Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR
416 004, MAHARASHTRA
PHONE : EPABX – 2609000, BOS Section – 0231-2609094, 2609487
Web : www.unishivaji.ac.in Email: bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर ४१६ ००४, महाराष्ट्र
दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४, २६०९४८७
वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in

SU/BOS/Sci & Tech/ 499 **Date: 18 /08/2025**

To,

The Principal,
All Concerned Affiliated Colleges/Institutions
Shivaji University, Kolhapur

The Head/ Director/ Co-ordinator
All Concerned Department (Science)
Shivaji University, Kolhapur

Subject: Regarding revised syllabi of B.Sc. Part-II (Sem.III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0)

Ref: No. SU/BOS/Science/271 & 274 Date: 03/05/2025 Letter.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi, nature of question paper of B.Sc. Part-II (Sem.III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

B.Sc. Part-II (Sem. III & IV) as per NEP-2020 (2.0)			
1.	B.Sc.Part II Biochemistry	5.	Computer Science (Entire)
2.	Animation (Entire)	6.	Computer Science (Optional)
3.	B.Sc. - M.Sc. AI&ML)	7.	Information Technology (Entire)
4.	BCA		

This syllabus, nature of question and equivalence shall be implemented from the academic year 2025-2026 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020@suk (Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2025 & March/April 2026. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dr. S. M. Kubal
Dy. Registrar

Encl. : As above.

Copy to: For Information and necessary action.

1	I/c Dean, Faculty of Science & Technology	7	Appointment Section A & B
2	Director, Board of Examinations & Evaluation	8	Affiliation Section (T.1) (T.2)
3	The Chairpersan, Respective Board of Studies	9	P.G.Admission Section,
4	B.Sc. Exam Section	10	Computer Centre / IT Cell
5	Eligibility Section	11	Internal Quality Assorance Cell (IQAC)
6	P.G Seminar Section		

Estd. 1962
"A++" Accredited by
NAAC (2021)
With CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR - 416004,
MAHARASHTRA
PHONE:EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर -४१६००४,महाराष्ट्र
दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१—२६०९०९४
०२३१—२६०९४८७

Ref.No.SU/BOS/Science/271 **Date: 03/05/2025**

To,

The Principal,
All Concerned Affiliated Colleges/Institutions
Shivaji University, Kolhapur.

Subject: Regarding revised syllabi of B.Sc. Part-II (Sem.III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi, nature of question paper B.Sc. Part-II (Sem. III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

B.Sc.Part-II (Sem. III & IV) as per NEP-2020 (2.0)			
1.	Pollution	8.	Food Science (Entire)
2.	Biochemistry	9.	Biotechnology (Entire)
3.	Food Science and Quality Control	10.	Environmental Science (Entire)
4.	Computer Science (Optional)	11.	Information Technology (Entire)
5.	Biotechnology (Optional/Vocational)	12.	Food Science and Technology (Entire)
6.	Animation (Entire)	13.	Food Technology & Management (Entire)
7.	Computer Science (Entire)	14.	All Faculty UG Part II Environmental Studies (VEC)

This syllabus, nature of question and equivalence shall be implemented from the academic year 2025-2026 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020@suk(Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2025 & March/April 2026. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy Registrar
Dr. S. M. Kubal

Encl: As above

for Information and necessary action

Copy to:

1	Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations and Evaluation	7	I.T.Cell /Computer Centre
3	Chairman, Respective Board of Studies	8	Eligibility Section
4	B.Sc.-M.Sc. Exam Section	9	Affiliation Section (T.1) (T.2)
5	Internal Quality Assurance Cell (IQAC Cell)	10	P.G. Seminar Section

SHIVAJ I UNIVERSITY, KOLHAPUR

NAAC A++ Grade with CGPA 3.52

Multiple Entry and Multiple Exit Option (NEP-2020)

Syllabus for

B.Sc. Computer Science (Entire)

(Under Faculty of Science and Technology)

PART-II SEMESTER- III & IV

(Syllabus to be implemented from Academic year 2025-26)

Multiple Entry and Multiple Exit Option (NEP-2.0)

B.Sc. Computer Science Entire Part-II (Level-5.0)

SEMESTER-III (Duration- Six Month)										
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam minutes	Maximum Marks	Minimum Marks	Exam minutes
1	**Subject I Major V:** Object Oriented Programming Using C++	2	-	2	40	14	90	10	04	20
2	**Subject I Major VI**: Database Concepts	2	-	2	40	14	90	10	04	20
3	**Subject I Practical IV:** Practical Based on Subject I Major V & Major VI	-	4	2	40	14	90	10	04	-
4	**Minor V:** As per students choice and availability but must be continued with previous year Minor	2	-	2	40	14	90	10	04	20
5	**Minor VI :** As per students choice and availability but must be continued with previous year Minor	2	-	2	40	14	90	10	04	20
6	**Minor Practical III:** Practical based on Minor V and Minor VI	-	4	2	40	14	90	10	04	-
7	**OE– III(T):** As per students choice and can be opted from other than BSc. (ie. B.Com or BA) Basket	2	-	2	40	14	90	10	04	20

8	**VSC–I (P) Major Specific:** HTML, CSS And Java Script	-	4	2	40	14	90	10	04	20
9	**SEC-I(T):** Cyber Security / Statistics for Computer Science I	2	-	2	40	14	90	10	04	20
10	**AEC-I:** Formal Communication	2	-	2	40	14	--	10	04	20
11	**CC-I:** Basics of Yoga	2	-	2	40	14	90	10	04	20
	Total (A)			**22**	**440**			**110**		

SEMESTER-IV(Duration-Six Month)										
Sr. No.	**Course Code**	**Teaching Scheme**			**Examination Scheme**					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam minutes	Maximum Marks	Minimum Marks	Exam minutes
1	**Subject II Major VII:** Data Structure With C++	2	-	2	40	14	90	10	04	20
2	**Subject II Major VIII**: RDBMS with PL-SQL	2	-	2	40	14	90	10	04	20
3	**Subject II Practical IV:** Practical Based on Subject II Major VII & Major VIII	-	4	2	40	14	90	10	04	-
4	**Subject II Minor VII** As per students choice and availability but must be continued with Minor I and Minor IV	2	-	2	40	14	90	10	04	20
5	**Subject II Minor VIII** As per students choice and availability but must be continued with previous year Minor	2	-	2	40	14	90	10	04	20
6	**Subject II Practical VI:** As per students choice and availability but must be continued with previous year Minor	-	4	2	40	14	90	10	04	-
7	**OE– IV (T):** As per students choice and can be opted from other than BSc. (ie. B.Com or BA)	2	-	2	40	14	90	10	04	20

	Basket									
8	**SEC-II (T):** PHP With MySQL	-	4	2	40	14	2	10	04	-
9	**AEC-II :** Soft skills	2	-	2	40	14	2	10	04	2
10	**VEC – II (T)** Environment Studies	2	-	2	40	14	2	10	04	2
11	CEP-I (P): Field Work	-	4	--	10	4	--	40	14	90
	Total (A)			**22**	**440**			**110**		

B.Sc. Computer Science Entire Part-II (Level-5.0)

