Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Four Year B.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

CBCS Syllabus

F.Y.B.Sc.(Computer Science) Semester -II

For Department of Computer Science

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

(Eligibility : 12th Science with Mathematics)

Title of the Programme: F.Y.B,Sc (Computer Science)

Preamble

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moralcapacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students.By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Computer Science and related subjects, the Board of Studies in Computer Science at TuljaramChaturchand College, Baramati - Pune, has developed the curriculum for the first semester of F.Y.B.Sc.(Computer Science),which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

A degree in Computer Sciencesubject equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths.Career in Computer Science is considered one of the most high-paying jobs and is full of opportunities; particularly when India's prowess in information technology industry is recognized across the globe. The pool of talented computer professionals working in IT companies of the USA, Canadaand other

countries shows that IT can take a person to higher levels. Numerous IT companies from India employ huge number of computer professionals in their Indian and overseas offices. Students who are interested in programming**,** software development, and have good analytical and reasoning skills may pursue this course. Job opportunities are available for Graduates and Post Graduates in Government as well as Private sector. Graduates may take up the following job posts- Software Engineer, Software Tester, Data Analyst, Project Manager, Network Administrator, database administrator and Application Developer.

Overall, revising the Computer Science syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Specific Outcomes (PSOs)

for

B.Sc. (Computer Science)

PSO1: Apply fundamental principles and methods of Computer Science to a widerange of applications.

PSO2: Design, correctly implement and document solutions to significant computational problems.

PSO3: Impart an understanding of the basics of our discipline.

PSO4: Prepare for continued professional development.

PSO5: Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

PSO6: Develop proficiency in the practice of computing.

PSO7: Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Computer Science

From 2022-23 to 2024-25

Sr.No.	Name	Designation
1.	Dr.Upendra Choudhari	Chairman
2.	Dr. Vilas Kardile	Member
3.	Mr. Abhijeet Mankar	Member
4.	Mr. Vishal Shaha	Member
5.	Mrs. Prajakta Kulkarni	Member
6.	Mrs. Asmita Bhagat	Member
7.	Mr. Rahul Shah	Member
8.	Dr.ShashikantNakate	Member
9.	Mr. Purushottam Dixit	Member
10.	Mr. Swapnil Chemte	Member
11.	Mrs. Kalyani Londhe	Member
12.	Mrs. Poornima Gavimath	Member
13	Dr.Kavita A. Khobragade	Vice-Chancellor Nominee
14	Dr.Sudhakar Bhoite	Expert from other University
15	Dr.Suhas S. Satonkar	Expert from other University
16	Mr. Rohit Shah	Industry Expert
17	Mr. Yogesh More	Meritorious Alumni
18	Mr. Abhijeet Chopade	Student Representative
19	Miss. Rutuja Harihar	Student Representative
20	Mr. Akshada Kulkarni	Student Representative
21	Mr. Prajwal Nimbalkar	Student Representative

Credit Distribution Structure for F.YB.Sc.(Computer Science)-2023-2024

Level	SEM	Major		Minor	GE/OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr./ Sem.	Degree/ Cum. Cr.
		Mandatory	Electives							
4.5	I	**COS-101-MJM:** Basic Programming using C **COS-102-MJM:**DBMS **COS-103-MJM:**Computer Science Practical – I **Credits-2+2+2**	--	--	**COS-116-OE**Internet Awareness (TH) **COS-117-OE:**Introduction to MS-Office (PR) Credit- 2+2	**COS-126-SEC(ST):** Introduction to Statistical Software OR (PR) **COS-126-SEC(MT)** Mathematics for Computer Science OR **COS-126-SEC(EL)** Electronics Pract.-I **COS-121-VSC:**(TH) Problem Solving Skills & DBMS Using PostgreSQL Credit- 2+2	**ENG-131-AEC:**FunctionalEnglish – I **COS-137-IKS:**Evolution of Computer **COS-135-VEC:** Environmental Science Credit- 2+2+2	**CC:** NSS/NCC/Yoga/ Cultural Activity/Sports Credit- 2	22	**UG Certificate 44**
	II	**COS-151-MJM::** Advanced Programming Using C **COS-152-MJM:** Relational Database Management System **COS-153-MJM:** Computer Science Practical – II Credits-2+2+2		**COS-161-MN (A)::** Exploratory Data Analysis-IOR **COS-161-MN(B):** Discrete Mathematics Credits-2OR **COS-161-MN (C)::**Basics ofElectronics **COS**-161-MN (D): Computer Fundamentals Credits-2	**COS-166-OE**Advanced MS-Excel **COS-167-OE** E-Banking Credit- 2+2	**COS-176-SEC:** Basic Graphics Design using C **COS-171-VSC:** Database Applications using PL/pgSQL Credit- 2+2	**ENG-181-AEC:** Functional English – II **COS-185-VEC:** Digital and Technological Solutions Credit- 2+2	**CC:** NSS/NCC/Yoga/ Cultural Activity/Sports Credit- 2	22	
	Cum Cr.	**12**	**-**	**2**	**8**	**8**	**10**	**4**	**44**	

Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

*** 1 Credit = 15 hr.**

Course Structure for F.Y.B.Sc. (Computer Science)(2023 Pattern)

Sem.	Course Type	Course Code	Title of Course	Course Types	No. of Credits
I	Major Mandatory	COS-101-MJM	Basic Programming using C	Theory	2
	Major Mandatory	COS-102-MJM	DBMS	Theory	2
	Major Mandatory	COS-103-MJM	Computer Science Practical	Practical	2
	Open Elective (OE)	COS-116-OE	Internet Awareness	Theory	2
	Open Elective (OE)	COS-117-OE	Introduction to MS-Office	Practical	2
	Skill Enhancement Course (SEC) (Any one)	COS-126-SEC(ST) COS-126-SEC(MT) COS-126-SEC(EL)	Introduction to Statistical Software Mathematics for Computer Science Electronics	Practical	2
	Vocational Skill Course (VSC)	COS-121-VSC	Problem Solving Skills & DBMS Using PostgreSQL	Theory	2
	Ability Enhancement Course (AEC)	ENG-131-AEC	Functional English - I	Theory	2
	Value Education Course (VEC)	COS-135-VEC	Environmental Science	Theory	2
	Indian Knowledge System (IKS)	COS-137-IKS	Evolution of Computers	Theory	2
	Co-curricular Course (CC)	---------	To be selected from the Basket	------	2
Total Credits I:					**22**
II	Major Mandatory	COS-151-MJM	Advanced Programming Using C	Theory	2
	Major Mandatory	COS-152-MJM	Relational Database Management System	Theory	2
	Major Mandatory	COS-153-MJM	Computer Science Practical	Practical	2
	Minor (For B.Sc.(CS)) (Any one)	COS-161-MN(A) COS-161-MN(B) COS-161-MN(C)	Exploratory Data Analysis-I Discrete Mathematics Basics ofElectronics	Theory	2
	Minor (For Others)	COS-161-MN (D)	Computer Fundamentals	Theory	2
	Open Elective (OE)	COS-166-OE	Advanced MS-Excel	Practical	2
	Open Elective (OE)	COS-167-OE	E-Banking	Theory	2
	Vocational Skill Course (VSC)	COS-171-VSC	Database Applications using PL/pgSQL	Theory	2
	Skill Enhancement Course (SEC)	COS-176-SEC	Basic Graphics Design using C	Practical	2
	Ability Enhancement Course (AEC)	ENG-181-AEC	Functional English – II	Theory	2
	Value Education Course (VEC)	COS-185-VEC	Digital and Technological Solutions	Theory	2
	Co-curricular Course (CC)	------	To be selected from the Basket	------	2
Total Credits II:					**22**
Cumulative Credits Semester I and II:					**44**

SYLLABUS (CBCS as per NEP 2020) FOR F. Y. B. Sc. (Computer Science)
Sem-II
(w.e.f. A.Y. 2023-24)

Name of the Program	: B.Sc. Computer Science
Program Code	: USCOS
Class	: F.Y.B.Sc. (Computer Science)
Semester	: II
Course Type	: Major
Course Name	: Advanced Programming using C (TH)
Course Code	: COS-151-MJM
No. of Lectures	: 30
No. of Credits	: 02

A) CourseObjectives:

