JSS MAHAVIDYAPEETHA
JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(Autonomous)
Ooty Road, Mysuru-570025

Model Curriculum Structures for Bachelor of Science (Basic and Honours) Programme with Computer Science as Major & Minor Course Model Syllabus for I and VI Semesters and Open Elective Courses in Computer Science

As per

NATIONAL EDUCATION POLICY - 2020 (NEP-2020)

2021-22, 2022-23& 2023-24 on words (Revised)

DEPARTMENT OF COMPUTER SCIENCE

The objectives of the B.Sc. - Computer Science Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise software.
2. It helps students analyze the requirements for system programming and exposes students to information systems
3. This programme provides students with options to specialize in various software systems.
4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide the opportunity for the study of modern methods of information processing and its applications.
6. To develop among students programming techniques and problem-solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications.

Program Outcomes:

1. **Discipline knowledge:** Acquiring knowledge ofthe basics of Computer Science and the ability to apply design principles in the development of solutions for problems of varying complexity.
2. **Problem solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge of data structures and algorithms.
3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems.
4. **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. **Application Systems Knowledge**: Possessing a minimum knowledge to practice existing computer application software.
6. **Communication:** Must have a reasonably good communication knowledge both in oral and writing.
7. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.
9. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

Additional Program Outcomes for B. Sc. (Hons) in Computer Science

The four years Bachelors in Computer Science (Hons) program enables students to attain the following additional attributes besides the afore-mentioned attributes:

1. Apply standard Software Engineering practices and strategies in real-time software project development
2. Design and develop computer programs/computer-based systems in the areas related to AI, algorithms, networking, web design, cloud computing, IoT and data analytics.
3. Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems
4. The ability to apply the knowledge and understanding noted above to the analysis of a given information handling problem.
5. The ability to work independently on a substantial software project and as an effective team member.

IIIA. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka

Bachelor of Science (Basic/Hons.) in subjects with practical with both subjects as majors

Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective (DSE) / Open Elective (OE)(Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC),		Skill Enhancement Courses (SEC)			Total Credits
					Skill based credits (L+T+P)	Value based (Credits) (L+T+P)		
I	Discipline A1(4+2) Discipline B1(4+2)	OE-1 (3)	L1-1(3),L2-1(3) (4 hrs. each)	Environmental Studies (3)		Physical Education for fitness (1) (0+0+2)	Health & Wellness (1) (0+0+2)	25
II	Discipline A2(4+2) Discipline B2(4+2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs. each)		SEC-1: Digital Fluency (2) (1+0+2)	Physical Education - Yoga (1) (0+0+2)	NCC/NSS/R&R(S&G) /Cultural (1) (0+0+2)	25
Exit option with Certificate (50 credits)								
III	Discipline A3(4+2) Discipline B3(4+2)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs. each)	Constitution of India (3)		Physical Education-Sports (1) (0+0+2)	NCC/NSS/R&R(S&G) /Cultural (1) (0+0+2)	25
IV	Discipline A4(4+2) Discipline B4(4+2)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs. each)		SEC-2:Artificial Intelligence (2) (1+0+2)	Physical Education - Games (1) (0+0+2)	NCC/NSS/R&R(S&G) /Cultural (1) (0+0+2)	25
Exit option with Diploma (100 credits) or continue the third year with both the subjects as majors								
V	Discipline A5(3+2), Discipline A6(3+2) Discipline B5(3+2), Discipline B6(3+2)				SEC-3: SEC such as Cyber Security (2) (1+0+2)			23
VI	Discipline A7(3+2), Discipline A8(3+2 Discipline B7(3+2) Discipline B8(3+2) Internship (2)				SEC-4: Professional Communication (2) Employability Skills			24
Exit option with Bachelor of Arts, B.A./ Bachelor of Science, B. Sc. Basic Degree (146 credits) or choose one of the Disciplines as Major								
VII	Discipline A/B-9(3+2) Discipline A/B-10(3+2) Discipline A/B-11(3)		DS-A/B Elective-1(3) DS-A/B Elective-2(3) Res. Methodology (3)					22
VIII	Discipline A/B-12(3+2) Discipline A/B-13(3) Discipline A/B-14(3)		DS-A/B Elective-3(3) Research Project (6) *					20