With Mathematics as Minor

SEMESTER-III(Duration- Six Month)										
Sr. No.	**Course Code**	**Teaching Scheme**			**Examination Scheme**					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam minutes	Maximum Marks	Minimum Marks	Exam minutes
1	**Minor V:** Linear Algebra	2	-	2	40	14	90	10	04	20
2	**Minor VI :** Numerical Methods	2	-	2	40	14	90	10	04	20
3	**Minor Practical III:** Practical based on Minor V and Minor VI	-	4	2	40	14	90	10	04	-

SEMESTER-IV(Duration-Six Month)										
Sr. No.	**Course Code**	**Teaching Scheme**			**Examination Scheme**					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam minutes	Maximum Marks	Minimum Marks	Exam minutes

1	**Subject II Minor VII** Computational Geometry	2	-	2	40	14	90	10	04	20
2	**Subject II Minor VIII** Operation Research	2	-	2	40	14	90	10	04	20
3	**Subject II Practical VI:** Practical Based on Subject Minor	-	4	2	40	14	90	10	04	-

Multiple Entry and Multiple Exit Option (NEP-2.0)

B.Sc. Computer Science Entire Part-II (Level-5.0)

With Electronics as Minor

B.Sc. Computer Science Entire Part-II (Level-5.0)

With Mathematics as Minor

SEMESTER-III(Duration- Six Month)										
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam minutes	Maximum Marks	Minimum Marks	Exam minutes
1	**Minor VII:** Computer Organization	2	-	2	40	14	90	10	04	20
2	**Minor VIII:** Electronic Communication	2	-	2	40	14	90	10	04	20
3	**Minor Practical IV:** Practical based on Minor VII and Minor VIII	-	4	2	40	14	90	10	04	-

SEMESTER-IV(Duration-Six Month)										
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam minutes	Maximum Marks	Minimum Marks	Exam minutes
1	**Subject II Minor VII** Computer Networking	2	-	2	40	14	90	10	04	20
2	**Subject II Minor VIII** Micro-Controller &Interfacing	2	-	2	40	14	90	10	04	20
3	**Subject II Practical VI:** Practical Based on Subject Minor VII and VIII	-	4	2	40	14	90	10	04	-

B.Sc. Computer Science [Entire] (Semester–III)(NEP2.0)(Level–5.0)

Course: Subject I Major V

Course Title: Object Oriented Programming Using C++ (**Major)**

Course Outcomes: After completion of this course student should be able to

1. Understand basic concepts of object-oriented programming.
2. Design classes and objects and Able to use construct or and destructor.
3. Utilize the OOP techniques like operate or overloading, inheritance, and polymorphism.

UNIT	Contents	Hours Allotted
1	**Object Oriented Concepts:** • Difference between POP and OOP. • Concepts of OOP- Data abstraction, Encapsulation, Inheritance, Polymorphism. • Basics of C++, Terminology: Tokens, Keywords, Identifiers, constants. • Basic data types, Structure of C++program, Input and output streams. • Operators in C++, Dynamic Memory allocation(New &Delete),this pointer. • Dynamic initialization of variable, reference variables, default argument. • Control structures: Branching and looping statements. **Class, Object and Functions**: • Classes and objects-Definitions, defining class, Defining member functions within class and outside class, Nesting of member functions, static data members, static member function • Access modifiers: private, public and protected. • Array of objects, object as function argument, returning objects. • Inline function, Friend function and friend class.	**15**
2	**Constructor and Operator Overloading**: • Constructor: Definition, types-Default Constructor, Copy constructor, Parameterized constructor, Multiple constructors in class, constructor with default argument. • Destructors. • Operator overloading**:** Definition, Rules for overloading operator, overloading unary and binary operators. • Overloading operator using friend function. **Inheritance and Polymorphism** • Inheritance**:** Introduction, Defining base and derived class. • Single Inheritance, Making private ember inheritable, • multiple Inheritance, multilevel Inheritance, hierarchical Inheritance, hybrid Inheritance, • Abstract Class, Constructors in derived class • Polymorphism**:** Definition, Types of polymorphism: Compile Time Polymorphism, Run Time Polymorphism Virtual function.	**15**

Text Book/Reference book:

1. Object oriented programming By E.Balagurusamy.
2. C++Programming–By D.Ravichandran
3. Let Us C++ By Yashwant Kanetkar.
4. Object Oriented Programming in C++-Dr.G. T.Thampi, Dr. S.S. Mantha
5. Mastering C++- By Venu Gopal

B.Sc. Computer Science Entire(Semester–III)(NEP2.0)(Level–5.0)

Course: Subject I Major VI
Course Title: Database Concepts (**Major)**

Course Outcomes:

After successful completion of this course, students will able to:

1) Describe the basic concepts of DBMS and various databases used in real applications.
2) Demonstrate the principles behind systematic database design approach.
3) Describe the fundamental elements of Relational Database Management Systems.
4) Use various commands in data languages with example.

UNIT	Contents	Hours Allotted
01	**Basics of RDBMS** • Characteristics of database approach, advantages and disadvantages of DBMS, Data models: Hierarchical, Network, Relational, Schema and Instances, • DBMS architecture: Three Schema Architecture, Internal, Conceptual, External, Data independence: Logical, Physical, Concept of RDBMS, • Terminologies: relation, attribute, domain, tuple, entities, • Integrity Constraints (Domain, Entity, Referential), • Entity Relationship Model, Entity Relationships: one-one, one- many, many-one, many- many, Key: Super key, Composite Key, Candidate Key, Primary Key, Alternate Key or Secondary Key, Foreign Key), • Normalization:1Nf,2NF,3NF,De-normalization,Relational algebra	**15**
02	**Basics of MySQL** • Features of MySQL, Data types, User management, Database (Create, Use, Drop, Show, Copy), • DDL,DML, DCL, TCL Commands, • Clauses– Order by, where and group by, • Operators: Arithmetic(DIV,/, -,+,*,%,MOD),Comparison operator (=, <>, >, <, >=,<=), • Set operators : Union, Union all, Intersect, Minus Other Operator: like, in, not, between, exists, all, any, isnull, isnot null, distinct	**15**

Reference Books:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition ,Pearson Education, 2010.
2. R.Ramakrishanan, J.Gehrke,Database Management Systems 3rdEdition,McGraw-Hill,2002.
3. A.Silberschatz ,H.F.Korth,S. Sudarshan, Database System Concepts6thEdition, McGraw Hill, 2010.
4. R. Elmasri,S.B. Nava the Database Systems Models, Languages, Design and application Programming, 6th Edition, Pearson Education, 2013.
5. Database System Concept– Silberschatz ,Korth

B.Sc. Computer Science (Entire)(Part-II)(Semester-III)(NEP) Major Practical- III

Computer Science Practical based on Major V and VI

Lab Course based on C++ and DBMS (Major)

Credits: 02 Teaching Scheme: Practical – 4 Lectures/Week/batch Total Marks: 50 List of Practical:

Following is a sample list of assignments for practical, in structures are advised to provide more lab assignments to students to meet the course specified outcomes

Practical's: Lab Course based on Subject I Practical III: Practical Based on Subject I Major V& Major VI