1. Introduce students to the advanced concepts of C programming
2. Learn to develop complex programs
3. Enhanced ability to define and manage data structures based on problem subject domain
4. Define and use of pointers with simple applications
5. Master the use of strings, structures, pointers
6. Gain proficiency in working with files and preprocessor directives
7. Introduce file handling and basic I/O operations

B) CourseOutcomes:

CO1: Apply appropriate Control structures to solve problems
CO2: Implement strings in C code.
CO3: Manage I/O operations in your C program
CO4: Repeat the sequence of instructions and points for a memory location
CO5: Implement functions towards performing operations on Files
CO6: Improve code efficiency and optimization
CO7: Explain the uses of pre-processors and various memory models

Units	Contents	No. of Lectures
Unit 1	**Strings** 1.1 String Literals, string variables, declaration initialization, format specifiers 1.2 Standard library functions 1.3 Strings and pointers 1.4 Array of strings 1.5 Command Line Arguments	06
Unit 2	**Structures and Unions** 2.1 Introduction, definition, initialization 2.2 Accessing structure members 2.3 Use of Typedef	08

	2.4 Array of structures 2.5 Passing structures to functions 2.6 Nested structures 2.7 Pointers and structures 2.8 Concept of Union 2.9 Difference between structures and unions	
Unit 3	**Pointers** 3.1 Introduction to Pointers, Types of pointers 3.2 Declaration, definition, initialization, dereferencing 3.3 Pointer arithmetic 3.4 Pointer to pointer 3.5 Arrays and pointers 3.6 Functions and pointers – passing pointers to functions, function returning pointers 3.7 Dynamic memory allocation: 3.8 Dangling pointers	08
Unit 4	**File Handling** 4.1 Streams 4.2 Types of Files 4.3 Operations on files 4.4 Standard library input/output functions 4.5 Random access to files	04
Unit 5	**C Preprocessor** 5.1Format of Preprocessor directive 5.2 File Inclusion directive 5.3 Macro substitution, nested macro, argumented macro 5.4 Macros VS Functions	04

Text Books:

1. Mr. Kamil Ajmal Khan and Mrs. Deepali N. Bhoskar: Advanced C programming, Nirali Prakashan
2. Dr. Poonam Ponde. Advanced C programming, Vision Publication

References Books:

1. Yashavant Kanetkar: Let Us C ,7th Edition, PBP Publications
2. E Balaguruswamy : Programming in ANSI C 7th Edition, Tata Mc-Graw Hill Publishing Co.Ltd.-New Delhi
3. Brian W. Kernighan and Dennis M. Ritchie: The C Programming Language 2nd Edition, Prentice Hall Publication
4. Herbert Schildt, The Complete Reference to C
5. Harrow, Problem Solving with C
6. Ajay Mittal, Programming in C,A practical Approach,Pearson

E-Resources links:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3schools.com/c/index.php
3. https://www.guru99.com/c-programming-tutorial.html
4. https://www.geeksforgeeks.org/c-programming-language/
5. https://nptel.ac.in/courses

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	1	1	2	1
CO2	2	2	2	1	2	2	1
CO3	3	3	3	1	1	2	1
CO4	2	2	2	1	2	1	1
CO5	3	3	2	1	2	1	1
CO6	3	3	2	1	2	2	2
CO7	2	3	3	1	2	1	1

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justification of PO1 to ALL COs:

CO1:PO1-Mastery of these programming constructs is essential for a deep understanding of computer science principles, directly contributing to comprehensive knowledge in the field.

CO2:PO1-Applying theoretical concepts to practical problems demonstrates a profound understanding and the ability to use methodologies effectively in a broader context.

CO3:PO1-Algorithmic thinking is fundamental to computer science, requiring an in-depth understanding of key concepts and principles, strongly relating to comprehensive knowledge.

CO4:PO1-While crucial for foundational knowledge in programming, this CO is more specific and less broad compared to others, providing a moderate but essential understanding.

CO5:PO1-Proficiency in syntax and semantics is necessary for foundational knowledge but does not alone encompass the broader multidisciplinary context as strongly as other COs.

CO6:PO1-Basic I/O operations are fundamental skills that contribute to partial understanding, forming the building blocks for more complex concepts.

CO7:PO1-Debugging skills are crucial for understanding the intricacies of programming and developing robust solutions, moderately contributing to comprehensive knowledge.

2. Justification of PO2 to ALL COs:

CO1:PO2-These programming constructs are fundamental practical skills essential for professional tasks in software development, reflecting industry standards and best practices.

CO2:PO2-Solving real-world problems with C programming demonstrates the application of professional and procedural knowledge in practical scenarios, adhering to industry standards.

CO3:PO2-Algorithmic problem-solving is crucial for professional expertise, involving best practices and effective application of procedural knowledge in real-world tasks.

CO4:PO2-While important for practical skills, this CO is more specific and less broad compared to others, providing moderate but essential knowledge for professional tasks.

CO5:PO2-Proficiency in syntax and semantics is necessary for foundational practical skills but is more technical and less focused on procedural knowledge

CO6:PO2-Basic I/O operations are fundamental skills that provide the groundwork for more complex practical applications, contributing partially to professional knowledge.
CO7:PO2-Writing and debugging code are critical practical skills for professional tasks, involving industry standards and best practices, and essential for effective application in real-world scenarios.

1. Justification of PO3 to ALL COs :

CO1:PO3-Technical skills with minimal contribution to entrepreneurial mindset.
CO2:PO3-Directly supports innovation and opportunity identification, essential for entrepreneurship.
CO3:PO3-Fosters innovative thinking and creative solutions, moderately contributing to entrepreneurship.
CO4:PO3-Specific programming skills with partial relevance to business principles and market dynamics.
CO5:PO3-Foundational proficiency with limited impact on entrepreneurial thinking.
CO6:PO3-Fundamental skills with limited direct influence on entrepreneurial mindset and innovation.
CO7:PO3-Supports problem-solving and practical application, moderately fostering entrepreneurial skills through solution-oriented thinking.

2. Justification of PO4 to ALL COs :

CO1:PO4-Mastering these constructs demonstrates proficiency in technical skills and analytical abilities.
CO2:PO4-Designing solutions showcases problem-solving skills, technical proficiency, and adaptability.
CO3:PO4-Algorithmic problem-solving requires strong analytical abilities and technical skills, critical for specialized competencies.
CO4:PO4-Developing programs with these constructs show technical skill and problem-solving ability.
CO5:PO4-Proficiency in syntax and semantics is fundamental for technical skills, contributing moderately to specialized competencies.
CO6:PO4-Basic I/O operations are foundational technical skills with limited direct impact on broader specialized competencies.
CO7:PO4-Writing and debugging code requires strong problem-solving skills and technical proficiency, essential for specialized competencies.

3. Justification of PO5 to ALL COs :

CO1:PO5-These programming constructs are essential for applying concepts in practical settings and solving complex problems.
CO2:PO5-Designing and developing real-world solutions requires critical thinking, creativity, and problem-solving skills.
CO3:PO5-Algorithmic problem-solving is at the core of analytical reasoning and capacity for complex problem-solving.
CO4:PO5-Developing programs with these constructs showcase problem-solving ability and application of learned concepts.
CO5:PO5-Proficiency in syntax and semantics is crucial for effective problem-solving and application.

CO6:PO5-Basic I/O operations are foundational skills that contribute partially to the capacity for application and problem-solving.
CO7:PO5-Writing and debugging code requires strong problem-solving skills and analytical reasoning.

4. Justification of PO6 to ALL COs :

CO1:PO6-Developing programs is primarily a technical skill with limited direct impact on communication and collaboration.
CO2:PO6-Designing real-world solutions involves teamwork and effective communication.
CO3:PO6-Exploring algorithmic approaches enhances problem-solving skills that benefit teamwork, though direct impact on communication is moderate.
CO4:PO6-Developing specific programs is a technical skill with limited contribution to communication and collaboration.
CO5:PO6-Proficiency in syntax and semantics is fundamental but does not significantly impact communication or collaboration.
CO6:PO6-Basic I/O operations are technical skills with minimal relevance to communication and teamwork.
CO7:PO6-Writing and debugging code requires clear thinking and can benefit from collaboration, with moderate impact on communication skills.