NEP-2020 Model Syllabus – B.Sc. (Cs M) and B.Sc. (P Cs) 2021-22 onwards

Year	Sem	Combination	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
											Th. IA		Pr. IA		Exam			
					L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
I	I	**Cs M**	**FSA45034** [DSC-1]	Computer Fundamentals and Programming in C	**4**	**0**	**0**	**4**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
		P Cs	**FSA45035** [DSC-1]	Computer Fundamentals and Programming in C	**4**	**0**	**0**	**4**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
		Cs M	**FSA45134** [DSC-1L]	C Programming Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**
		P Cs	**FSA45135** [DSC-1L]	C Programming Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**
		IBA EG	FHA21031	SEC - DIGITAL FLUENCY	**1**	**0**	**1**	**1**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**1 Hour**	**50**
		IBA HP	FHA21032															
		IBA KG	FHA21033															
		IBA HE	FHA21034															
		IBA JP	FHA21035															
			FSA880	**Open Elective (OE) - Office Automation**	**3**	**0**	**0**	**3**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
			FSA890	**Open Elective (OE) - C Programming Concepts**	**3**	**0**	**0**	**3**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
	II	**Cs M**	**FSB45034** [DSC-2]	Data Structures using C	**4**	**0**	**0**	**4**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
		P Cs	**FSB45035** [DSC-2]	Data Structures using C	**4**	**0**	**0**	**4**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
		Cs M	**FSB45134** [DSC-2 L]	Data structures Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**
		P Cs	**FSB45135** [DSC-2 L]	Data structures Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**

Year	Sem	Combination	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
											Th. IA		Pr. IA		Exam			
					L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
I	II	I BCA	FAB210	SEC - DIGITAL FLUENCY	1	0	2	1	0	1	-	-	10	15*	25	-	3 Hours	50
		I B.Sc. PC	FSB21031															
		I B.Sc. PM	FSB21032															
		I B.Sc. PE	FSB21033															
		I B.Sc. CsM	FSB21034															
		I B.Sc. PCs	FSB21035															
		I B.Sc. BtZ	FSB21036															
		I B.Sc. CBt	FSB21037															
		I B.Sc. CZ	FSB21038															
		I B.Sc. BZ	FSB21039															
		I B.Sc. BtBc	FSB21040															
		I B.Sc. MbBt	FSB21041															
		I B.Sc. MbBc	FSB21042															
			FSB880	OE – E Commerce	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
			FSB890	OE-Web Designing	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		Exit option with Certificate (50 credits)																
II	III	Cs M	FSC45034 [DSC – 3]	Object Oriented Programming in JAVA	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		P Cs	FSC45035 [DSC – 3]	Object Oriented Programming in JAVA	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		Cs M	FSC45134 [DSC – 3L]	JAVA Programming Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		P Cs	FSC45135 [DSC – 3L]	JAVA Programming Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		IBA EG	FHC21031	SEC - Artificial Intelligence	1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA HP	FHC21032		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA KG	FHC21033		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA HE	FHC21034		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA JP	FHC21035		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
			FSC880	OE -Python Programming Concepts	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
			FSC890	OE– Fundamentals of Multimedia	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100

Year	Sem	Combination	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
											Th. IA		Pr. IA		Exam			
					L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
II	IV	Cs M	FSD45034 [DSC-4]	Database Management Systems	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		P Cs	FSD45035 [DSC-4]	Database Management Systems	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		Cs M	FSD45134 [DSC-4L]	DBMS Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		P Cs	FSD45135 [DSC-4L]	DBMS Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		I B.Sc. PC	FSD21031	SEC - Artificial Intelligence	1	0	2	1	0	1	-	-	10	15*	25	-	3 Hours	50
		I B.Sc. PM	FSD21032															
		I B.Sc. PE	FSD21033															
		I B.Sc. CsM	FSD21034															
		I B.Sc. PCs	FSD21035															
		I B.Sc. BtZ	FSD21036															
		I B.Sc. CBt	FSD21037															
		I B.Sc. CZ	FSD21038															
		I B.Sc. BZ	FSD21039															
		I B.Sc. BtBc	FSD21040															
		I B.Sc. MbBt	FSD21041															
		I B.Sc. MbBc	FSD21042															
			FSD880	OE – Cloud Computing	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
			FSD890	OE- Fundamentals of Mobile Application	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		Exit option with Diploma (100 credits) or continue the third year with both the subjects as majors																

Note: 15* is spilt 10 marks for Practical's of C2 + 5 marks for practical Record/Report

Open Electives in Computer Science: (For BA, BSc, BCom, BSW, BBA, BBM students studying Core Courses other than Computer Science/ Computer Applications)		
• Office Automation • Fundamentals of Multimedia • Computer Animation • Accounting Package	• C Programming Concepts • Python Programming Concepts • R Programming • Multimedia Processing • Fundamentals of Mobile Application	• E-Content Development • E-Commerce • Web Designing • Cloud Computing

