases, Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra NoSQL Key/Value databases using MongoDB, NoSQL Key/Value databases using Riak, Graph NoSQL databases using Neo4J, NoSQL database development tools and programming languages Future Trends for NoSQL databases

Mapping of Course Outcomes	CO6

Text Book:

1. Raghurama Krishnan, Johannes Gehrke , Database Management Systems, 3rd edition, Tata McGraw Hill, New Delhi,India
2. Elmasri Navate, Fundamentals of Database Systems, Pearson Education,India.

Reference Book:

Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2005), Database System Concepts, 5th edition, McGraw-Hill, New Delhi,India.
2. Peter Rob, Carlos Coronel (2009), Database Systems Design, Implementation and Management, 7thedition

Practical List:

Assignments from all Groups (A, B, C) are compulsory.

Group- A:

1. Draw E-R diagram and convert entities and relationships to relation table for a given scenario. a. Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college)
2. Install and configure client and server for MySQL and MongoDB (Show all commands and necessary steps for installation and configuration).
3. Perform the following: a. Viewing all databases, creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)
4. Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, backing up / Restoring a Database.
5. For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions Join Queries- Inner Join, Outer Join Subqueries- with IN clause, With EXISTS clause.

6. For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views, Selecting from a view.
7. Write a Pl/SQL program using FOR loop to insert ten rows into a database table.
8. Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.
9. Illustrate how you can embed PL/SQL in a high-level host language such as C/Java and demonstrates how a banking debit transaction might be done.
10. Given an integer i, write a PL/SQL procedure to insert the tuple (i, 'xxx') into a given relation.
11. Study the Riak database and its uses. Also elaborate on building and installing of Riak.

Group B-
MongoDB/Apache Cassandra Queries:

1. Design and Develop MongoDB/Apache Cassandra Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators etc.).
2. MongoDB/Apache Cassandra - Aggregation and Indexing: Design and Develop MongoDB Queries using aggregation and indexing with suitable example using MongoDB.
3. MongoDB/Apache Cassandra - Map reduces operations: Implement Map reduces operation with suitable example using MongoDB.
4. Database Connectivity: Write a program to implement MongoDB database connectivity

Note* - Teachers can take the flexibility to use any other advanced tools Instead of MongoDB/Apache Cassandra

Group C-
Using the database concepts covered in Group A and Group B, develop an application with following details:
1. Follow the same problem statement decided in Assignment -1 of Group A.
2. Follow the Software Development Life cycle and other concepts learnt in Software Engineering Course throughout the implementation.
3. Develop application considering:
   - Front End : Java/Perl/PHP/Python/Ruby/.net/any other language
   - Backend : MongoDB/MySQL/Oracle
4. Test and validate application using Manual/Automation testing.
5. Student should develop application in group of 2-3 students and submit the Project Report which will consist of documentation related to different phases of Software Development Life Cycle:
   - Title of the Project, Abstract, Introduction
   - Software Requirement Specification
   - Conceptual Design using ER features, Relational Model in appropriate Normalize form
   - Graphical User Interface, Source Code
   - Testing document
   - Conclusion.

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CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO2	1	2	_	2	_	_	_	_	_	_	_	_
CO3	2	1	2	1	_	_	_	_	_	_	_	_
CO4	1	2	_	2	_	_	_	_	_	_	_	_
CO5	-	_	2	_	_	_	_	_	_	_	_	_
CO6	-	2	1	2	_	_	_	_	_	_	_	_