Course Title		Database Management System				
Type of Course	**Major**	Academic Level	200 - 299			
Pre-requisites	Discrete Mathematics, Data structures and Programming Basics					
Semester	IV					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	
	4	3	-	2	75	
Course Summary	This course provides an introduction to database management systems. The topics covered include the concept of Database Management System, ER Model, Relational model, SQL, Database design, Transactions, concepts of other data model-NoSQL and practical session to implement Database Concepts.					

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	A comprehensive understanding of fundamental concepts in database management systems and its application	U	C	Instructor-created exams / Quiz
CO2	Understand concepts of Relational Data Model and Normalization Techniques	U	C	Instructor-created exams / Quiz
CO3	Apply principles of entity-relationship modeling and normalization techniques to design efficient and well-structured databases that meet specified requirements.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Acquire expertise in crafting and executing SQL queries for the retrieval, updating, and manipulation	Ap	p	Practical Assignment /
	of data, showcasing adept skills in database querying and data manipulation			Observation of Practical Skills
CO5	Comprehend and apply strategies for managing transactions and implementing mechanisms for controlling concurrency, ensuring the database's consistency and reliability in environments with multiple users.	Ap	P	Practical Assignment / Observation of Practical Skills
CO6	Explore and analyze recent trends in database management systems, with a focus on unstructured databases, NoSQL technologies	An	P	Practical Assignment / Observation of Practical Skills

Detailed Syllabus:

Module	Unit	Content	Hrs	Mark
I		**Database System- Concept**	**10**	**15**
	1	Introduction, Characteristics of the Database Approach	2	

	2	Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach, File system vs Database	2	
	3	Data Models, Schemas, and Instances , Three-Schema Architecture and Data Independence	3	
	4	Database Languages and Interfaces	2	
	5	Structured, Semi Structured and Unstructured Database	1	
II	**Database Design**		**14**	**20**
	6	ER Model- Basic concepts, entity set & attributes, notations	2	
	7	Relationships and constraints, cardinality, participation, notations, weak entities	2	
	8	Relational Model Concepts-Domains, Attributes, Tuples, and Relations, Values and NULLs in the Tuple	2	
	9	Relational Model Constraints and Relational Database Schemas	2	
	10	Relational Database Design- Atomic Domain and Normalization-INF, 2NF,3NF,BCNF	4	
	11	4NF,5NF	2	
III	**Query Languages**		**11**	**20**
	12	SQL-, introduction to Structured Query Language (SQL)	1	
	13	Data Definition Language (DDL), Table definitions and operations	2	
	14	SQL DML (Data Manipulation Language) - SQL queries on single and multiple tables	4	
	15	Nested queries (correlated and non-correlated), Aggregation and grouping, Views, assertions, Triggers, SQL data types.		
	16	Introduction to NoSQL Databases	2	
	17	Main characteristics of Key-value DB (examples from: Redis), Document DB (examples from: MongoDB)	2	
IV	**Transaction Processing,Concurrency Control**		**10**	**15**
	18	Transaction Processing: Introduction, Transaction and System Concepts	3	
	19	Desirable Properties of Transactions	1	
	20	Characterizing Schedules Based on Recoverability & Serializability	2	
	21	Transaction Support in SQL.	1	
	22	Introduction to Concurrency Control: Two-Phase Locking Techniques	3	
V	**DBMS LAB**		**30**	
	1	Students should decide on a case study and formulate the problem statement.	3	
	2	Based on Identified problem Statement, Design ER Diagram (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) Note: Student is required to submit a document by drawing ER Diagram to the Lab teacher.	3	
	3	Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys) Note: Student is required to submit a document showing the database tables created from ER Model.	2	

	4	Normalization -To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form	3	
	5	Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables	3	
	6	Practicing DML commands-Insert, Select, Update, Delete	2	
	7	Experiment 7:Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc.	2	
	8	Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).	2	
	9	Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping.	4	
	10	Install and Configure MongoDB to execute NoSQL Commands.	6	

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	-	-	-	-						
CO 2	3	2	1	-	-	-						
CO 3	1	-	2	3	-	-						
CO 4	-	-	-	3	3	-						
CO 5	-	-	-	3	3	-						
CO 6	-	-	-	-	2	3						

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3		✓	✓	✓
CO 4		✓	✓	✓
CO 5	✓	✓		✓
CO 6		✓	✓	✓

Text books

1. Database System Concepts (Sixth Edition) Avi Silberschatz, Henry F. Korth, S. Sudarshan McGraw-Hill 2011 ISBN 978-0071325226/ 0-07-352332-1
2. Database Management Systems, Third Edition Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill ©2003 ISBN: 978-0072465631/ 0-07-246563-8