Year	Sem	Combination	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
											Th. IA		Pr. IA		Exam			
					L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
III	V	Cs M	**FSE45034** [DSC-5]	Programming in Python	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		P Cs	**FSE45035** [DSC-5]	Programming in Python	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		Cs M	**FSE45134** [DSC-5L]	Python Programming Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		P Cs	**FSAE45135** [DSC-5L]	Python Programming Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		Cs M	**FSE45234** [DSC-1]	Computer Networks	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		P Cs	**FSE45235** [DSC-1]	Computer Networks	4	0	0	4	0	0	20	20	-	-	60	-	2½ Hours	100
		Cs M	**FSE45334** [DSC-1L]	Computer Networks Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		P Cs	**FSAE45335** [DSC-1L]	Computer Networks Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
				SEC – 4 Employability Skills	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100

Year	Sem	Combination	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
											Th. IA		Pr. IA		Exam			
					L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
III	VI	**Cs M**	**FSF45034** [DSC-2]	Web Technologies	**4**	**0**	**0**	**4**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
		P Cs	**FSF45035** [DSC-2]	Web Technologies	**4**	**0**	**0**	**4**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
		Cs M	**FSF45134** [DSC-2 L]	Web Technologies Lab – Java Script	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**
		P Cs	**FSF45135** [DSC-2 L]	Web Technologies Lab – Java Script	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**
		Cs M	**FSF45234** [DSC-2]	Statistical Computing & R Programming	**4**	**0**	**0**	**4**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
		P Cs	**FSF45235** [DSC-2]	Statistical Computing & R Programming	**4**	**0**	**0**	**4**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**
		Cs M	**FSF45334** [DSC-2 L]	R Programming Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**
		P Cs	**FSF45335** [DSC-2 L]	R Programming Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**10**	**15***	**-**	**25**	**3 Hours**	**50**
				SEC - 5 Cyber Security	**3**	**0**	**0**	**3**	**0**	**0**	**20**	**20**	**-**	**-**	**60**	**-**	**2½ Hours**	**100**

NEP-2020 Model Syllabus for BSc (Basic and Honors), Semesters I and II

Semester: I

Course Code: **DSC-1 [FSA450]**	Course Title: **Computer Fundamentals and Programming in C**
Course Credits: **04**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **52Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks
- Understand working of Hardware and Software and the importance of operating systems
- Understand programming languages, number systems, peripheral devices, Networking, Multimedia and internet concepts
- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C
- Write programs that perform operations on arrays

Course Content	Hours
Unit - 1	
Fundamentals of Computers: Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples. **Introduction to C Programming:** Over View of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C.	13
Unit - 2	
C Programming Basic Concepts: C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants. **Input and output with C:** Formatted I/O functions - *printf*and *scanf,* control stings and escape sequences, output specifications with *printf*functions; Unformatted I/O functions to read and display single character and a string - *getchar, putchar, gets* and *puts* functions. **C Operators & Expressions:** Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associatively; Evaluation of arithmetic expressions; Type conversion.	13
Unit - 3	
Control Structures: Decision making Statements - S*imple if, if_else*, *nested if_else, else_if ladder, Switch-case*, *goto, break &continue* statements; Looping Statements - Entry controlled and Exit controlled statements, *while, do-while, for* loops, Nested loops. Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation. Strings: Declaring & Initializing string variables; String handling functions - *strlen, strcmp, strcpy and strcat;* Character handling functions - *toascii, toupper, tolower, isalpha, isnumeric*etc.	13

Unit - 4	
Pointers in C: Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays; Pointer Arithmetic; Advantages and disadvantages of using pointers; **User Defined Functions:** Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type. **User defined data types:** Structures - Structure Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, comparing structure variables, Array of Structures; Unions - Union definition; difference between Structures and Unions.	13

Text Books

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. E. Balaguruswamy: Programming in ANSI C (TMH)

References

1. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
2. V. Rajaraman: Programming in C (PHI – EEE)
3. S. ByronGottfried: Programming with C (TMH)
4. Kernighan & Ritche: The C Programming Language (PHI)
5. Yashwant Kanitkar: Let us C
6. P.B. Kottur: Programming in C (Sapna Book House)

Course Code: **DSC-1L [FSA450]**	Course Title: **C Programming Lab**
Course Credits: **02**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **25**	Total Contact Hours: **52Hours**
Exam Marks: **25**	Exam Duration: **03Hours**

Practice Lab

The following activities be carried out/ discussed in the lab during the initial period of the semester.

1. Basic Computer Proficiency
   a. Familiarization of Computer Hardware Parts
   b. Basic Computer Operations and Maintenance.
   c. Do's and Don'ts, Safety Guidelines in Computer Lab
2. Familiarization of Basic Software – Operating System, Word Processors, Internet Browsers, Integrated Development Environment (IDE) with Examples.
3. Type Program Code, Debug and Compile basic programs covering C Programming fundamentals discussed during theory classes.