5. Justification of PO7 to ALL COs :

CO1:PO7-Developing programs is primarily a technical skill with limited direct impact on observational and inquiry skills needed for research.
CO2:PO7-Designing solutions for real-world problems involves formulating questions and methodologies, aligning closely with research-related skills.
CO3:PO7-Exploring algorithmic approaches requires inquiry skills and analytical thinking, which are crucial for research.
CO4:PO7-While developing specific programs is a technical skill, it has limited direct relevance to research methodologies and inquiry skills.
CO5:PO7-Proficiency in syntax and semantics is a foundational skill with minimal impact on research-related skills.
CO6:PO7-Basic I/O operations are technical skills with limited direct relevance to research inquiry and methodologies.
CO7:PO7-Writing and debugging code involves problem-solving and attention to detail, which moderately supports research-related skills.

SYLLABUS (CBCS as per NEP 2020) FOR F. Y. B. Sc. (Computer Science) Sem-II
(w. e. f. A.Y. 2023-2024)

Name of the Programme	**:**	B.Sc. Computer Science
Program Code	**:**	USCOS
Class	**:**	F. Y. B. Sc. (Computer Science)
Semester	**:**	II
Course Type	**:**	Major (TH)
Course Name	**:**	Relational database management system
Course Code	**:**	COS-152-MJM
No. of Lectures	**:**	30
No. of Credits	**:**	02

A) Course objective:

1. Understand concepts of transaction processing & concurrency control
2. Learn Deadlock and its detection, Prevention and recovery.
3. Understand concept of database integrity & integrity constraints.
4. Learn Recovery concepts in database.
5. Study of database backup and recovery technique.
6. Understand the other databases like xml, NoSQL, etc.

B) Course Outcomes:

CO1: Understand the concepts of relational database management system.
CO2: Understand transaction management concept in RDBMS.
CO3: Know the concepts of Time stamping and locking.
CO4: Analyse the recovery system of different databases.
CO5: Apply normalization concept to real world problems
CO6: Know the information about different databases.
CO7: Understand database integrity & security concept.

Units	Title & Content	No. of lectures
Unit 1	**Transaction concepts and concurrency control** 1.1 Describe a Transaction, Properties of Transaction, State of the Transaction 1.2 Executing Transaction concurrently Associated Problem in Concurrent Execution 1.3 Schedules, Types of Schedules, Concept of Serializability, Precedence graph for Serializability 1.4 Ensuring Serializability by locks, different lock modes, 2PL and its variations. 1.5 Basic timestamp method for concurrency, Thomas Write Rule. 1.6 Locks with multiple granularity, dynamic database concurrency (Phantom Problem).	**10**

	1.7 Timestamps versus locking. 1.8 Deadlock and deadlock handling - Deadlock Avoidance (wait-die, wound-wait), Deadlock Detection and Recovery (Wait for graph).	
Unit 2	**Database Integrity and Security Concepts** 2.1 Domain Constraint 2.2 Referential Integrity 2.3 Introduction to database security concepts 2.4 Methods for database security ➢ Discretionary access control method ➢ Mandatory access control ➢ Role base access control for multilevel security. 2.5 Use of views in security Enforcement. 2.6 Overview of encryption technique for security. 2.7 Statistical database security.	**12**
Unit 3	**Crash Recovery** 3.1 Failure classification 3.2 Recovery concepts 3.3 Log base recovery techniques (Deferred and Immediate update) 3.4 Checkpoints, Relationship between database manager and buffer Cache. Aries recovery algorithm 3.5 Recovery with concurrent transactions (Rollback, checkpoints, commit) 3.6 Database backup and recovery from catastrophic failure	**04**
Unit 4	**Other Databases** 4.1 Introduction to Parallel and distributed Databases 4.2 Introduction to Object Based Databases 4.3 XML Databases 4.4 NoSQL Database 4.5 Multimedia Databases 4.6 Big Data Databases	**04**

<u>NOTE</u>: To understand, knowing & handling database in small- & large-scale IT industries, so students must visit & observing different IT industries

Book References:

1. Database System Concepts, By Silberschatz A., Korth H., Sudarshan S., 6th Edition, McGraw Hill Education
2. Database Management Systems, Raghu Ramakrishnan, Mcgraw-Hill Education
3. Database Systems, Shamkant B. Navathe, Ramez Elmasri, PEARSON HIGHER EDUCATION
4. Fundamentals of Database Systems, By: Elmasri and Navathe, 4th Edition Practical PostgreSQL O'REILLY

5. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill Science/Engineering/Math; 3 editions, ISBN: 9780072465631
6. NoSQL Distilled, Pramod J. Sadalage and Martin Fowler, Addison Wesley
7. An Introduction to Database Systems", C J Date, Addison-Wesley
8. Database Systems: Concepts, Design and Application", S.K.Singh, Pearson, Education
9. NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence: by Pramod J. Sadalage, Martin Fowler, Addison-Wesley, Pearson Education, Inc.
10. MongoDB: The Definitive Guide, Kristina Chodorow, Michael Dirolf, O'Reilly Publications

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	1	1	1	3
CO2	1	3	1	1	1	1	3
CO3	3	3	3	3	1	1	3
CO4	3	3	3	3	1	3	1
CO5	3	3	1	1	1	1	1
CO6	3	3	3	1	1	1	3
CO7	3	3	3	1	1	3	3

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. **Justification of PO1 to ALL COs:**

A) CO1 is strongly related to PO1 with a weightage of 3 because understanding the concepts of relational database management systems is fundamental to achieving comprehensive knowledge in database management.
B) CO2 is strongly related with a weightage of 3, as understanding transaction management concepts in RDBMS is crucial for a complete grasp of how databases operate and ensure data integrity.
C) CO3 is moderately related to PO1 with a weightage of 2 since knowing the concepts of timestamping and locking contributes to a broader understanding of database management but is more specialized.
D) CO4 is moderately related with a weightage of 2, as analyzing the recovery systems of different databases enhances knowledge but focuses on specific operational aspects rather than a comprehensive understanding.
E) CO5 is strongly related to PO1 with a weightage of 3 because applying normalization concepts to real-world problems is essential for developing a thorough understanding of database design and efficiency.
F) CO6 is partially related to PO1 with a weightage of 1, as knowing about different databases provides foundational knowledge but does not encompass the depth of understanding required for comprehensive database management.

G) CO7 is strongly related with a weightage of 3, as understanding database integrity and security concepts is vital for comprehensive knowledge in protecting data and ensuring its proper management.

2. Justification of PO2 to ALL COs:

A) CO1 is strongly related to PO2 with a weightage of 3, as understanding the concepts of relational database management systems is essential for practical application and professional use in database management.
B) CO2 is strongly related with a weightage of 3, since understanding transaction management concepts in RDBMS is crucial for ensuring data integrity and effective operational procedures in a professional environment.
C) CO3 is moderately related to PO2 with a weightage of 2, as knowing the concepts of timestamping and locking is important for practical implementations but is more specialized and technical in nature.
D) CO4 is moderately related with a weightage of 2, as analyzing the recovery systems of different databases supports practical knowledge but focuses on specific operational strategies rather than broad procedural skills.
E) CO5 is strongly related to PO2 with a weightage of 3 because applying normalization concepts to real-world problems is vital for practical database design and management in professional settings.
F) CO6 is partially related to PO2 with a weightage of 1, as knowing about different databases provides some practical knowledge but does not involve in-depth procedural skills or application.
G) CO7 is strongly related with a weightage of 3, as understanding database integrity and security concepts is essential for implementing best practices in data management and maintaining professional standards.

3. Justification of PO3 to ALL COs:

CO1 is moderately related to PO3 with a weightage of 2, as understanding the concepts of relational database management systems can inform entrepreneurial decisions regarding data-driven business models.

CO2 is moderately related with a weightage of 2, since understanding transaction management concepts in RDBMS supports an entrepreneurial mindset by highlighting the importance of data integrity and reliability in business operations.

CO3 is partially related to PO3 with a weightage of 1, as knowing the concepts of timestamping and locking is more technical and less directly tied to entrepreneurial strategies.

CO4 is moderately related with a weightage of 2, as analyzing the recovery systems of different databases can influence entrepreneurial decisions regarding risk management and data protection.

CO5 is strongly related to PO3 with a weightage of 3 because applying normalization concepts to real-world problems fosters innovative thinking and efficiency in data management, which are critical for entrepreneurship.

CO6 is partially related to PO3 with a weightage of 1, as knowing about different databases provides useful information but does not directly contribute to an entrepreneurial mindset.