Programme	B. Sc. Computer Science				
Course Title	**Fundamentals of Python Programming**				
Type of Course	Major				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. CSC2CJ101 – Fundamentals of Programming				
Course Summary	This course explores the versatility of Python language in programming and teaches the application of various data structures using Python. The course also gives an introduction to scientific computing using popular Python packages.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basic concepts of Python programming language.	U	C	Instructor-created exams / Quiz
CO2	Apply problem-solving skills using the basic constructs in Python programming	Ap	P	Coding Assignments/ Code reading and review
CO3	Apply modular programming using functions in Python	Ap	P	Coding Assignments/ Code reading and review
CO4	Analyse the various data structures and operations on it using Python	An	C	Instructor-created exams / Case studies
CO5	Apply various packages available in Python	Ap	P	Coding Assignments/ Case studies
CO5	Apply visualization tools in Python	Ap	P	Coding Assignments/ Case studies

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs
I	**Fundamentals of Python (15 Marks)**		**12**
	1	Features of Python, Identifiers, Keywords, Variables, Operators, Operands, Expressions and Data types	3
	2	Precedence and Associativity, Indentation, Comments	1
	3	Input, Output and Import functions, Mathematical functions, range function, Type Conversions	1
	4	Decision-making Structures	3
	5	Looping Structures	3
	6	Control Statements	1
II	**Functions & Modules (15 Marks)**		**8**
	7	Function Definition, Function Calling, Flow of Execution, Parameters and Arguments	2
	8	Types of Function Arguments – Required, Keyword, Positional and Variable length arguments	2
	9	Scope and lifetime of variables	1
	10	Types of Functions – Recursive, Anonymous, Functions with more than one return value, Void Functions	2
	11	Built in modules, User defined modules and packages	1
III	**Data Structures in Python (20 Marks)**		**15**
	13	Strings - Indexing, Traversal, Slicing, Joining, and Splitting of Strings, Formatting Strings, Operation and Methods of Strings	5
	14	Lists- Indexing and Traversal, Slicing, Joining, and Splitting of Lists, Operations and Methods of Lists	4
	15	Tuples – Indexing and Traversal, Operations and Methods of Tuples	2
	16	Dictionaries – Accessing and Modifying *key-value* pairs in Dictionary, Operations and Methods	3
	17	Sets - Creation and Operations of Sets	1
IV	**Introduction to Scientific Computing in Python (20 Marks)**		**10**
	18	Introduction to NumPy Arrays – Advantage of NumPy Arrays, Creation of NumPy Arrays	2
	19	Computation on NumPy Arrays - Universal Functions, Broadcasting, Fancy Indexing	3
	20	Introduction to Pandas - Pandas Series and Pandas Data Frames. Series - Construction from arrays, explicit indices, and dictionaries. **Data Frames-** Construction from arrays and dictionaries.	3
	21	Introduction to Matplotlib Basic plotting - Line plots, Scatter plots, Bar plots ,Histograms and Pie charts.	2
V	**Hands-on Data Structures: Practical Applications, Case Study and Course Project**		**30**

	1	**Basics of Python** 1. Demonstrate basic data types in python using interactive Interpreter. 2. Write a Python script that reads two integers and perform all arithmetic operations on these two numbers. 3. Write a program to compute distance between two points. 4. Write a program to calculate the area of a circle. **Control Structures** 5. Write a program to check whether a number is odd or even. 6. Write a program that reads a positive integer, *n*, from the user and then displays the sum of the first n natural numbers.	20
		7. Write a Python program to check whether a given year is a leap year or not. 8. Develop a program that reads a four-digit integer from the user and displays the sum of the digits in the number. For example, if the user enters 2151 then your program should display 2+1+5+1=9. **Function** 9. Write a program to find the largest of three numbers using functions. The program should pass three numbers as arguments and should return the result. 10. Write a function to check whether a given number is prime or not. 11. Write a recursive function to find the factorial of a number. **Python Data Structures: Strings, Sets, Lists , Tuples and Dictionaries** 12. Create a program that checks whether a given string is a palindrome or not. 13. Write a program to check whether an item exists in a tuple. 14. Write a program to create intersection, union, set difference, and symmetric difference of sets. 15. Write a program to create a telephone directory using a dictionary and display its contents. Also check for a specific phone number in the dictionary. **NumPy, Pandas and Matplotlib** 16. Write a program to implement matrix multiplication using NumPy. 17. Create a pandas series from a dictionary of values, and an ndarray. 18. Write a program to draw a line plot for the given heights and weights of a group of people. height=[145,155,165,175,185,195] weight=[43, 56, 60,69, 78,95]	
	2	**Case Study**	3
	3	**Capstone (/Course) Project:** Build a practical application using any one package and demonstrate using visualization tools.	7

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	-	-	-	-	-						
CO 2	2	-	2	-	1	-						
CO 3	2	-	2	1	-	-						
CO 4	1	-	1	-	-	-						
CO 5	-	2	2	2	2	2						
CO 6	-	2	2	-	2	2						

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Reference Books:

1. Jose, Jeeva. Taming Python By Programming. Khanna Book Publishing, 2017. Print.
2. S, Gowrishankar, and A, Veena. Introduction to Python Programming. Chapman & Hall/CRC Press, 2018.
3. Downey, Allen. Think Python. Green Tea Press, 2nd ed. 2009
4. VanderPlas, Jake. Python Data Science Handbook: Essential Tools for Working with Data. United States, O'Reilly Media, 2016.
5. Stephenson, Ben. *The Python Workbook*. SPRINGER INTERNATIONAL PU, 2016.