Programming Lab

Part A:

1. Write a C Program to read radius of a circle and to find area and circumference
2. Write a C Program to read three numbers and find the biggest of three
3. Write a C Program to demonstrate library functions in *math.h*
4. Write a C Program to check for prime
5. Write a C Program to generate n primes
6. Write a C Program to read a number, find the sum of the digits, reverse the number and check it for palindrome
7. Write a C Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers
8. Write a C Program to read percentage of marks and to display appropriate message

(Demonstration of else-if ladder)

9. Write a C Program to find the roots of quadratic equation (demonstration of switch-case statement)
10. Write a C program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
11. Write a C Program to remove Duplicate Element in a single dimensional Array
12. Program to perform addition and subtraction of Matrices

Part B:

1. Write a C Program to find the length of a string without using built in function
2. Write a C Program to demonstrate string functions.
3. Write a C Program to demonstrate pointers in C
4. Write a C Program to check a number for prime by defining *isprime( )* function
5. Write a C Program to read, display and to find the trace of a square matrix
6. Write a C Program to read, display and add two m x n matrices using functions
7. Write a C Program to read, display and multiply two m x n matrices using functions
8. Write a C Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
9. Write a C Program to Reverse a String using Pointer
10. Write a C Program to Swap Two Numbers using Pointers
11. Write a C Program to demonstrate student structure to read & display records of n students.
12. Write a C Program to demonstrate the difference between structure & union.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course **Evaluation Scheme for Lab Examination**

Assessment Criteria		**Marks**
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on C Programming		05
Total		**25**

Semester: II

Course Code: **DSC-2 [FSB450]**	Course Title: **Data Structures using C**
Course Credits: **04**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **52 Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms a
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees
- Compare alternative implementations of data structures with respect to performance
- Describe the concept of recursion; give examples of its use
- Discuss the computational efficiency of the principal algorithms for sorting and searching

Course Content	Hours
Unit - 1	
Introduction to data structures: Definition; Types of data structures - Primitive & Nonprimitive, Linear and Non-linear; Operations on data structures. Algorithm Specification, Performance Analysis, Performance Measurement Recursion: Definition; Types of recursions; Recursion Technique Examples - Fibonacci numbers, GCD, Binomial coefficient ${}_nC_r$, Towers of Hanoi; Comparison between iterative and recursive functions.	13
Unit - 2	
Arrays: Basic Concepts – Definition, Declaration, Initialisation, Operations on arrays; Types of arrays; Arrays as abstract data types (ADT); Representation of Linear Arrays in memory; Traversing linear arrays; Inserting and deleting elements; Sorting – Selection sort, Bubble sort, Quick sort, Selection sort, Insertion sort; Searching - Sequential Search, Binary search; Iterative and Recursive searching; Multidimensional arrays; Representation of multidimensional arrays; Sparse matrices. Dynamic memory allocation: Static & Dynamic memory allocation; Memory allocation and de-allocation functions - *malloc*, *calloc*, *realloc* and *free.*	13
Unit - 3	
Linked list: Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, Doubly liked list, Header liked list, Circular linked list; Representation of Linked list in Memory; Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation; Garbage collection. Stacks: Basic Concepts – Definition and Representation of stacks; Operations on stacks; Applications of stacks; Infix, postfix and prefix notations; Conversion from infix to postfix using stack; Evaluation of postfix expression using stack; Application of stack in function calls.	13
Unit - 4	
Queues: Basic Concepts – Definition and Representation of queues; Types of queues - Simple queues, Circular queues, Double ended queues, Priority queues; Operations on Simple queues; Trees: Definition; Tree terminologies –node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth; Binary tree: Type of binary trees - strict binary tree, complete binary tree, binary search tree and heap tree; Array representation of binary tree. Traversal of binary tree; *preorder, inorder* and *postorder* traversal; Reconstruction of a binary tree when any two of the traversals are given.	13

Text Books

1. Satraj Sahani: Fundamentals of Data Structures

References

1. Tanenbaum: Data structures using C (Pearson Education)
2. Kamathane: Introduction to Data structures (Pearson Education)
3. Y. Kanitkar: Data Structures Using C (BPB)
4. Kottur: Data Structure Using C
5. Padma Reddy: Data Structure Using C
6. Sudipa Mukherjee: Data Structures using C – 1000 Problems and Solutions (McGraw Hill Education, 2007))

Course Code: **DSC-2Lab [FSB 450]**	Course Title: **Data Structures Lab**
Course Credits: **02**	Hour of Teaching/Week: **04 Hours**
Formative Assessment Marks: **25**	Total Contact Hours: **52Hours**
Exam Marks: **25**	Exam Duration: **03Hours**

Programming Lab

Part A:

1. Write a C Program to find GCD using recursive function
2. Write a C Program to display Pascal Triangle using binomial function 3. Write a C Program to generate n Fibonacci numbers using recursive function.
4. Write a C Program to implement Towers of Hanoi.
5. Write a C Program to implement dynamic array, find smallest and largest element of the array.
6. Write a C Program to create two files to store even and odd numbers.
7. Write a C Program to create a file to store student records.
8. Write a C Program to read the names of cities and arrange them alphabetically.
9. Write a C Program to sort the given list using selection sort technique.
10. Write a C Program to sort the given list using bubble sort technique.