CO7 is moderately related, with a weightage of 2, since understanding database integrity and security concepts is important for entrepreneurs to ensure that their data practices align with best practices and build trust with customers.

4. Justification of PO4 to ALL COs:

CO1 is strongly related to PO4 with a weightage of 3, as understanding the concepts of relational database management systems is fundamental to developing specialized skills in database management.

CO2 is strongly related with a weightage of 3, since understanding transaction management concepts in RDBMS is crucial for mastering specialized procedures that ensure data integrity in complex systems.

CO3 is moderately related to PO4 with a weightage of 2, as knowing the concepts of timestamping and locking is important for specialized knowledge but focuses on specific technical details rather than broader competencies.

CO4 is moderately related with a weightage of 2, as analyzing the recovery systems of different databases enhances specialized skills but is more focused on operational procedures than on comprehensive competencies.

CO5 is strongly related to PO4 with a weightage of 3, because applying normalization concepts to real-world problems is essential for demonstrating specialized skills in database design and optimization.

CO6 is partially related to PO4 with a weightage of 1, as knowing about different databases provides foundational knowledge but does not encompass the depth of specialized skills required for advanced database management.

CO7 is strongly related with a weightage of 3, as understanding database integrity and security concepts is vital for developing specialized competencies in protecting data and ensuring proper management.

5. Justification of PO5 to ALL COs:

CO1 is strongly related to PO5 with a weightage of 3, as understanding the concepts of relational database management systems directly supports problem-solving and analytical reasoning in database design and management.

CO2 is strongly related with a weightage of 3, since understanding transaction management concepts in RDBMS is critical for applying analytical reasoning to ensure data consistency and integrity during transactions.

CO3 is moderately related to PO5 with a weightage of 2, as knowing the concepts of timestamping and locking enhances analytical reasoning but is more focused on technical implementation than broader problem-solving applications.

CO4 is moderately related with a weightage of 2, as analyzing the recovery systems of different databases involves applying analytical reasoning to assess and improve data recovery strategies.

CO5 is strongly related to PO5 with a weightage of 3 because applying normalization concepts to real-world problems requires critical thinking and problem-solving skills to optimize database structures effectively.

CO6 is partially related to PO5 with a weightage of 1, as knowing about different databases provides some foundational knowledge but does not significantly enhance analytical reasoning or problem-solving capabilities.

CO7 is moderately related, with a weightage of 2, since understanding database integrity and security concepts is important for applying analytical reasoning to protect data and ensure compliance with standards.

6. Justification of PO6 to ALL COs:

CO1 is partially related to PO6 with a weightage of 1, as understanding the concepts of relational database management systems provides foundational knowledge but does not directly enhance communication skills.

CO2 is partially related with a weightage of 1, since understanding transaction management concepts in RDBMS is primarily technical and less focused on communication and collaboration.

CO3 is partially related to PO6 with a weightage of 1, as knowing the concepts of timestamping and locking is important for database operations but does not inherently involve collaboration or communication.

CO4 is moderately related with a weightage of 2, as analyzing the recovery systems of different databases can involve discussions and teamwork, especially when developing strategies for data recovery.

CO5 is moderately related to PO6 with a weightage of 2, as applying normalization concepts to real-world problems may require collaboration and clear communication of design choices and trade-offs with team members.

CO6 is partially related to PO6 with a weightage of 1, since knowing about different databases provides some context for discussions but does not focus heavily on collaborative efforts.

CO7 is moderately related, with a weightage of 2, since understanding database integrity and security concepts can facilitate important discussions within teams about data protection and compliance measures.

7. Justification of PO7 to ALL COs:

CO1 is moderately related to PO7 with a weightage of 2, as understanding the concepts of relational database management systems provides foundational knowledge that is beneficial for conducting research in database management.

CO2 is moderately related with a weightage of 2, since understanding transaction management concepts in RDBMS informs research related to data integrity and reliability within databases.

CO3 is partially related to PO7 with a weightage of 1, as knowing the concepts of timestamping and locking is more technical and specialized, making it less directly relevant to broader research skills.

CO4 is moderately related with a weightage of 2, as analyzing the recovery systems of different databases requires research-oriented thinking to assess the effectiveness of various recovery strategies.

CO5 is strongly related to PO7 with a weightage of 3, because applying normalization concepts to real-world problems involves critical analysis and problem-solving, which are essential skills in research contexts.

CO6 is partially related to PO7 with a weightage of 1, as knowing about different databases provides some useful context but does not significantly enhance research skills.

CO7 is moderately related, with a weightage of 2, since understanding database integrity and security concepts is important for conducting research that addresses data protection and compliance issues.

SYLLABUS (CBCS as per NEP 2020) FOR F. Y. B. Sc. (Computer Science)
Sem-II
(w. e. f. A.Y. 2023-2024)

Name of the Programme	: B.Sc. Computer Science
Program Code	: USCOS
Class	: F. Y. B.Sc. (Computer Science)
Semester	: II
Course Type	: Major
Course Name	: Computer Science Practical – II (PR)
Course Code	: COS-153-MJM
No. of Practical's	: 15 (60 Hours)
No. of Credits	: 02

A) Course Objectives:

1. Implement problem solving skills using pointer concept
2. Learn the functions of Structures and Unions
3. Working with files using the programming language.
4. Master the use of functions and modular programming
5. Understand design and implementation of a relational database system.
6. Study physical, logical database designs and database modelling.
7. Understanding and development of essential RDBMS concepts.

B) Course Outcomes:

CO1: To solve real world computational problems.
CO2: To define and manage data structures based on problem subject domain.
CO3: To work with textual information, characters and strings
CO4: To Manage I/O operations in your C program.
CO5: Understand the advanced database concepts and database management system.
CO6: Apply advanced SQL features like views database Management
CO7: Analyse PL/SQL structures like functions, procedures, cursors and triggers for Database applications

	Title of Experiment/ Practical
1	Use of pointers and Dynamic Memory allocation
2	Concept of strings, Array of strings.
3	Strings using standard library functions
4	Use of Structures and unions
5	C Pre-processor directives
6	Command line arguments
7	File handling
8	Case study
9	Nested Queries, using aggregate functions

10	Queries using Views
11	Stored Function
12	Cursors
13	Exception Handling
14	Triggers
15	Case study

Mapping of this course outcomes with Programme outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	2	1	2
CO2	2	1	2	2	2	1	2
CO3	3	3	2	1	2	1	1
CO4	3	3	2	1	2	1	1
CO5	3	2	2	1	2	1	1
CO6	3	3	2	1	1	2	1
CO7	3	2	1	1	1	2	1

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1.Justification of PO1 to ALL COs :

CO1:PO1-Developing problem-solving and programming capabilities encompasses foundational theories and methodologies.
CO2:PO1-Advanced and graphics programming involves deeper understanding of methodologies and concepts.
CO3:PO1-Solving real-world computational problems requires applying theories and principles in practical contexts.
CO4:PO1-Understanding and managing data structures involves foundational theories and methodologies.
CO5:PO1-Working with textual information requires understanding key concepts in character encoding and string manipulation.
CO6:PO1-Managing I/O operations demonstrate proficiency in practical application of programming theories and concepts.
CO7:PO1-Designing and implementing C programs encompasses applying theories, methodologies, and concepts in varied contexts.

2. Justification of PO2 to ALL COs :

CO1:PO2-Developing problem-solving and programming capabilities is foundational for practical skills essential in professional tasks.
CO2:PO2-Advanced and graphics programming skills enhance practical expertise, moderately related to professional tasks.
CO3:PO2-Solving real-world computational problems directly applies practical skills in professional scenarios.
CO4:PO2-Knowledge of data structures and their management is crucial in applying industry standards and best practices.
CO5:PO2-Working with textual data is a practical skill applicable in various professional contexts, moderately related to industry standards.
CO6:PO2-Managing I/O operations demonstrates practical knowledge in handling program inputs and outputs, moderately related to professional tasks.
CO7:PO2-Designing and implementing C programs showcases practical application of programming skills in real-world scenarios, strongly relating to professional tasks.