B.Sc. Computer Science(Entire)(Part-II) (Semester IV) (NEP) Practical-I, (C++ and DBMS Practical based on Miner VII & VIII)	
Sr. No.	**Name of the Practical**
1	Write a C++programs based on branching and looping statements.
2	Write a C++programs based implementation of class having data member, member function inside the class.
3	Write a C++ programs based on implementation of class having data member ,member function outside the class
4	Write a C++ programs based on nesting of member function.
5	Write a C++ programs based on array of object.
6	Write a C++ programs based on passing object as Parameter
7	Write a C++ programs based on returning object
8	Write a C++ programs based on static data members and static member function
9	Write a C++programs based on programs based on usage of construct or with its types
10	Write a C++ programs based on destructor
11	Write a C++ programs based on usage of Inline and friend function
12	Write a C++ programs based on implementation of Single Inheritance
13	Write a C++ programs based on usage of constructors in derived class
14	Write a C++ programs based on implementation of multilevel Inheritance
15	Write a C++ programs based on implementation of multiple Inheritance
16	Write a C++ programs based on implementation of hierarchical Inheritance
17	Write a C++programs based on implementation of hybrid Inheritance
18	Write a C++ programs based on implementation off unction overloading
19	Write a C++programs based on implementation unary, binary operate or overloading
20	Write aC++programsbasedonimplementationoverloadingoperatorsusingfriendfunction
21	Write a C++ programs based on implementation of run time polymorphism i.e., virtual function
22	Write a C++ programs based on implementation of Abstract Class

•**Practical Based on Course: Subject I Major VI- DBMS**

Following is as list of assignments for practical, in struct or s are advised to provide more lab assignments to students to meet the course specified outcomes.

1	A practical on create, use and drop database.
2	A practical on DDL commands– Create table, Alter table: Add, modify, drop, rename column, rename table using first/after; Drop, Rename, Truncate)
3	A practical on DML commands–insert record, update record, select and delete record
4	A practical on creating table and use of different constraints on table. Insert at least10 records
5	A practical on user management in My SQL
6	A practical on DCL commands –Grant, Revoke
7	A practical on TCL commands–Rollback, Commit, Save Point

B.Sc. Computer Science (Entire) Part-II (Semester III)

Course III: Minor V

Course Title: Linear Algebra (Minor)

Course Outcomes: After complete on of this course, student should be able to

1. Understandtheconceptoflineartransformationanditsapplicationtoreallifeapplications.
2. Evaluate mathematical expressions to compute quantities that deal with linear systems and Eigen value problems.
3. Analyze an the matical statements and expressions.
4. Reasonmathematically.Understandthenotionofvectorspace,subspace,basis.

UNIT	CONTENTS	HOURS ALLOTTED
1	**Linear Equations and Matrices:** 1.1 Matrices 1.2 Matrix Transformation 1.3 Linear Systems 1.4 Results on system oflinearequationsandinvertible matrices 1.5 SolutionsofSystemofLinearEquations 1.5.1 GaussElimination Method 1.5.2 Gauss-JordonMethod 1.6 Eigenvalues, Eigenvectorsand diagonalization 1.6.1 Eigenvaluesand Eigen Vectors 1.6.2 Diagonalization 1.6.3 Cayley-Hamiltoniantheorem(StatementOnly)and Examples	15
2	**Vector Space:** 2.1 VectorSpace 2.2 Sub Space 2.3 LinearDependentandIndependent 2.4 LinearSpan 2.5 Basisand Dimension 2.6 DefinitionandExamples ofInnerProductSpace 2.6.1. DefinitionandExamples 2.6.2. PropertiesofInnerProductSpace 2.6.3. OrthonormalBasisinR 2.6.4. Gram-SchmidtProcess	15

***Note:** All theoremsinsections1.4, 1.6,2. 5 ,2. 6 are without proof.

Recommended Book:

Elementary Linear Algebra with Applications , Howard Anton,ChrisRorres,JohnWileyandsons.,7th Edition (1994).

REFERENCEBOOKS:

1. A textbook of Matrices ,Shanti Narayan, P.K.Mittal,S. Chand.
2. To pics in Algebra,I. N.Herstein.
3. Linear Algebra,SchaumSeries.

B.Sc. Computer Science (Entire)Part-II (Semester III)

Course VI Minor VI

Course Title: Numerical Methods (Minor)

Course Outcomes: After completion of this course, student should be able to

1. Understand how to find the roots of transcendental equations.
2. Understand learn numerical solution of differential equations
3. Understand how to find the roots of transcendental equations.
4. Understand how to interpolate the given set of values.

UNIT	CONTENTS	HOURS ALLOTTED
1	**Solution of Non-linear Equations and Numerical Interpolation** 1.1 Introduction 1.2 Bisection method: Algorithm, graphical presentation and examples. 1.3 Regula– Falsimethod: Algorithm, graphical representation and examples. Newton Raphs on method: Algorithm, graphical presentation, examples. 1.4 Interpolation, Equally and Unequally spaced data. 1.5 Definition of Forward Difference(Δ),B awkward Difference(∇)and Shift Operator (E). 1.6 ElementaryresultsofΔ, ∇, E. 1.7 Fundamental the orem of difference calculus(with proof). 1.8 Newton-Gregory Forwar dinterpolation formula(with proof)&Examples 1.9 Newton-Gregory Backwar dinterpolation formula(with proof)&Examples 1.10 Lagrange' sinterpolation formula(with proof)and example	15
2	**Numerical Integration** 2.1 Introduction of numericalintegration. 2.3GeneralQuadrature formula (with proof). 2.3 Trapezoidalrule (with proof)and examples. 2.4 Simpson's1⁄3rule (with proof)and examples. 2.5 Simpson's3⁄8rule (with proof)and examples. 2.6 Weddle'srule (with proof)and examples.	15

RecommendedBook:

1. IntroductoryMethodsofNumericalAnalysis,S.S.Sastry,3rdedition, Prentice Hallof India, 1999.
2. Finite difference sand Numerical Analysis,H.C. Saxena,S. Chandand Company.

REFERENCE BOOKS:

1. NumericalAnalysis,Balguruswamy.
2. CalculusofFiniteDifferencesandNumericalAnalysis,P.P.Gupta,G.S.MalikandS. Gupta,Krishna Prakashan Media (P) Ltd.
3. Computer oriented Numericalmethods, A.B.AutiTech-maxpublications.

B.Sc. Computer Science (Entire)(Part-II)(Semester-III)(NEP)
Minor Practical- III
Mathematics Practical based on Minor V and VI
(Minor)

List of Practical:

Practical Number	Title of the practical
1	Gauss Eliminati onMethod and Gauss-Jordon Method
2	Eigen values and Eigenvectors, Diagonalization
3	Verification of Cayley-Hamiltontheorem
4	Inverse of a matrix using Cayley-HamiltonTheorem
5	Examples on Basis of Vector Space
6	GramSchmidtprocess
7	Bisection method
8	Newton Forward and Backward interpolation, Lagrange'sinterpolation
9	Trapezoidal,Simpson's1⁄3andSimpson's3⁄8rule
10	Weddle's rule
11	Regula-FalsiMethodandNewtonRaphsonmethod
12	Computer Programfor 1) Trapezoidal rule 2) Simpson1⁄3ruleand Simpson3⁄8 rule 3) Weddle'srule 4) Bisectionmethod,Regula-FalsiMethodandNewtonRaphson method