Part B:

1. Write a C Program to sort the given list using insertion sort technique.
2. Write a C Program to sort the given list using quick sort technique.
3. Write a C Program to sort the given list using merge sort technique.
4. Write a C Program to search an element using linear search technique.
5. Write a C Program to search an element using recursive binary search technique.
6. Write a C Program to implement Stack.
7. Write a C Program to convert an infix expression to postfix.
8. Write a C Program to implement simple queue.
9. Write a C Program to implement linear linked list.
10. Write a C Program to display traversal of a tree.

Evaluation Scheme for Lab Examination

Assessment Criteria		**Marks**
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on C Programming		05
Total		**25**

Skill Enhancement Courses (SEC)
for B.A.,B.Com., BBA , B.Sc. & BCA
Semester: I / II

Course Code: [FHA210 / FSB210 / [FAB210]

Course Title:SEC**Digital Fluency** **Course Credits: 2**

Total Contact Hours: 15 hours of theory and 30 hours of practical's Duration of ESA:

Formative Assessment Marks: 5**0 marks**

Summative Assessment Marks: 50 marks

Model Syllabus Authors:

Course Outcomes (COs):

At the end of the course the student should be able to:

(Write 3-7 course outcomes. Course outcomes are statements of observable student actions that serve as evidence of knowledge, skills and values acquired in this course)

1. Have an intelligent conversation on the key concepts and applications of Artificial Intelligence (AI), Big Data Analytics (BDA), Internet of Things (IoT), Cloud Computing, and Cybersecurity
2. Develop holistically by learning essential skills such as effective communication, Problemsolving, design thinking, and teamwork
3. Build his/her personal brand as an agile and expansive learner – one who is interested in Horizontal and vertical growth?

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

This mapping needs to be done considering POs of respective programs.

Course Outcomes (COs) / Program Outcomes (POs) 1 2 3 4 5 6 7 8 9 10 11 12

1. Have an intelligent conversation on the key concepts and applications of AI, BDA, IoT, Cloud Computing, and Cyber security
2. Develop holistically by learning essential skills such as effective communication, problemsolving, design thinking, and teamwork
3. Build his/her personal brand as an agile and expansive learner – one who is interested in horizontal and vertical growth

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Course Content (Digital 101)

Details of topic		**Duration**
Module 1:	**Emerging Technologies**	05 hours

Overview of Emerging Technologies:

i. Artificial Intelligence, Machine Learning, Deep Learning,
ii. Database Management for Data Science, Big Data Analytics,
iii. Internet of Things (IoT) and Industrial Internet of Things (IIoT)
iv. Cloud computing and its service models &
v. Cyber Security and Types of cyber attack

Module 2: Applications of Emerging Technologies 05 hours

Applications of emerging technologies:

i. Artificial Intelligence
ii. BigData Analytics

iii. Internet of Things
iv. Cloud Computing v. Cyber Security

Module 3: Building Essential Skills beyond Technology 05 hours

Importance of the following:

i. Effective Communication Skills

ii. Creative Problem Solving & Critical Thinking iii. Collaboration and Teamwork Skills iv. Innovation & Design Thinking v. Use of tools in enhancing skills

References to learning resources:

1. The learning resources made available fo the course titled "Digital 101" on Future Skills Prime Platform of NASSCOM

Open Elective Courses offered by the Department of Computer Science I Semesters

Course Code: **Open Elective OE-1 [FSA880]**	Course Title: **Office Automation**
Course Credits: **03**	Hour of Teaching / Week: **03Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42 Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

- Be familiar various office automation tools.
- Create and format a document**.**
- Create and analyse data using Excel.
- Create and customize a presentation for a specific topic.

Course Content	Hours
Unit – 1	
Introduction, Block diagram of a computer, Input and output devices, memory and storage devices, Types of software, Introduction to operating system – functions, types of operating system and examples. Introduction to word processing – creating and saving a document, formatting a document – Line spacing, paragraph, Fonts, inserting symbols, header and footer, shape, Tables, Find and replace, Mail merge, saving a document in different formats	14
Unit – 2	
Introduction to spread sheet – entering different types of data like text, numbers, date, functions and formulae- different categories of functions, chart-creating and formatting a chart, filter, working with single and multiple work books, cell referencing, printing and previewing a document.	14
Unit – 3	
Introduction to presentation tools-creating and viewing a presentation, applying design template, formatting options, inserting different objects in a presentation, customize a presentation, adding audio to a presentation, Slide animation, preview Slide transitions Slide show options, adding effect to presentation.	14

Reference books

1. Computer Basics with Office Automation- Archana Kumar, Dreamtech press, First Edition.
2. The Handbook of Office Automation- Ralph Tomas Reilly, Iuniverse publication, First Edition.