Programme	B. Sc. Computer Science				
Course Title	**Computer Networks**				
Type of Course	Major				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Knowledge in Computer Organization and Architecture. 2. Knowledge in Operating System.				
Course Summary	This course covers the concepts of data communication and computer networks. It comprises of the study of the standard models for the layered protocol architecture to communicate between autonomous computers in a network and also the main features and issues of communication protocols for different layers. Topics covered comprise of introduction to OSI and TCP/IP models also.				

Sl. NO:	Course Outcome	Cognitive level *	Knowledge category #	Evaluation Tools used
CO1	To understand the fundamentals of computer networks including concepts like data communication ,network topologies and the reference models	U	C	Instructor-Create Exams or Quiz
CO2	Proficiency in Transmission Media and Multiplexing Techniques:	A	P	Discussions and Quizzes
CO3	To familiarise with the common networking protocols and standards	U	F	Instructor created exams or Home assignments
CO4	Describe ,analyse and compare different data link, network and transport layer protocols	A, E	P	Discussions, Quizzes
CO5	Design/implement data link and network layer protocols in simulated networking environment	Ap	P	Viva Voce Observation of practical skills

CO6	To understand the need of various Application layer protocols	U	M	Instructor Created -Exams, Assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge

(M)

Module	Unit	Content	Hrs	Marks
I	**Introduction to Computer networks and Network models**		**12**	**17**
	1	*Types of computer networks, Internet, Intranet, Network topologies, Network classifications.*	2	
	2	*Network Architecture Models: Layered architecture approach, OSI Reference Model, TCP/IP*	2	
	3	*Physical Layer: Analog signal, digital signal, Analog to Digital, Digital to Analog, maximum data rate of a channel transmission*	4	
	4	*Transmission media (guided - unguided transmission media)*	2	
	5	*multiplexing (frequency division multiplexing, time division multiplexing, wavelength division multiplexing)*	2	
II	**Data Link Layer**		**11**	**18**
	6	*Data link layer services, error-detection* Types of errors, Single bit error and Burst error, Vertical redundancy check (VRC), longitudinal redundancy Check (LRC), Cyclic Redundancy Check (CRC),Check sum Error correction - Single bit error correction, Hamming code	2	
	7	*Error correction techniques, error recovery protocols (stop and wait, go back n, selective repeat),*	3	
	8	*multiple access protocols, (TDMA/FDP, CDMA/FDD/CSMA/CD, CSMA/CA),*	2	
	9	*Datalink and MAC addressing, Ethernet, Polling*	1	
	10	IEEE Standards- Wireless LANS,Ethernet,Bluetooth	3	
III	**Network layer**		**11**	**18**
	11	*Networking and Internetworking devices - Repeaters, Bridges, Routers, Gateways, Firewall*	2	
	12	*Logical addressing - IPv4 & IPv6 addresses, Network Address Translation (NAT), Internet protocols, internetworking, Datagram,*	2	

	13	*Transition from IPv4 to IPv6*	1	
	14	*Address Mapping-Error reporting and multicasting - Delivery,*	2	
	15	*Forwarding and Routing algorithms, Distance Vector Routing,*	2	
	16	*Link State Routing. Dijkstra*	2	
IV	**Transport Layer and Application layer**		**11**	**17**
	17	*Transport layer, Process-to-process Delivery: UDP, TCP*	2	
	18	*Congestion control and Quality of Service,*	2	
	19	*Domain Name Systems-Remote Login, Email*	2	
	20	*FTP, WWW, HTTP*	2	
	21	*Introductory concepts on Network management & Mail transfer: SNMP,*	2	
	22	*SMTP*	1	
V	**Hands-on Computer Networks:** **Practical Applications,**		**30**	
	1	Lab 1: identifying Networking Hardware components(Jacks, Cables, Tools) Lab 2 IP address - configuring. Lab3. crimping Lab 4: Configuring network host - setting hostname - assigning IP address Lab 5: configuring the Network Interface card – Lab 6: Setup a Wired LAN with more than two systems Lab 7:Setup a Wireless LAN with more than two systems Lab 8: Setting up Internet services File Transfer Protocol(FTP), Lab 9: Simple Mail Transfer Protocol(SMTP) and Post Office Protocol(POP) Lab 10: Setting up Intranet Services - Network File System(NFS),	20	
	2	Case study	3	

	3	**Capstone (/Course) Project:** Build a practical application using Wired Network	7	

References:

1. *Behurouz A Forozan, Introduction to Data Communications & Networking, TMH*
2. *Andrew S. Tanenbaum, Computer Networks, PHI*
3. *William Stallings, Data and Computer Communications, VIIth Edition, Pearson Education*