B.Sc. Computer Science (Entire) (Part-II)(Semester-III) (NEP2.0)(Level–5.0)
Course III, Minor V
Course Title: Computer Organization

Course Outcomes (COs): On completion the course , the students will be able to

1) Understand and the designing of Combinational circuits & Sequential circuits,
2) Understand the Internal organization of Memory,
3) To study and under and the Input & Output devices organization in a computer,
4) To study the architecture CPU & internal organization of CPU

Units	Contents	Hours
1.	**A) Digital System Design:** **Combinational circuits design**: Design of Full Adder, Full Sub tractor, Design of Binary to Gray code converter, Gray to Binary code converter,Designof1-bit&2- bit Digital Comparator or (i.e. Magnitude Comparator), **Sequential circuit design:** Excitation ables of different Flip-flops, Design of 2-bit Synchronous Up counter or Down counter by using JK flip-flops or T-flip-flops, Design of 3-bit Non-sequential Counter (i.e. Random sequence Counter), **B) Memory Organization:** Classification & Characteristics of memory systems, Internal organization of RAM memory & ROM memory, Memory map, **Memory Expansion**: Horizontal memory expansion with example, Vertical memory expansion with example, Memory interfacing diagrams with CPU, Cache memory, Cache memory mapping techniques, Virtual memory &Swapping process, Paging technique & Segmentati on technique, Comparison between Paging & Segmentation,	**15**

2.	**A) Input/Output Organization:** I/O devices, System bus, I/O bus, Addressing methods: I/O mapped I/OIsolated I/O) & Memory mapped I/O, Comparison between I/O mapped I/O & Memory mapped I/O, **I/O interfaces:** Internal block diagram of Parallel I/O interface, Internal block diagram of Serial I/O Interface (i.e. **UART**),Internal block diagram of **DMA controller,** DMA I/O data transfer with the interfacing diagram of DMA controller with the CPU**,** IO Pprocessor,Interfacing diagram between IO processor & Master CPU, **B) CPU Organization:** Functions of CPU, Internal block diagram of CPU, Control unit: Introduction of Hard wired control unit& Micro-programmed control unit, **RISC&CISC** Architecture CPU, Comparison between RISC& CISCCPU, Pipelining technique inside the CPU, Combinational ALU, Sequential ALU, Internal Organization of CPU: Accumulator based CPU, Register based CPU, Stack based CPU	**15**

Reference Books:

1. Computer Organization, by J. P. Hays,
2. Digital System Design ,by Techmax/ Nirali publication,
3. Computer System Architecture by Morris Mano,

B.Sc. Computer Science (Entire) (Part-II) (Semester-III)(NEP)
Course III Minor VI
Course Title: Electronic Communication

Course Outcomes (COs):

On completion of the course, the students will be able to:

1) Understand the concept of Electronic communication,
2) Understand Different Modulation techniques,
3) Understand Different Multiplexing techniques,
4) Understand wireless telecommunication systems

Unit	Contents	Hours
1	**A) Introduction to Electronic Communication Systems:** Block diagram of Electronic communication system, Electromagnetic spectrum ,Types of Electronic communication, Applications of different Communication system, Noise signal , types of Noise signal, Signal to Noise ratio, Signal bandwidth, Channel bandwidth, Nyquist Sampling theorem, Shannon's the orem for channel capacity, **B) Analog Modulation:** Need of modulation, classification on of modulation techniques, Baseband signal, carrier signal, Modulation, demodulation, Analog modulation: **Amplitude modulation** & demodulation , Representation of AM signal in Time domain &Frequency domain, Modulation index,Equation of A Msignal, Power distribution in AM signal,**Frequency Modulation** & Demodulation, Representation of FM signal in time domain & frequency domain, Modulation index, Comparison between AM & FM modulation	15
2	**A) Digital Modulation & Multiplexing:** Classification of Pulse modulation: PAM, Pulsecode modulation (PCM), Delta modulation, block diagrams & working of each, Digital modulation: ASK, FSK, PSK, Block diagram of FSK-MODEM, **Multiplexing:** Time division multiplexing, frequency division multiplexing, Code division multiplexing, **B) Wireless Communication:**	15

	Introduction to mobile communication, Cellular concept, Working of GPS, Handover mechanism in mobile communication, Introduction to GPRS, **WirelessProtocols:**RFID,ZigBee,BlueTooth&WiFiprotocols,Comparison between these wireless protocols,	

Reference Books:

1. Electronic Communication by Roddy Coolen,
2. Electronic Communication by Robert Kennedy,
3. Communication Electronics by L.E.Frenzel,

B.Sc. Computer Science (Entire)(Part-II)(Semester-III)(NEP) Minor
Practical- III
Electronics Practical based on Computer Organization and Electronic Communication

List of Practical

1. Study of Binary to Gray & Gray to Binary code convertor
2. Study of single bit Digital Comparator
3. Study Decimal to BCD as Priority Encoder using 74147
4. Study Analog Multiplexer(8:1/4:1)
5. Study of 3 bit flash ADC circuit
6. Study of Integrator & Differentiator by using Op-Amp
7. Study of 4 bit Asynchronous counter
8. Design 8 bit Arithmetic Logic Unit
9. To recognize the various component of personal computer
10. Study the architecture of Mother board of Computer
11. Install and configure windows OS
12. Study the installation of Printer and trouble shooting
13. Study of Amplitude Modulation &Demodulation
14. Study of Frequency Modulation & Demodulation
15. Study of ASK Modulator & Demodulation
16. Study of FSK Modulation & Demodulation
17. Study of PAM modulation& Demodulation
18. Study of PWM modulation &Demodulation
19. Study of Pulse code Modulation & Demodulation
20. Study of BPSK modulation & demodulation

B.Sc. Computer Science (Entire)(Part-II)(Semester-IV) (NEP)
Course III Minor VII
Course Title: Computer Networking
Total Contact Hours: 30 hrs. (30 lectures of 60min.)
Credits: 02 Teaching Scheme: Theory–2Lectures/Week TotalMarks:40

Course Outcomes: On completion of the course, the students will be able to:

1. Understand the concept of Networks & Network Models,
2. Understand different Networking Devices& Transmission media,
3. Understand the data linking, data flow control & error detection,
4. Understand Network Layer, Transport Layer, Application Layer

Unit	Contents	Hours
1	**A) Computer Networks & Network Models:** Classification of Networks, Network Topologies, Network Models:TCP/IP Model, 7 Layered ISO/OSI Model, Applications of each Layer of ISO/OSI Model, **B) PhysicalLayer:**TransmissionMedia:Guided&UnguidedMedia,Co-axialCable, Optical fiber, Ground-wave Propogation, Sky-wave Propogation, Microwave linking, Satellite linking, Networking devices: Hub, Switch, Router, Bridge, Gateway, DataModems, Multiplexing techniques, **C) Data-Link Layer:** Data-flow control- Framing, Data Error detection & Data Error correction,Stop-and Wait Protocol,SlidingWindow Protocols,	15
2	**A) Network Layer:** Logical Addressing, IPv4addressing:addressspace,classesof addressing, IPv6 addressing, Comparison between IPv4 & IPv6 addressing, Internet Protocol(IP): IP Datagram format, Fragmentation, ICMP Protocol &Messages, **B) Transport Layer:** Services-Connection-less & Connection-Oriented Service, UDP Protocol: User Datagram, UDP services & applications, TCP Protocol: TCP services, TCP features, TCP segment structure,TCP connection, SCTP Protocol: SCTP services, SCTP features, SCTP packet format **C) Application Layer:** World-Wide-Web (www),Domain Name System(DNS), HTTP Protocols, FTP Protocols, Email Protocols: SMTP	15

	protocol, POP protocol, IMAP protocol, SNMP protocol, DHCP Protocol, Remote Login Protocols: TELNET Protocol, SSH Protocol	