Course Code: **Open Elective OE-2 [FSA890]**	Course Title: **C Programming Concepts**
Course Credits: **03**	Hour of Teaching / Week: **03Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42 Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs): After completing this course satisfactorily, a student will be able to Confidently operate Desktop Computers to carry out computational tasks.

- Understand working of Hardware and Software and the importance of operating systems.
- Understand programming languages, number systems, peripheral devices, networking,
- multimedia and internet concepts.
- Read, understand and trace the execution of programs written in C language.
- Write the C code for a given problem.
- Perform input and output operations using programs in C.
- Write programs that perform operations on arrays.

Course Content	Hours
Unit – 1	
Fundamentals of Computers: Introduction to Computers -Hardware, software System software, Application software, Utility software, Operating System; Computer Languages – Machine Level, Assembly Level & High-Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program – Algorithm and Flowchart with Examples. Introduction to C Programming: Over View of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C. C Programming Basic Concepts: C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants.	14
Unit – 2	
Input and output with C: Formatted I/O functions - printf and scanf, control stings and escape sequences, output specifications with printf functions; Unformatted I/O functions to read and display single character and a string - getchar, putchar, gets and puts functions, C Operators & Expressions: Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associatively; Evaluation of arithmetic expressions; Type conversion. Control Structures: Decision making Statements - Simple if, if_else, nested if_else, else_if ladder, Switch-case, goto, break & continue statements; Looping Statements - Entry controlled and Exit controlled statements, while, do-while, for loops, Nested loops.	14
Unit – 3	
User Defined Functions: Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type. Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation. Strings: Declaring & Initializing string variables; String handling functions - strlen, strcmp, strcpy and strcat; Character handling functions - toascii, toupper, tolower, isalpha, isnumeric etc. Basics of Pointers in C: Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointer Arithmetic; Advantages and disadvantages of using pointers;	14

Text Books:

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. E. Balgurusamy: Programming in ANSI C (TMH)

References:

1. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
2. V. Rajaraman: Programming in C (PHI –EEE)
3. S. ByronGottfried: Programming with C (TMH)
4. Kernighan & Ritche: The C Programming Language (PHI)
5. Yashwant Kanitkar: Let us C 6. P.B. Kottur: Programming in C (Sapna Book House)

II Semesters

Course Code: **Open Elective OE-3 [FSB880]**	Course Title: **e-Commerce**
Course Credits: **03**	Hour of Teaching / Week: **03Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42 Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

- Be familiar with different e-commerce theories and terminology.
- Assess the impact of internet and internet technology in a business electronic commerce and electronic business.
- Learn strategies for e-commerce and electronic payment system.

Course Content	Hours
Unit – 1	
Introduction to e-commerce, the difference between e-commerce and e-business, Technological building blocks underlying e-commerce: the Internet, Web, and Mobile Platform, Major Trends in e-commerce, Unique Features of e-commerce Technology. Modes of electronic commerce: Overview, Electronic data interchange (EDI), ecommerce with WWW/Internet. Payments and Security: Electronic cash and electronic payment Schemes: Internet monetary payment and Security requirements, payment and purchase order process, Online electronic cash.	14
Unit – 2	
Types of e-commerce: Business-to-Consumer (B2C), Business-to-Business (B2B) , Consumer-to-Consumer (C2C), Mobile e-commerce (M-commerce), Social ecommerce, Local e-commerce. Consumer-oriented e-commerce: Introduction, Traditional retailing and e-retailing, benefits of e-retailing, Key success factors, Models of e-retailing, features of eretailing, developing a consumer-oriented e-commerce system, The PASS model.	14
Unit – 3	
e-Commerce Infrastructure: The Internet, Technology Background, Internet — Key Technology concepts, **TCP/IP, IP** addresses, Domain names, DNS and URLs, Client Server Computing, Cloud computing model, Mobile platform. Internet and Web: Hypertext, HTML, XML, Web servers and clients, Web browsers, Communication tools — E mail, messaging apps.	14

Text Books:

1. Laudon, Kenneth C., and Carol Guercio Traver. *E-Commerce 2020-2021.* Pearson, 2020.
2. Laudon, Kenneth C., and Carol Guercio Traver. *E-commerce Essentials.* Pearson, 2014.