3. Justification of PO3 to ALL COs :

CO1:PO3-Developing problem-solving and programming capabilities fosters innovation and creativity, essential for an entrepreneurial mindset.
CO2:PO3-Advanced programming skills, including graphics, can support innovative solutions and product development.
CO3:PO3-Solving real-world problems requires identifying opportunities and applying innovative solutions, strongly related to entrepreneurial skills.
CO4:PO3-Understanding data structures is crucial for efficient product design and development, moderately related to entrepreneurial knowledge.
CO5:PO3-Working with textual data involves creativity in handling information, moderately related to fostering innovation.
CO6:PO3-I/O operations are essential but have limited direct impact on entrepreneurial mindset or innovation.
CO7:PO3-Designing and implementing programs for varied problems demonstrates entrepreneurial skills in identifying and seizing opportunities.

4. Justification of PO4 to ALL COs:

CO1:PO4-Proficiency in problem-solving and programming is fundamental to technical skills and analytical abilities required in specialized fields.
CO2:PO4-Advanced programming, including graphics, enhances technical proficiency and problem-solving abilities.
CO3:PO4-Solving real-world problems demonstrates practical problem-solving skills and adaptability, strongly relating to specialized competencies.
CO4:PO4-Managing data structures requires analytical abilities and technical skills, crucial for specialized competencies.
CO5:PO4-Working with textual data enhances communication skills and technical proficiency, moderately related to specialized skills.
CO6:PO4-I/O operations, while essential, have limited impact on specialized skills such as leadership and adaptability.

CO7:PO4-Designing and implementing programs demonstrates leadership in technical solutions and innovation, strongly related to specialized skills.

5.Justification of PO5 to ALL COs :

CO1:PO5-Developing problem-solving and programming capabilities directly enhance the capacity to solve complex problems and apply learned concepts practically.
CO2:PO5-Advanced programming skills contribute to applying complex concepts in practical settings, moderately related to analytical reasoning
CO3:PO5-Solving real-world computational problems require critical thinking and adaptability, directly related to problem-solving and analytical reasoning.
CO4:PO5-Managing data structures involve analytical reasoning and practical application of learned concepts in problem domains.
CO5:PO5-Working with textual data requires analytical reasoning and critical thinking in processing and manipulating information.
CO6:PO5-Managing I/O operations, while essential, has limited impact on analytical reasoning and problem-solving capabilities
CO7:PO5-Designing and implementing programs for various problems demonstrates the capacity for application, problem-solving, and analytical reasoning.

6.Justification of PO6 to ALL COs :

CO1:PO6-Programming enhances technical communication skills moderately but has a moderate impact on collaboration and leadership.
CO2:PO6-Advanced programming skills primarily focus on technical proficiency rather than communication and collaboration.
CO3:PO6-Solving real-world problems may involve communicating solutions effectively, moderately related to communication skills.
CO4:PO6-Understanding and managing data structures may involve communicating technical concepts, moderately related to communication skills.
CO5:PO6-Working with textual information directly enhances written communication skills, strongly related to effective communication.
CO6:PO6-I/O operations focus on technical aspects and have minimal impact on communication and collaboration skills.
CO7:PO6-Designing and implementing programs may involve collaboration and leadership in project teams, moderately related to collaboration skills.

7.Justification of PO7 to ALL COs :

CO1:PO7-Developing problem-solving skills involves structured thinking and logical reasoning, moderately related to research question formulation.
CO2:PO7-Advanced programming focuses on technical skills rather than research methodologies or data analysis.
CO3:PO7-Solving real-world problems requires systematic approaches similar to research methodologies, moderately related to research-related skills.
CO4:PO7-Managing data structures involves analytical skills relevant to research data management, moderately related.
CO5:PO7-Working with textual data involves skills in data manipulation and analysis, moderately related to research-related skills.

CO6:PO7-I/O operations are technical in nature and have limited direct relevance to research methodologies or data analysis.
CO7:PO7-Designing and implementing programs focuses on technical skills rather than research-specific methodologies or reporting.

SYLLABUS (CBCS as per NEP 2020) FOR U.G. Courses Semester-II
(w. e. f. 2023-24)

Name of the Program	: B.Sc. Computer Science
Program Code	: USCOS
Class	: U. G. Courses
Semester	: II
Course Type	: Minor
Course Name	: Computer Fundamentals (TH)
Course Code	: COS-161-MN (D)
No. of Lectures	: 30
No. of Credits	**:** 02

A) CourseObjectives:

1. Understand basic concepts of computers.
2. Knowing different computer languages.
3. Understand different components of computer.
4. Knowing structure of computer.
5. Knowing the current technologies and applications.
6. Understand concept of networking and Internet services.

B) Course Outcomes: Students will be able to:-

CO1: Understand fundamental concepts of computer
CO2: Know structure and working of computer
CO3: Know history and different generations of computer
CO4: Understand an Operating system
CO5: Understand concept of input and output devices
CO6: Know the concept of computer networking
CO7: Understand current technologies in computer science

Units	Title & Content	No. of lectures
Unit 1	**Knowing Computers** 1.1 Introduction to computer 1.2 History and Generations of computer 1.3 Characteristics of Computer 1.4 Classification of computer 1.5 Basic Applications of Computer	**08**
Unit 2	**Structure and working of Computer** 1.1 Fundamental Block diagram of computer 1.2 Input/output Devices 1.3 Concepts of Hardware and Software 1.4 Storage Devices 1.5 Computer Memory 1.6 Computer Languages 1.7 Operating System 1.8 Introduction to DBMS	**08**
Unit 3	**Networking and Internet services** 1.1 Need and use of computer network 1.2 Networking topologies 1.3 Concept of networking: LAN, MAN, WAN, PAN 1.4 Networking devices 1.5 Wired and wireless Technologies	**10**

	1.6 Introduction to internet 1.7 Internet access 1.8 World Wide Web (WWW) 1.9 Applications of internet 1.10 Advantages and Disadvantages of internet	
Unit 4	**Introduction to Current Technologies** 1.1 Artificial Intelligence 1.2 Machine Learning 1.3 Internet of Things (IOT) 1.4 Augmented Reality (AR) and Virtual reality 1.5 Edge Computing 1.6 Extended Reality (XR) 1.7 Robotics 1.8 Block chain	**04**

Mapping of this course with Program Outcomes

Course Outcomes	**Program Outcomes (POs)**						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	1	1	1	3
CO2	2	3	1	1	1	1	3
CO3	2	3	2	3	1	1	3
CO4	3	3	3	3	1	3	1
CO5	3	3	1	1	1	1	1
CO6	2	3	2	1	1	1	3
CO7	3	2	3	1	1	3	2

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR B. Sc. (Computer Science) Sem - II
(w. e. from AY 2023-24)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	**:** PSCOS
Class	**:** Arts and Commerce Faculty
Semester	: II
Course Type	**:** Open Elective (PR)
Course Name	**:** Advanced Excel
Course Code	**:** COS-166-OE
No. of Lectures	**:** 60 (15 Practicals)
No. of Credits	**:** 2

A) Course Objectives*:*

1. Edit worksheets using advanced enhancements and worksheet features.
2. Import and export data from the Internet and merge the data in to Excel
3. Worksheets and publish Excel worksheets on the web.
4. Work with named ranges and create lists
5. Import and Export data to and from Excel and other Office applications
6. Enhance lists using pivot tables and pivot table charts
7. Summarize data in worksheets and workbooks
8. Customize Excel worksheets and workbooks
9. Use case studies to create worksheets and workbooks.

B) Course Outcomes:

CO1: Able to handle MS-Excel data feeding and formatting

CO2: Able to manipulate data lists using Outline, Auto filter and PivotTables.

CO3: To Use Consolidation to summarize and report results from multiple worksheets.

CO4: Use advanced functions and productivity tools to assist in developing worksheets.

CO5: Able to create various data representation charts.

CO6: Understand to use various data validations

CO7: Applying advanced Excel skills to real-world projects and business scenarios, demonstrating the ability to solve complex problems using Excel.