Reference Books:

1. Computer Networking by Andrew Tannenbaum,
2. Data & Computer communication by William Stallings,
3. Advanced Computer Networking by Nirali Publication,
4. Computer Networking &Data Communication by Nirali Publication,

B.Sc. Computer Science (Entire)(Part-II)(Semester-IV) (NEP)
Course III, Minor _VIII
Course Title: Micro-Controller &Interfacing,

Course Outcomes: On completion of the course, the students will be able to

1. Understand the difference between Microprocessor & Micro-controller,
2. Learn & Understand the Instruction set of Micro-controller,
3. Study different features of Micro-controller,
4. Study interfacing of different peripheral device switches Micro-controller

Units	Contents	Hours
1.	**A) IntroductiontoMicro-controller-8051:** Comparison between Micro-controller&Microprocessor,4-bit,8-bit,16-bit&32-bit Micro-controllers & their applications, Study of 8051 Micro-controller & itsfamily, Comparative study of 89c51, 8031, 8032,8052, 8751, 89c51RD2, 89c51VRD2, Architectureof8051:InternalBlockdiagramf8051,Reset&Clocksignal,Registers, Flags, Internal memory, SFR registers, I/O ports, **B) 8051InstructionSet:**InstructionSet,AddressingModes,TypesofInstructions: Arithmetic & Logical, Data transfer, Jump, loop, CALL, Bit Manipulation, Serial Communication instructions, machine control instructions, Assembly language programming, Embedded C programming,	**15**
2.	**A) Facilities in 8051:** Timers & Counters: Timer Modes, Programming of Timers & Counters, Assembly language programming, Embedded C programming, Time-delay generation. Serial Port: Programming of Serial Port, RS-232 standards, IC MAX-232, Baud Rate, Programming for transmitting character through serial port in Assembly & Embedded C. B) Interfacing of Peripheral Devices with 8051: Interfacing of LED, Relay, Opto-coupler, Thumb-wheel switch, 7-segment display, Interfacing of Stepper motor, DC motor (PWM), LCD (16x2) with 8051, with Assembly language & Embedded C programming.	**15**

Reference Books:

1. 8051Micro-controllers&InterfacingbyMohammadMazidi,
2. 8051Micro-controller byK.JAyala,
3. 8051 Micro-controller by Ajay Deshmukh,
4. Micro-controller & Interfacing byA.P.Godse,Technical publication,
5. Micro-controoler Architecture &Programming, by Nirali Publication,

B.Sc. Computer Science (Entire) (Part-II)
(Semester-IV)(NEP) Practical-I,

(Electronics Practical based on Minor VII & VIII)

1.Interfacing of LED, Relay & Opto-coupler with Microcontroller - 8051
2.Interfacing of a Thumb-wheel switch or 7-segment display with 8051
3.Time delay generation using Timers (in Mode 1 or Mode 2) of 8051
4.Interfacing of a Stepper motor with 8051
5.Interfacing of DC motor (PWM) with 8051
6.Arithmetic & Logical operations by using 8051
7.Interfacing of DAC with 8051 to generate Square wave & Triangular wave
8.Interfacing of LCD display & Keyboard with microcontroller 8051
9.Interfacing of ADC to sample a signal & convert into digital with 8051
10. Programming & transmission of Serial data through serial port of 8051
11. Introduction to Networking devices, cables & connectors, Crimping tool & LAN tester
12. Preparation of Patch cord & Cross connection cable to connect devices in a LAN
13. Configuration of LAN: setting of IP addresses manually & DHCP addressing
14. Prepare & configure a LAN of 3 computers using HUB/Switch, for sharing of Resources
15. Study of different Networking commands on command line interface in a LAN
16. Study of different Networking software: Cisco Packet Tracer, Network Simulator (NS)
17. Configure Internet connectivity of your computer in a LAN with LAN Network drivers
18. Study of sharing of resources by FTP protocol to transfer a file from one system to another
19. Interconnect two computers by using RS-232 cable & transfer data between computers
20. Install & configure a Router/Repeater/Bridge of your LAN network

B.Sc. Computer Science[Entire](Semester–III)(NEP2.0)(Level–5.0)

Course: Value Education Course (VEC) - I

Course Title: HTML,CSS And Java Script

Teaching Scheme: Practical 04 Lectures/ Week/Batch **TotalMarks:**50 **Credits:**02

Course Outcomes:

Students who complete this course should be able to:

1. Understand basic as well as advanced concepts of HTML , CSS and Java Script.
2. Understand basics of CSS to design a page.
3. Design and develop website using HTML , CSS, Java Script

UNIT	Contents	Hours Allotted
01	**Introduction To HTML And CSS** Standard HTML Document Structure, Basic Text Formatting, Elements<b>,,<i>,<s>,<emp>, <u>,<small>,<big>,<tt>. Images<img>, Hypertext Links <a>, and , Lists- Ordered and Unordered, <input> (Type – Text, Password, Button, Submit, Reset). Table tags, Frames, Marquee , Navigation menus, Semantic tags. **Cascading Style Sheets**: Introduction, Types of CSS, Basic syntax, Selectors–element, id, class, group, universal, Style Properties of color, font, text, size and border.	15
02	**Introduction To Java Script:** Introduction, Document Object Model, Variables, Data types and Operators, Control Statement –if, if-else, break, Looping Statements–while, for, Element Access in Java Scripts– getElementById() and getElementsByName(), Event and event handling –onClick(), onBlur(), onFocus(), onKeyPress(), Dialog boxes– alert(),prompt(), confirm().	15

Text Books / Reference Books

4. TeachYourself Web Technologies–Ivan Bayross,BPB Publications
5. Web Technology–Ramesh Bangia
6. HTML 4Unleashed-Second Edition-Rick Dranell
7. HTML& CSS: The Complete Reference-Fifth Edition–Thomas A.Powell
8. HTML5&CSS 3-Seventh Edition–Castro Elizabethand Bruce Hyslop
9. HTML Black Book–Steven Holzner

Practical: Lab Course based on VEC-1:HTML,CSS And Java Script

1	Design a web page using heading and text formatting tags in HTML
2	Design a web page using heading and link tags in HTML
3	Design a web page using frame tag in HTML
4	Create your class timetable using table tag and its attributes in HTML
5	Create a form for student admission/student feedback by using form tag and its attributes in HTML
6	Design webpages of your College/Department with an attractive background, text color, images and fonts by using CSS properties
7	Design webpage/s of your city by using in line, internal and external CSS
8	Design webpage/s for display of on line products by using CSS and CSS selectors
9	Write a JavaScript on Conditional Statement
10	Write a JavaScript function demonstrating for loop
11	Write a JavaScript function to calculate square of given number
12	Write a JavaScript to use all the dialog boxes.
13	Write a JavaScript to Event handling.