References:

1. Ravi Kalakota, Andrew B. Frontiers of Electronic Commerce, Addison Wesley 1996.

Course Code: **Open Elective OE-4 [FSB890]**	Course Title: **Web Designing**
Course Credits: **03**	Hour of Teaching / Week: **03Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42 Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

- Be familiar with different web design theories and terminology.
- Analyze a web page and identify its elements and attributes.
- Create web pages using XHTML and Cascading Style Sheets.
- Build dynamic web pages using JavaScript (Client-side programming)

Course Content	Hours
Unit – 1	
Fundamentals: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, the Web Programmers Toolbox. Introduction to XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links, Lists, Tables, Forms, Frames Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, <Span> and <Div> tags	14
Unit – 2	
The Basics of JavaScript: Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples. The JavaScript execution environment, The Document Object Model, Element access in JavaScript, Events and event handling, handling events from the Body elements	14
Unit – 3	
Button elements, Text box and Password elements, The DOM 2 event model, the navigator object, DOM tree traversal and modification. Dynamic documents with JavaScript: Introduction, positioning elements, moving elements, Element visibility, changing colors and fonts, Dynamic content, Stacking elements, locating the mouse cursor, Reacting to a mouse click, slow movement of elements, Dragging and dropping elements.	14

Text Books:

1.Robert W. Sebesta: Programming the World Wide Web,4th Edition, Pearson Education, 2008.

References:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
2. Chris Bates: Web Programming Building Internet Applications,3rd Edition, Wiley India, 2007.
3. Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

NEP-2020 Model Syllabus for BSc (Basic and Honors), Semesters III and IV

Semester: III

Course Code: **DSC-3 [FSC 450]**	Course Title: **Object Oriented Programming in Java**
Course Credits: **04**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **52Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

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

- Explain the object-oriented concepts and JAVA.
- Write JAVA programs using OOP concepts like Abstraction, Encapsulation, Inheritance and Polymorphism.
- Implement Classes and multithreading using JAVA.
- Demonstrate the basic principles of creating Java applications with GUI.

Course Content	Hours
Unit – 1	
Introduction to Java: Basic OOPs concepts,Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java. **Objects and Classes:** Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers.	13
Unit – 2	
Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference. **Inheritance and Polymorphism:** Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.	13
Unit – 3	
Event and GUI programming: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Exception handling mechanism.	13
Unit – 4	
I/O programming: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try catch-finally, Collections in java, Network Programming	13

References:

Object Oriented Programming with Java: Somashekara M.T., Guru, D.S., Manjunatha K.S, 1st Edition, PHI Learning 2017.

Programming with Java, By E Balagurusamy – A Primer, 4th Edition, McGraw Hill Publication.

Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall.

Java 2 - The Complete Reference, Herbert Schildt, 5th Edition, McGraw Hill Publication, 2017. Java - The Complete Reference, Herbert Schildt, 7th Edition, McGraw Hill Publication, 2017.

Course Code: **DSC-3L [FSC 450]**	Course Title:**Java Programming Lab**
Course Credits: **02**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **25**	Total Contact Hours: **52Hours**
Exam Marks: **25**	Exam Duration: **03Hours**

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Implement Object Oriented programming concept using basic syntaxes of control Structures
- Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem
- Demonstrates how to achieve reusability using inheritance
- Demonstrate understanding and use of interfaces, packages, different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.
- Identify and describe common user interface components to design GUI in Java using Applet & AWT along with response to events

Java Programming Lab

PART A: Fundamentals of OOPs in Java

1. Program to assign two integer values to X and Y. Using the „if‟ statement the output of the program should display a message whether X is greater than Y.
2. Program to list the factorial of the numbers 1 to 10. To calculate the factorial value, use while loop. (Hint Fact of 4 = 4*3*2*1)
3. Program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.
4. Program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
5. Program with class variable that is available for all instances of a class. Use static variable declaration. Observe the changes that occur in the object's member variable values.
6. Program
    a. To find the area and circumference of the circle by accepting the radius from the user.
    b. To accept a number and find whether the number is Prime or not
7. Program to create a student class with following attributes; Enrollment No: Name, Mark of sub1, 3 Mark of sub2, mark of sub3, Total Marks. Total of the three marks must be calculated only when the student passes in all three subjects. The pass mark for each subject is 50. If a candidate fails in any one of the subjects his total mark must be declared as zero. Using this condition write a constructor for this class. Write separate functions for accepting and displaying student details. In the main method create an array of three student objects and display the details.
8. In a college first year class are having the following attributes Name of the class (BCA, BCom, BSc), Name of the staff No of the students in the class, Array of students in the class
9. Define a class called first year with above attributes and define a suitable constructor. Also write a method called best Student () which process a first-year object and return the student with the highest total mark. In the main method define a first-year object and find the best student of this class
10. Program to define a class called employee with the name and date of appointment. Create ten employee objects as an array and sort them as per their date of appointment. ie, print them as per their seniority.