Unit	Title and Contents	No. of Practical
Unit-1	**Review of Basic Excel Skills** • Recap of fundamental Excel functions and features.	**01**
Unit-2	**Advanced Formulas and Functions:** • Nested functions • Array formulas • Logical functions (IF, AND, OR, etc.)	**05**

	• Lookup and reference functions (VLOOKUP, HLOOKUP, INDEX, MATCH, etc.) • Text functions • Date and time functions	
Unit-3	**Data Analysis Techniques:** • Data validation • What-if analysis with scenarios • Goal seek and solver • Data tables • Pivot tables and Pivot Charts	**05**
Unit 4	**Advanced Formatting and Conditional Formatting:** • Advanced formatting options • Creating custom cell styles • Advanced conditional formatting rules	**03**
Unit 5	**Collaboration and Security:** • Workbook protection and security • Sharing workbooks and managing changes	**01**

References:

1. Excel 2019 Bible, 1st Edition by Michel Alexander, Richard Kulseika, John Walkenbatch.

Web links:

www.tutorialspoint.com

Course Outcomes	**Program Outcomes (POs)**						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	-	-	2	3
CO2	3	1	3	-	-	2	2
CO3	3	1	3	-	-	2	1
CO4	3	-	3	1	-	-	-
CO5	3	1	2	1	2	-	-
CO6	3	-	1	2	3	-	-
CO7	3	1	1	1	2	2	3

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR F. Y. B. Sc. (Computer Science) Sem-II (w. e. f. 2023-2024)

Name of the Program	: B.Sc. Computer Science
Program Code	: USCOS
Class	: F. Y. B. Sc. (Computer Science)
Semester	: II
Course Type	: OE (Theory)
Course Name	: E-Banking
Course Code	: COS-167(OE)
No. of Lectures	: 30
No. of Credits	: 02

A) COURSE OBJECTIVES:

7. Provide an overview of e-banking and explain the basic concepts and terminologies associated with electronic banking.
8. Introduce the various technologies and platforms used in e-banking, such as mobile banking apps,online banking websites, and ATM networks.
9. Highlight the importance of security in e-banking.
10. Provide an overview of the different e-banking services, including checking account balances, fund transfers, bill payments, mobile banking, and digital wallets.
11. Teach students how to perform common e-banking transactions, such as fund transfers, setting up recurring payments, and managing accounts online.
12. Explore the various types of security threats and cybercrimes that target e-banking, such as phishing, malware, and account takeovers.
13. Explore the various E-Locking Techniques.

B) COURSE OUTCOMES:

CO1. Gain a comprehensive understanding of electronic banking.

CO2. Learn about various digital banking services, including online account management, electronic funds transfer, mobile banking, and more.

CO3. Develop skills in evaluating and using mobile banking applications for various devices, including smartphones and tablets.

CO4. Promote financial literacy among students by understanding how e-Banking can be used to educate students about personal finance.

CO5. Explore the concept of green banking and how e-Banking can contribute to sustainable finance and environmental responsibility.

CO6. Develop a strong awareness of cybersecurity threats and vulnerabilities in e-Banking and understand best practices for mitigating risks.

CO7. Learn about the many digital payment methods, including RTGS, IMPS, NEFT, and debit cards.

Unit	Topic	No. of Lectures
Unit – 1	**E-Banking: Introduction** 1. Meaning 2. Definition 3. Features 4. Mobile Banking 5. Internet Banking 6. Digital wallets 7. Online Bill Payments 8. IFSC, IMPS, NEFT, RTGS.	[6]
Unit – 2	**ATM**: 1. Meaning, Features Functions 2. Service available from ATM a. Different types of cards, virtual debit cards b. Cash Deposit, Withdraw, Last few transactions, Balance & fund transfer.	[6]
Unit – 3	**Internet Banking:** 1. Introduction 2. Net banking account opening a. Username and Password b. Secrecy of maintaining One Time Password (OTP) 3. Net Banking Services a. Fund Transfer b. Make Payment.	[6]
Unit – 4	**E-Banking Securities:** 1. Introduction needs for security 2. E-banking Attack: Phishing,Man-in-the-Middle,Account Takeover,Cross-Site Scripting. 3. Cybercrimes: Malware and Banking Trojans, Ransomware,Identity Theft.	[6]
Unit –5	**E-banking Security System** 1. Digital certificate 2. Digital Signature & Electronic Signature-E-Security solutions 3. Solutions providers-E-locking technique a. E-locking services b. Transaction security c. Security devices d. Public Key Infrastructure-(PKI) e. Firewalls Secure Ledger-(FSL)	[6]

Text and Reference Books

1. Meaning with information by H. Jerome Lenter
2. Computer information Technology Global business by Puri and Vidin Puri
3. Fundamentals of data base systems by Jerome Lenter, Pearson
4. An introduction to Information Technology by Dr. Srinivasa Vallabhan, Sultan Chand & Sons
5. Law of Information Technology by D. P. Mittal, Tax Man, E-Markets, Macmillan 2007.
6. C.S. Rayudu, E-Business, Himalaya Publishing House.
7. Roger Hunt& John Shelly, Computers and Commonsense.
8. Bhushan Dewan, E-Commerce.

Mapping of this course with Program Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2				2
CO2	3	2	2				
CO3	2	2	3				2
CO4	2	3	1				2
CO5	2	3	3				2
CO6	3	2	3				2
CO7	3	3	3				3

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR F. Y. B. Sc. (Computer Science)
Sem-II
(w. e. f. A.Y. 2023-2024)

Name of the Programme	: B.Sc. Computer Science
Program Code	: USCOS
Class	: F. Y. B. Sc. (Computer Science)
Semester	: II
Course Type	: VSC (TH)
Course Name	: Database application using PL/PostgreSql.
Course Code	: COS-171-VSC
No. of Lectures	: 30
No. of Credits	: 02

A) Course objectives:

1. Learn basic for PL/pgsql.
2. Know the language structure of PL/pgsql.
3. Handle error and exceptions in PL/pgsql.
4. Learn programming control flow statements like conditional statements, Loops etc.
5. Understanding creation, manipulation and querying of data in database.
6. Understand stored function, trigger, cursor, stored Procedures etc…
7. Study physical database design and database modelling.

B) Course Outcomes:

CO1: The broad understanding of database concept.

CO2: Understand database techniques such as SQL & PL/pgSQL

CO3: Understand about query execution and its performance.

CO4: Master the advanced of database concepts and database management system.

CO5: Understand application of database system.

CO6: Know the syntax of trigger, function, cursor etc.

CO7: Understand conditional statements and loops in relational database concept.

Units	Title & Content	No. of lectures
Unit 1	**2. Introduction to PL/pgSQL and relational database concept** 2.1 Normalization (1NF,2NF,3NF, BCNF,4NF, 5 NF) 2.2 Introduction to PL/pgSQL ➢ Features of PL/pgSQL ➢ Advantages of PL/pgSQL ➢ Developing in PL/pgSQL. ➢ To add language PL/pgSQL to database.	**08**

	2.3 PL/pgsql: Language Structure ➢ Structure of PL/pgsql code block ➢ Data types in PL/pgsql ➢ Statement and Expressions ➢ Declarations (function parameter, Attribute, Record) 2.4 Controlling the program flow ➢ Conditional statements ➢ Loops ✓ Simple/basic loop ✓ While loop ✓ For loop ✓ Looping through query result ✓ For –In-Execute statements.	
Unit 2	**7.Stored Procedures and Stored Function.** 7.1 Introduction to stored procedure 7.2 Advantages and disadvantages of stored procedure 7.3 Syntax 7.4 Introduction to stored Function ➢ Calling a function ➢ Dropping a function	**06**
Unit 3	**8.Cursor, Handling errors and exceptions** 8.1 Declaring cursor variables 8.2 Opening cursor 8.3 Fetching rows 8.4 Closing cursor 8.5 Returning cursor 8.6 Looping through cursor results 8.7 Handling error and exception examples	**08**
Unit 4	**5. Trigger and Views** 5.1 Creating trigger 5.2 Listing triggers 5.3 Dropping trigger 5.4 Views syntax and examples	**08**

References:

11. Database System Concepts, By Silberschatz A., Korth H., Sudarshan S., 6th Edition, McGraw Hill Education
12. Database Management Systems, Raghu Ramakrishnan, Mcgraw-Hill Education
13. Database Systems, Shamkant B. Navathe, Ramez Elmasri, PEARSON HIGHER EDUCATION
14. Fundamentals of Database Systems, By: Elmasri and Navathe, 4th Edition Practical PostgreSQL O'REILLY

15. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill Science/Engineering/Math; 3 editions, ISBN: 9780072465631
16. NoSQL Distilled, Pramod J. Sadalage and Martin Fowler, Addison Wesley
17. An Introduction to Database Systems", C J Date, Addison-Wesley
18. Database Systems: Concepts, Design and Application", S.K.Singh, Pearson, Education
19. NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence : by Pramod J. Sadalage, Martin Fowler, Addison-Wesley, Pearson Education, Inc.
20. MongoDB: The Definitive Guide, Kristina Chodorow, Michael Dirolf, O'Reilly Publications

Mapping of this course with Program Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	1	1	3	3
CO2	3	3	3	1	1	3	3
CO3	3	3	3	1	1	3	3
CO4	3	3	1	1	1	1	3
CO5	3	3	1	1	1	3	3
CO6	3	3	1	1	1	1	3
CO7	3	3	1	1	1	1	3

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR F. Y. B. Sc. (Computer Science) Sem-II
(w. e. from A.Y.- 2023-2024)

Name of the Programme : B.Sc. Computer Science
Program Code : USCOS
Class : F.Y.B.Sc. (Computer Science)
Semester : II
Course Type : Major (PR)
Course Name : Basic Graphics Design using C
Course Code : COS-176-SEC
No. of Practical's : 15 (60 Hours)
No. of Credits : 02

A) Course Objectives:

1. To introduce to the students the concepts of computer graphics
2. To provide comprehensive introduction about computer graphics system,
3. Prepares students for activities involving in design, development
4. To know and understand interaction techniques.
5. To develop programming skills in computer graphics through programming assignments.
6. Detailed knowledge about basic shading and texture mapping technique.
7. To generate real-time graphics.