B.Sc. Computer Science[Entire](Semester–III)(NEP2.0)(Level–5.0)
Skill Enhancement Course (SEC) - I
Course Title: Cyber Security

Teaching Scheme: Theory-02 Lectures/Week **TotalMarks:**50 **Credits:**02

Course Outcomes:
After successful completion of this course, students will able to:

1. Understand importance of cyber security and security management.
2. Learn different security threats.

Unit	Contents	Hours Allotted
1	**The introduction to Cyber Security-** The importance of Cyber Security , History of Cyber security , Important Terms used in Cyber security , Major Components of Cyber security, Types of Cyber Threats, The Cyber Attack Lifecycle, Impacts of Cyber Attacks ,Understanding Cyber Threats :- Malware, Phishing, Ransomware, Denial-of-Service (DoS) and Distributed Denial-of-Service (DDoS) Attacks, Advanced Persistent Threats (APTs), Zero-Day Exploits , Insider , Threats , Social Engineering ,Defensive Cyber Security Strategies : Introduction , Implementing , Strong Access Controls , Securing Networks and Systems , Encrypting Data , Implementing , Security Policies and Procedures, Conducting Regular Security Assessments, Implementing Backup and Recovery.	**15**
2	**Defensive Cyber Security Strategies**: Identity and Access Management (IAM) , Data Protection , Incident Response and Management , Threat Intelligence and Monitoring , Human Factors in Cyber 0security , Regulatory Compliance and Legal Considerations , Cyber Security in Corporate Environments: Introduction , Corporate Cyber Security Frameworks and Standards , Network Security in Corporate Environments , Endpoint Security for Corporations , Application Security in Corporations, Identity and Access Management (IAM) , Data Protection and Privacy , Building a Comprehensive Cyber Security Program , Protecting Corporate Networks and Systems , Ensuring Compliance with Regulations , Employee Training and Awareness , Incident Response and Recovery , Securing Personal Devices and Data: Introduction , Fundamentals of Device Security , Securing Mobile Devices , Protecting Personal Computers, IoT Device Security , Data protection and Privacy , Securing Online Accounts , Safe Internet Practices , Social Media Security, Securing Personal Communication , Children's Online Safety , Identity Theft and Fraud Prevention , Digital Hygiene and Maintenance .	**15**

Reference Books:

1. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin,
2. E-Commerce- Indian Perspective- P.T. Joseph S.J.

3. E-Commerce and Security- KjellOrsborn
4. Cyber security: The Essential Guide by Pacific Books International by S.B.Gaikwad, K.G. Kharade, Rashmi Agrawal, R.K.Kamat

B. Sc. Computer Science (Entire) Part- II (Semester III)
Course Code: SEC-I: Skill Enhancement Course
Course Title: Statistics for Computer Science I
Credits: 02, Total Marks: 50 Teaching

Scheme: Theory: 02 Lect. / Week Course Outcomes:

After completion of this course students should be able to

1. Understand basics of univariate random variable and probability distribution.
2. Understand common discrete probability distributions like Uniform, binomial, Poisson distribution.
3. Analyze data effectively using different probability distributions.
4. Get insight to apply standard discrete probability distributions to different situations.

Unit	Contents	Hours Allotted
1.	1.1 Introduction to statistical experiment (deterministic and nondeterministic), random experiment, sample space (finite & countably infinite), events and its types, random variable (r.v.), discrete random variable and its real-life examples. 1.2 Concept of probability, Classical definition of probability, Axiomatic definition of probability, Theorems on probability: i) $P(\varphi)=0$, ii) $P(A') = 1 - P(A)$, iii) if $A \subseteq B$ then $P(A) \leq P(B)$, Conditional probability, independent events (for 2 and 3 events), theorems on independence of two events: if A and B are independent then, i) A and B^c are independent, ii) A^c and B are independent, iii) A^c and $B^c$are independent., Union rule for i) any two events, ii) for independent events, iii) for exclusive events, Multiplication rule, Baye's theorem, Illustrative examples.	**15**
2.	2.1 Probability distribution of discrete r.v. (p.m.f.), cumulative distribution function of r.v. (c.d.f.), expectation and variance of discrete random variable, properties of c.d.f., graph of p.d.f. and c.d.f.Illustrative examples. 2.2 Standard Discrete Prob. Distributions: Introduction to random experiments with special reference to computer science, Discrete Uniform Distribution: definition of p.m.f., real life examples, c.d.f., mean and variance.	**15**

	Binomial distribution: Bernoulli trials, definition of p.m.f., real life examples, c.d.f., mean and variance, recurrence relation. Poisson distribution: definition of p.m.f., real life examples, c.d.f., mean and variance, recurrence relation,Illustrative examples.	

References and Recommended Readings:

1. Parimal Mukhopadhyay: An Introduction to the Theory of Probability. World Scientific Publishing.
2. Hogg R. V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Macmillan Publishing, New York.
3. Gupta S. C. & Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi.
4. Goon, A.M., Gupta M.K. and Dasgupta B: Fundamentals of Statistics Vol. I and Vol. II World Press, Calcutta.
5. Mood A.M., Graybill F.A.: Introduction to theory of Statistics. (Chapter II, IV, V, VII) and Boes D.C. Tata, McGraw Hill, New Delhi. (Third Edition)
6. Walpole R.E. & Mayer R.H.: Probability & Statistics. (Chapter 4, 5, 6, 8, 10) Mac Millan Publishing Co. Inc, New York.

B.Sc. Computer Science [Entire](Semester–III)(NEP2.0)(Level–5.0) Skill Enhancement Course (AEC) - I

Course Title: Formal Communication

Teaching Scheme: Theory-02Lectures/Week **TotalMarks:**50 **Credits:**02

Course Outcomes:

After successful completion of this course, students will able to:

1. Introduce communication techniques
2. Have professional correspondence techniques
3. Enhance writing skills

Unit	Contents	HoursAllotted
1	Communication: Nature and Importance of Communication, Objectives of Communication, Importance of Communication, Process and barriers to Communication, Elements of Communication, Forms of Communication Verbal Communication Techniques: Art of Speaking, Speech Styles. Oral Presentation- Preparation of Formal Speech, Meetings, Interviews, Group Discussion, Debate, Elocution, Extempore.	15
2	Non-verbal Communication-Meaning, Characteristics & classification of Non-verbal Communication, Body Language, Gestures, Postures. Listening & observation skills. Rapid review of Grammar:- Corrections of common errors, Verb and its subject, forms of verb, Use of phrases and idioms, Use of infinitive Gerund and Participle, Errors & Use of Adjective and adverb, Punctuation and capitalisation.	15

Reference Books:

1. R.K. Chaddha Communication Techniques and skills – DhanpalRai Publication, NewDelhi.
2. Pravil S. R. Bhatia, Professional Communication Skills- S. Chand and Co.,NewDelhi.
3. J.D.O'Connor, Better English pronounciation.
4. Wren and Martin, Highschool English Grammer and Composition – Chand and Co.,New Delhi.