B) Course Outcomes:

CO1. Understand the basics of computer graphics
CO2. Knowing graphics different graphics systems and
CO3. Understand applications of computer graphics.
CO4. Use of geometric transformations on graphics objects
CO5. Design two dimensional transformations.
CO6. Testing of modeling, shading and animation.
CO7. Understand of the structure of an interactive computer graphics system

	Title of Experiment/ Practical
1	Introduction to use of basic graphics using C
2	Introduction to use of basic graphics using C
3	Color filling functions
4	Color filling functions
5	Drawing shapes and graphics simulation
6	Drawing shapes and graphics simulation
7	Formatting Text
8	Formatting Text
9	Applying Hashing pattern

10	Applying Hashing pattern
11	Printing graphics
12	Charts using graphics
13	Case studies
14	Case studies
15	Case studies

Mapping of this course outcomes with Program outcomes

Course Outcomes	**Program Outcomes (POs)**						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	1	2	2	1
CO2	3	2	3	1	2	1	2
CO3	3	3	2	1	1	1	1
CO4	3	2	2	1	2	1	1
CO5	2	2	3	2	1	2	1
CO6	3	2	3	2	2	1	2
CO7	3	3	2	1	2	1	1

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

SYLLABUS (CBCS as per NEP 2020) FOR F.Y. B.Sc., F. Y. B. Sc. (Computer Science), F.Y. B.Com., FYBBA(CA), FYBBA Sem - II
(w. e. f. A.Y. 2023-2024)

Name of the Programme : F.Y. B.Sc., F. Y. B. Sc. (Computer Science), F.Y. B.Com., FYBBA(CA), FYBBA

Program Code : USCOS
Class : F. Y. B. Sc. (Computer Science)
Semester : II
Course Type : Value Education Course (VEC) (TH)
Course Name : Digital and Technological Solutions
Course Code : COS-185-VEC
No. of Lectures : 30
No. of Credits : 02

Course Objectives:

- To gain. /'familiarity with digital paradigms
- To sensitize about role & significance of digital technology.
- To provide know how of communications & networks
- To bring awareness about the e-governance and Digital India initiatives
- To provide a. flavour of emerging technologies - Cloud, Big Data, AI 3D printing

Course Outcome:

CO1. Knowledge about digital paradigm.
CO2. Realisation of importance of digital technology, digital financial tools, e-commerce.
CO3. Know-how of communication and networks.
CO4. Familiarity with the e-governance and Digital India initiatives
CO5. An understanding of use & applications of digital technology.
CO6. Basic knowledge of all machine learning and big data.
CO7. Knowledge about social networking.

Units	Couse Contents	No. of Lectures
Unit - I	**Introduction & Evolution of Digital Systems**: Role & Significance of Digital Technology. Information & Communication Technology & Tools. Computer System & it's working, Software and its types. **Operating Systems:** Types and Functions. Problem Solving: Algorithms and Flowcharts. Communication Systems: Principles, Model & Transmission Media.	8
Unit - II	**Computer Networks & internet:** Concepts & Applicators, WWW, Web Browsers, Search Engines, Messaging, Email, Social Networking. **Computer Based information System:** Significance & Types.	7

	E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges.	
Unit –III	**Digital India & e-Governance:** initiatives, infrastructure, Services and Empowerment. **Digital Financial Tools:** Unified Payment interface, Aadhar Enabled Payment System, USSD, Credit/Debit Cards, e-Wallet's internet Banking, NEFT/RTGS and IMPS, Online Bill Payments and pos.	8
Unit- IV	**Cyber Security:** Threats, Significance, Challenges, Precautions, Safety Measures, & Tools **Emerging Technologies & their applications:** Overview of Cloud Computing, Big Data, internet of Things, Virtual Reality, Blockchain, Robotics, Artificial intelligence, 3-D Printing. Future of Digital Technologies.	7

REFERENCE BOOKS:

1. Fundamentals of Computers by E Balagurusamy- Tata Mc GrawHill

2. Data Communications and Networking by Behrouz A. Forouzan - McGraw Hill

3. "Cloud Computing- Principals and Paradigms" by Buvya, Broberg, and Gosciniski- Wiley

4. "E commerce" by Laudon.

5. "Artificial lntelligence- A Modern Approach by Russel and Norving" - Pearson Education.

6. "lnternet of Things" by Samuel Greengard - MIT press

7. "lntroduction to Computers by Peter Norton" - Tata McGraw Hill

8. "E-Commerce Concepts, Models, Strategies"- C.S.V. Murthy

9. "Basics of Artificial lntelligence and Machine Learning" by Dheeraj Mehrotra - Notion press.

10. "Big Data for dummies" by Hurwith, Nugent,Halper, Kaufman, Wiley & Sons - Wile

Mapping of this course outcomes with Program outcomes

Course Outcomes	**Program Outcomes (POs)**						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	1	2	2	1
CO2	3	2	3	1	2	1	2
CO3	3	3	2	1	1	1	1
CO4	3	2	2	1	2	1	1
CO5	2	2	3	2	1	2	1
CO6	3	2	3	2	2	1	2
CO7	3	3	2	1	2	1	1

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justification of PO1 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 3) Justification: PO1 focuses on comprehensive knowledge, which includes understanding the digital paradigm deeply. CO1 directly aligns with this objective as it emphasizes knowledge about the digital paradigm.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 3) Justification: PO1 emphasizes understanding the importance of digital technology and related tools. CO2 directly relates to this by focusing on the realization of the significance of digital technology, financial tools, and e-commerce.
- **CO3: Know-how of communication and networks.** (Weightage: 3) Justification: PO1 requires understanding communication and networks as part of digital knowledge. CO3 directly supports this by focusing on the know-how of communication and networks.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 2) Justification: While important, familiarity with e-governance and Digital India initiatives is somewhat narrower than the broader scope of PO1. It is moderately related as it contributes to understanding specific initiatives within the digital paradigm.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO1 includes understanding the use and applications of digital technology broadly. CO5 directly aligns with this by focusing on understanding how digital technology is used and applied.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: While machine learning and big data are important components of digital technology, they represent specific areas within a broader digital paradigm. Hence, CO6 is partially related to the comprehensive knowledge and understanding outlined in PO1.
- **CO7: Knowledge about social networking.** (Weightage: 2) Justification: Social networking is a specific aspect of digital technology and its applications. While relevant, it is not as comprehensive as the broader digital knowledge emphasized in PO1. Therefore, CO7 is moderately related.

2. **Justification of PO2 to ALL COs:**

- **CO1: Knowledge about digital paradigm.** (Weightage: 3) Justification: PO2 emphasizes practical and professional knowledge, which includes understanding the digital paradigm deeply. CO1 directly aligns with this objective as it focuses on knowledge about the digital paradigm.
- **CO2: Realisation of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 3) Justification: PO2 requires realizing the importance of digital technology and related tools in a practical and professional context. CO2 directly relates to this by focusing on the realization of their significance, which is crucial for practical application.
- **CO3: Know-how of communication and networks.** (Weightage: 3) Justification: PO2 emphasizes practical know-how of communication and networks, which are essential in professional settings. CO3 directly supports this by focusing on the practical aspects of communication and networks.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 2) Justification: Understanding e-governance and Digital India initiatives is important in a professional context, albeit somewhat narrower than the broader practical and procedural knowledge emphasized in PO2. Hence, it is moderately related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO2 requires understanding the practical use and applications of digital

technology in professional scenarios. CO5 directly aligns with this by focusing on understanding how digital technology is practically used and applied.

- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: While machine learning and big data are important, they represent specific technical skills within the digital paradigm. CO6 is partially related as it contributes to professional knowledge but may not cover all aspects of procedural knowledge emphasized in PO2.
- **CO7: Knowledge about social networking.** (Weightage: 2) Justification: Social networking knowledge is relevant in a professional context but is more specific and narrower in scope compared to the broader professional and procedural knowledge outlined in PO2. Hence, CO7 is moderately related.

3. Justification of PO3 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO3 requires understanding the digital paradigm to foster an entrepreneurial mindset. CO1 provides foundational knowledge about the digital paradigm, which is moderately related as it sets the context for entrepreneurial thinking.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 3) Justification: PO3 emphasizes realizing the importance of digital technologies and tools in entrepreneurial ventures. CO2 directly supports this by focusing on the significance of digital technology, financial tools, and e-commerce, which is strongly related to fostering an entrepreneurial mindset.
- **CO3: Know-how of communication and networks.** (Weightage: 3) Justification: Effective communication and networking are crucial for entrepreneurial success. PO3 includes developing know-how in these areas, and CO3 directly contributes by focusing on practical skills related to communication and networks, which is strongly related.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: While understanding e-governance and Digital India initiatives can be beneficial for entrepreneurs, it is less directly related to fostering an entrepreneurial mindset compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 2) Justification: PO3 requires understanding how digital technology can be practically applied in entrepreneurial ventures. CO5 directly aligns with this by focusing on understanding the use and applications of digital technology, which is moderately related.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 1) Justification: While machine learning and big data are important in various fields, including entrepreneurship, basic knowledge of these areas is less critical for developing an entrepreneurial mindset compared to other COs. Hence, it is partially related.
- **CO7: Knowledge about social networking.** (Weightage: 2) Justification: Social networking knowledge is directly relevant for entrepreneurs to build connections and partnerships. PO3 includes developing knowledge about social networking, and CO7 directly contributes to this aspect, which is moderately related.

4. Justification of PO4 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO4 requires foundational knowledge about the digital paradigm to develop specialized skills and competencies. CO1 provides this foundational knowledge, which is moderately related as it sets the context for specialized skill development.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 2) Justification: Understanding the importance of digital technology and related tools is essential for developing specialized skills in these areas. CO2 directly

supports this understanding, which is moderately related to developing specialized competencies.

- **CO3: Know-how of communication and networks.** (Weightage: 2) Justification: Effective communication and networking skills are specialized competencies required in various professional contexts. PO4 includes developing know-how in these areas, and CO3 directly contributes by focusing on practical skills related to communication and networks, which is moderately related.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: While familiarity with e-governance and Digital India initiatives can be beneficial, it is less directly related to developing specialized skills and competencies compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO4 emphasizes developing specialized skills in the practical use and applications of digital technology. CO5 directly aligns with this by focusing on understanding how digital technology is practically used and applied, which is strongly related.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: Machine learning and big data are specialized areas within the digital paradigm. CO6 provides basic knowledge in these areas, which is moderately related to developing specialized skills and competencies in these fields.
- **CO7: Knowledge about social networking.** (Weightage: 1) Justification: While knowledge about social networking is important, it is less directly related to developing specialized skills and competencies compared to other COs. Hence, it is partially related

5. Justification of PO5 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO5 requires a foundational understanding of the digital paradigm to apply problem-solving and analytical reasoning skills in digital contexts. CO1 provides this foundational knowledge, which is moderately related as it supports the application of these skills in digital scenarios.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 2) Justification: Understanding the importance of digital technology and related tools is crucial for applying problem-solving and analytical reasoning in digital environments. CO2 directly supports this understanding, which is moderately related to developing application and problem-solving capacities.
- **CO3: Know-how of communication and networks.** (Weightage: 2) Justification: Effective communication and networking skills are essential for problem-solving and analytical reasoning in professional contexts. PO5 includes developing know-how in these areas, and CO3 directly contributes by focusing on practical skills related to communication and networks, which is moderately related.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: While familiarity with e-governance and Digital India initiatives can provide context, it is less directly related to developing problem-solving and analytical reasoning skills compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO5 emphasizes the practical understanding and application of digital technology in problem-solving and analytical reasoning. CO5 directly aligns with this by focusing on understanding how digital technology is practically used and applied, which is strongly related.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: Machine learning and big data skills are increasingly important for analytical reasoning and

problem-solving in digital contexts. CO6 provides basic knowledge in these areas, which is moderately related to developing these capacities.

- **CO7: Knowledge about social networking.** (Weightage: 1) Justification: Knowledge about social networking, while useful, is less directly related to developing problem-solving and analytical reasoning skills compared to other COs. Hence, it is partially related.

6. Justification of PO6 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO6 requires a foundational understanding of the digital paradigm to effectively communicate and collaborate in digital contexts. CO1 provides this foundational knowledge, which is moderately related as it supports communication and collaboration in digital settings.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 2) Justification: Understanding the importance of digital technology and tools is essential for effective communication and collaboration in digital environments. CO2 directly supports this understanding, which is moderately related to developing communication skills and collaboration.
- **CO3: Know-how of communication and networks.** (Weightage: 3) Justification: PO6 emphasizes practical know-how in communication and networks, which are crucial for effective collaboration. CO3 directly contributes to this by focusing on developing practical skills related to communication and networks, which is strongly related.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: Familiarity with e-governance and Digital India initiatives, while important, is less directly related to developing communication skills and collaboration compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 2) Justification: Understanding the practical use and applications of digital technology is important for effective communication and collaboration in digital contexts. CO5 directly aligns with this by focusing on understanding how digital technology is used and applied, which is moderately related.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 1) Justification: While machine learning and big data are important, basic knowledge in these areas is less directly related to developing communication skills and collaboration compared to other COs. Hence, it is partially related.
- **CO7: Knowledge about social networking.** (Weightage: 2) Justification: Knowledge about social networking is directly relevant for fostering collaboration and effective communication. PO6 includes developing knowledge about social networking, and CO7 directly contributes to this aspect, which is moderately related.

7. Justification of PO7 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO7 requires a foundational understanding of the digital paradigm to conduct research effectively in digital contexts. CO1 provides this foundational knowledge, which is moderately related as it supports research activities within the digital paradigm.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 2) Justification: Understanding the importance of digital technology and tools is essential for conducting research related to digital environments. CO2 directly supports this understanding, which is moderately related to developing research-related skills.
- **CO3: Know-how of communication and networks.** (Weightage: 2) Justification: Effective communication and networking skills are crucial for conducting collaborative research. PO7 includes developing know-how in these areas, and CO3 directly contributes by focusing on practical skills related to communication and networks, which is moderately related.

•**CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: Familiarity with e-governance and Digital India initiatives can provide context for research, but it is less directly related to developing research-related skills compared to other COs. Hence, it is partially related.
•**CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO7 emphasizes understanding the practical use and applications of digital technology in conducting research. CO5 directly aligns with this by focusing on understanding how digital technology is practically used and applied, which is strongly related.
•**CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: Machine learning and big data skills are increasingly important in research methodologies, especially in digital contexts. CO6 provides basic knowledge in these areas, which is moderately related to developing research-related skills.
•**CO7: Knowledge about social networking.** (Weightage: 1) Justification: While knowledge about social networking can aid in collaboration for research, it is less directly related to developing research-related skills compared to other COs. Hence, it is partially related.

Examination Pattern / Evaluation Pattern

Teaching and Evaluation (for Major, Minor, AEC, VEC, IKS courses)

Course Credits	No. of Hours per Semester Theory/Practical	No. of Hours per Week Theory/Practical	Maximum Marks	CE 40 %	ESE 60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	4 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Teaching and Evaluation (for VSC, SEC & CC courses)

- Evaluation to be done by Internal & External Experts
- No descriptive end semester written examination
- Evaluation to be done at Department level preferably prior to commencement of Theory /Practical Examinations
- Evaluation to be done on the Skills gained by student