B.Sc. Computer Science [Entire](Semester–III)(NEP2.0)(Level–5.0) Skill Enhancement Course (CC) - I

Course Title: Basics of Yoga

Teaching Scheme: Theory-02Lectures/Week **TotalMarks:**50 **Credits:**02

Course Outcomes:

After successful completion no this course, students willable to:

1. To understand the importance of Yoga
2 . To understand various Asans

Unit	Contents	HoursAllotted
1	Yoga Definition, Objectives of yoga Education Difference between Yoga Asana, and physical exercises, Importance of Yoga in daily life, Methods and benefits of Asanas, Pranayama and Concentration, Knowledge of five yama with more emphasis on 'Asteya', Knowledge of five Niyama with emphasis on 'Santosh', Knowledge of Aahar-Vihar, Methods and benefits of Sukshma,Vyayama, Asanas and prayers. Types of Yoga: Jnana Yoga, Bhakti Yoga, Karma Yoga, Hatha Yoga,Raja Yoga.	15
2	Role of yoga in character building, Therapeutic values of yoga, Introduction of yoga literature, Life history of Arvindo, Vivekanand and other yogis, Knowledge of Bandha, Mudra and Chakras,Methods and benefits of Asans, Pranayama and Concentration Effects of Asanas and Pranayama on physiology of human body, Concept of Nishkama Karma Yoga, Role of Yoga practices in developing concentration, will power and discipline, Techniques of stress management, Methods and benefits of Asanas, Pranayama and concentration.	15

References:

1. Light on Yoga by B.K.S. Iyengar
2. The Yamas &Niyamas: Exploring Yoga's Ethical Practice by Deborah Adele

B.Sc. Computer Science [Entire](Semester–IV)(NEP2.0) (Level–5.0)

Course: Subject I Major VII

Course Title: Data Structure with C++

TotalContactHours:30Hrs.(30Lecturesof60Minutes)

Teaching Scheme: Theory–02 Lectures/Week **Marks:**50 **Credits:**02

Course Outcomes:

After completion of this course, student will be to

- Understand concept of data structure and concept of array operations and applications of array.
- Understand different sorting and searching algorithms for problem solving.
- Implements algorithms to solve problems using appropriated at a structures.
- Understand implementations of linked list and basics of Trees.

UNIT	Contents	Hours Allotted
01	**Concepts of Data structure and Array** • Concept of Data, Data Object, Types of Data-Atomic Data, Non-atomic Data • Definition of Data Structure, types of Data Structure and advantages of Data Structure. • Array in data structure, representation of array, memory allocation of an array, multi-dimensional array **Algorithm Analysis** • Space complexity, time complexity • Asymptotic notation (Big O, Omega Ω, ThetaΘ) • Searching algorithms- Linear search, binary search and their algorithms • Sorting algorithm-Bubble Sort, insertion sort, selection sort, quick sort and their algorithms.	**15**

02	**Stack and Queue** • **Stack**: Concept of Stack: Definition, working of stack Operations on Stack: push, pop, peek, Array implementation of Stack, Linked List implementation of Stack, Applications of Stack-Recursion, Infix, Prefix, Postfix, conversion from Infix to Prefix and Infix to Postfix • **Queue**: Concepts of queue: Definition, working of queue, Operations on Queue: Insert, Delete, peek, Array implementation of queue, Linked List Implementation of Queue, Types of Queue-Linear, Circular and Priority, Applications of Queue. **Linked List and Tree** • **Linked List**: Concept of Linked List Memory representation of Linked List, Operations on Linked List: Insertion, Deletion, Display and Search, Types of Linked List: Singly, Doubly Linked List& Circular Linked List • **Tree**: Definition of Tree, Tree terminology (root, child, parent, sibling, descendent, ancestor, leaf/external node, branch node/internal node, degree, edge, path, level, depth, height of node, height of tree, forest), Difference between Binary Tree and Binary Search Tree	**15**

Text Book/Reference book:

1. Data structure through C++-Yashwant Kanitkar (BPB Publications)
2. Principles of Data structures using c ++ -Vinu V. Das (New Age International Publication)
3. Data Structures with C-SEYMOUR LIPSCHUTZ (Tata McGraw-Hill)
4. Data structures, Algorithms and Applications in C++, S. Sahni, University Press (India)Pvt.Ltd,2nd edition, Universities Press Orient Longman Pvt. Ltd.

B.Sc. Computer Science [Entire](Semester–IV) (NEP2.0) (Level–5.0) Course: Subject I Major VIII

Course Title: RDBMS with PL-SQL

Total Contact Hours:30 Hrs. (30 Lectures of 60 minutes)

Teaching Scheme: Theory-02Lectures/Week **Marks:**50 **Credits:** 02

Course Outcomes:

After successful completion of this course, students willable to:

1) Understand various functions and subqueries.
2) Understand various joins and views.
3) Use the control statements and stored procedures.
4) Use the cursors and triggers.

UNIT	Contents	Hours Allotted
01	**MySQL Functions, Subqueries and Join.** • **Functions in MySQL:** Aggregate functions (avg, count, min, max, sum), String Functions (con cat, instr, mid, length, strcmp, trim, ltrim, rtrim), Math Functions (abs, ceil, floor, mod, pow, sqrt), Date and Time Functions (adddate, datediff, day, month, year, hour, min, sec). • **Subqueries**–Concepts of Subqueries, subqueries with IN, EXISTS, NOT EXISTS, subqueries restrictions, Nested subqueries, ANY/ALL clause, correlated sub queries, Group by and Having clause. • **Concepts of Join**, Types of Joins- Inner Join, Outer Join, Left Join, Right Join, Cross Join • **Views** (creating, altering dropping, renaming and manipulating views).	15
02	**Advanced MySQL** • **Control Statements**- If, case and loop, • **Block Structure and Stored procedures**–Creating and executing procedures with and without parameters, • **Cursors-**Declare, open, fetch, close, • **Triggers**-Create, show and drop trigger, Types of triggers.	15

Reference Books:

1. R. Rama krishanan, J. Gehrke, Database Management Systems 3rdEdition, McGraw- Hill, 2002.
2. A.Silberschatz, H. F .Korth, S.Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
3. R.Elmasri, S.B.Navathe Database Systems Models, Languages, Design and application Programming, 6th Edition, Pearson Education, 2013.

B.Sc. Computer Science (Entire) (Part-II) (Semester-III) (NEP)

Major Practical- III

Computer Science Practical based on Major VII and VIII List of Practical:

Following is a sample list of assignments for practical, instructors a reavised to provide more lab assignments to students to meet the course specified outcomes.

1	Write a C++ program to implement recursive I) Linear search ii) Binary search
2	Write a C++ program to implement sorting methods (Using Array) I) Bubble sort ii) Selection sort iii) Quick sort iv) Insertion sort
3	Write a C++ program to implement the following using an array a)Stack ADT b) Queue ADT
4	Write a C++ program to implement list ADT to perform following operations
5	Insert an element into a list
6	Delete an element from list
7	Search for a key element in list
8	Count number of nodes in list
9	Write C++ program to implement the following using a singly linked list a) StackADT b) QueueADT
10	Write C++ program for implementing sorting methods (Using Linked List) i)Bubble sort ii)Selection sort iii)Quick sort iv)Insertion sort

RDBMS with Pl-SQL

1	A practical to demonstrate different date & time functions.
2	A practical to demonstrate different mathematical functions.
3	A practical to demonstrate different string functions.
4	A practical to demonstrate different other functions.
5	A practical to demonstrate different clauses.
6	A practical to demonstrate simple and nested query.

7	A practical to demonstrate different join types.
8	A practical on how to create view and drop view.
9	A practical on how to create stored procedure and other operations.
10	A practical to demonstrate different iterative statements.
11	A practical to demonstrate different control flow statements.
12	A practical on how to create and drop triggers.

B.Sc. Computer Science Entire (Semester–IV)(NEP2.0)(Level–5.0)
SEC-II (P) Course Title: PHP With MySQL
Total Contact Hours: Teaching Scheme:Practical–4 Lectures/Week/batch
Marks:50 Credits:02

Course Outcomes:

1. To understand basic concept of PHP.
2. To Learn how to developing applications in PHP using MySQL.
3. To learn and develop various PHP technology applications that definitely meets the current industry needs.

UNIT	Contents	Hours Allotted
1	Start PHP program ,Variable naming rules, scope, unset variable, Functions, Constant: define() function to define constant, constant() to retrieve value of constant, PHP predefined constants Operators, Strings: Single Quoted and Double Quoted, escape sequences, Multiline String, Concatenation operator(.), string functions(chr(), strlen(), Itrim(), rtrim(), trim(), strtoupper(), strtolower(), strcmp(), substr(), strrev(), echo(), print(), printf()), Decision Making Statements: if, if... else, if ... elseif...else, switch statement, Iterative Statements: for, while, do... while, foreach, break and continueStatement, Exit statements: exit, die, User Defined Functions: Declaring functions, function arguments(byval, byref, default arguments, variable number of arguments), global scope, static variables, Dynamic Function call Arrays: Concept, Types(Numerical/List, Associative/Maps, MultiDimentional), empty array, Initialisation of arrays([] operator, array() function, range() function), inserting element in array, Display entire array(print_r(),var_dump()), Sorting functions(sort(), rsort(), asort(), arsort(), ksort(), krsort(), natsort(),natcasesort(), array_multisort(), usort()), is_array() function, mergearrays array_merge()) and using + operator, array as stack(array_push(), array_pop(), array_shift(). array_unshift()), reverse array (array_reverse()), array_keys() and array_value(), key().	15
2	MySql connectivity MySql Database: Connect(mysql_connect()/mysqli_connect()), Close(mysql_close()/mysqli_close()), Select a database(mysql_select_db() /mysqli_select_db()),execute mysql query. Working with retrieving data , Creating Record With PHP , Inserting Record With PHP , Updating and Deleting Record With PHP.	15

Text Book/Reference book:

1. PHP and MySQL By Dreamtech Publications
2. PHP Concepts Unleashed For Novice - Vol 1-By Poornima Naik, Kavita Oza, Evincepub Publishing .
3. PHP A Beginner's Guide - Vikram Vaswami
4. PHP for Beginners - By Ivan Bayross and SharanamShah(Shroff Publishers & Distributors)
5. Beginning PHP 6, Apache, MySQL Web Development- By Timothy Boronczyk,
6. PHP and MySQL by Rajendra Salokhe(Aruta Publications)
7. Learning PHP 7 by Antonio Lopez 5.3 by Matt Doyle

B. Sc. Computer Science (Entire) Part- II (Semester IV)
Course Code: SEC-II: Skill Enhancement Course
Course Title: Statistics for Computer Science II
Credits: 02, Total Marks: 50 Teaching
Scheme: Theory: 02 Lect. / Week Course Outcomes:

After completion of this course students should be able to

1. Understand concept of continuous univariate random variable and probability distribution.
2. Understand standard continuous probability distributions like Uniform, Exponential and Normal distribution.
3. Analyse data effectively using above continuous probability distributions.
4. Get insight to apply standard continuous probability distributions to different situations.

Unit	Contents	Hours Allotted
1.	**1.1 Continuous random experiment and variable** Introduction to random experiment with special reference to infinite outcomes, Definition: infinite sample space, continuous random variable (r.v.)and its real-life examples. **1.2 Probability density function (p.d.f.)** Probability distribution of continuous r.v. (p.d.f.), cumulative distribution function of r.v. (c.d.f.), expectation (mean), median, mode and variance of continuous random variable, properties of c.d.f., graph of p.d.f. and c.d.f. Illustrative examples.	15
2.	**2.1 Standard Continuous Probability Distributions**: Real life situations of continuous r.v. with reference to computer science, Continuous Uniform distribution: Definition of p.d.f., real life examples, c.d.f., mean and variance. Exponential distribution: Definition of p.d.f., real life examples, c.d.f., mean and variance, memory less property and its applications in computer science field, Illustrative examples.	15

	2.2 Normal Distribution: Definition of p.d.f., real life examples, Standard Normal distribution, Normal curve, properties of Normal distribution, mean and variance, 6-sigma limits, Importance of 6-sigma limits in IT industry, Limiting form of Binomial to Normal and Poisson to Normal distribution (only statements), Additive property of Normal distribution, Illustrative examples.	

References and Recommended Readings:

1. Trivedi R.S.: Probability and Statistics with Reliability and Computer Science Application, Prentice–Hall of India Pvt. Ltd., New Delhi.
2. Parimal Mukhopadhyay: An Introduction to the Theory of Probability. World Scientific Publishing.
3. Hogg R.V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Mac-Millan Publishing, New York.
4. Goon A.M., Gupta M.K. and Dasgupta B.: Fundamentals of Statistics Vol. I and Vol. II World Press, Calcutta.
5. Gupta S.C.& Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi.
6. Gupta S. C. & Kapoor V.K.: Applied Statistics. Sultan Chand & sons, New Delhi.
7. Mood A.M., Graybill F.A. and Boes D.C.: Introduction to theory of Statistics. Tata, Mc-Graw Hill, New Delhi.(Third Edition)
8. Walpole R.E. & Mayer R.H.: Probability & Statistics. Mac-Millan Publishing Co. Inc, New York.

B.Sc. Computer Science (Entire) (Semester – IV) (NEP 2.0)
(Level – 5.0)
Course: AEC-II
Course Title: Soft Skills

Course Outcomes:

The course will enable students to;

1. To empower the students towards general and technical writing, oral communications
2. To empower listening skills: letter writing, technical report writing, and business communication.

UNIT I **(15 Hours)**

Expression: Practical communication skill development, business presentation with multimedia, speaking skill, prepared speech, extempore speech.

UNIT II **(15 Hours)**

Writing: Technical/business letter, Resume Preparation, organization of writing material, poster presentation, writing technical document, preparing software user manual, preparing project documentation.

Reference Books:

1. Business Correspondence & Report Writing, Sharma, TMH
2. Business Communication Strategies, Monipally, TMH
3. English for Technical communication, Laxminarayanan,Scitech
4. Business Communication, Kaul,PHI
5. Communication Skill for Effective Mgmt., Ghanekar,EPH

B.Sc. Computer Science (Entire) (Semester – IV) (NEP 2.0) (Level – 5.0)
Course: VEC- II

Course Title: Environment Studies

- To be taken from Environmental Science BoS

B.Sc. Computer Science (Entire)(Semester – IV) (NEP 2.0) (Level – 5.0) Course: CEP-I

Title of course: CEP-I: Field work

- **Field work as per NEP 2.0 (CEP, CC), University circular enclosed**