PART B: Exception Handling & GUI Programming

1. Program to catch Negative Array Size Exception. This exception is caused when the array is initialized to negative values.
2. Program to handle Null Pointer Exception and use the “finally” method to display a message to the user.
3. Program which creates and displays a message on the window
4. Program to draw several shapes in the created window
5. Program to create an applet and draw grid lines
6. Program which creates a frame with two buttons father and mother. When we click the father button the name of the father, his age and designation must appear. When we click mother similar details of mother also appear.
7. Create a frame which displays your personal details with respect to a button click
8. Create a simple applet which reveals the personal information of yours.
9. Program to move different shapes according to the arrow key pressed.
10. Demonstrate the various mouse handling events using suitable example.

Note: Student has to execute a minimum of 8 programs in each part to complete the Lab course.

Evaluation Scheme for Lab Examination:

Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

Semester: IV

Course Code: **DSC-4 [FSD 450]**	Course Title:**Database Management System**
Course Credits: **04**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **52Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

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

- Explain the various database concepts and the need for database systems.
- Identify and define database objects, enforce integrity constraints on a database using DBMS.
- Demonstrate a Data model and Schemas in RDBMS.
- Identify entities and relationships and draw ER diagram for a given real-world problem.
- Convert an ER diagram to a database schema and deduce it to the desired normal form.
- Formulate queries in Relational Algebra, Structured Query Language (SQL) for database manipulation.
- Explain the transaction processing and concurrency control techniques.

Course Content	Hours
Unit – 1	
Database Architecture: Introduction to Database system applications. Characteristics and Purpose of database approach. People associated with Database system. Data models. Database schema. Database architecture. Data independence. Database languages, interfaces, and classification of DBMS. **E-R Model:** Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes, key attribute, and domain of an attribute.	13
Unit – 2	
Relationships between the entities. Relationship types, roles and structural constraints, degree and cardinality ratio of a relationship. Weak entity types, E-R diagram. **Relational Data Model:** Relational model concepts. Characteristics of relations. Relational model constraints: Domain constrains, key constraints, primary & foreign key constraints, integrity constraints and null values. Relational Algebra: Basic Relational Algebra operations. Set theoretical operations on relations. JOIN operations Aggregate Functions and Grouping. Nested Sub Queries-Views.	13
Unit – 3	
Data Normalization: Anomalies in relational database design. Decomposition. Functional dependencies - Axioms, Minima and Maxima covers. Normalization. First normal form, Second normal form, Third normal form. Boyce-Codd normal form.	13
Unit – 4	
Query Processing Transaction Management: Introduction Transaction Processing. Single user & multiuser systems. Transactions: read & write operations. Need of concurrency control: The lost update problem, Dirty read problem. Types of failures. Transaction states. Desirable properties (ACID properties) of Transactions.	13

References:

1. Fundamentals of Database Systems, Ramez Elamassri, Shankant B. Navathe, 7th Edition, Pearson, 2015
2. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
3. Introduction to Database System, C J Date, Pearson, 1999.
4. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S.Sudarshan, 6th Edition, McGraw Hill, 2010.
5. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3rd Edition, McGraw Hill, 2002.

Course Code: **DSC-4L [FSD 450]**	Course Title:**DBMS Lab**
Course Credits: **02**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **25**	Total Contact Hours: **52Hours**
Exam Marks: **25**	Exam Duration: **03Hours**

Course Outcomes (COs):

Student would be able to create tables, execute queries

1. Execute a single line query and group functions.
2. Execute DDL Commands.
3. Execute DML Commands 4. Execute DCL and TCL Commands.
4. Implement the Nested Queries.
5. Implement Join operations in SQL
6. Create views for a particular table
7. Implement Locks for a particular table

Activity 1:

Database: Student (DDL, DML Statements) Table: Student

Name	Reg. No	Class	Major
Smith	17	1	CS
Brown	8	2	CS

Table: Course

Course Name	Course Number	Credit Hours	Department
Introduction to Computer Science	CS1310	4	CS
Data Structure	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database Management System	CS3380	3	CS

Table: Section

Section Identifier	Course Number	Year	Instructor
85	MATH2410	98	King
92	CS1310	98	Andreson
102	CS3320	99	Knuth
112	MATH2410	99	Chang
119	CS1310	99	Andreson
135	CS3380	99	Stone

Table: Grade_Report

Reg. No	Section_Identifier	Grade
17	112	B
17	119	C
8	85	A
8	92	A
8	102	B
8	135	A

- Create Tables using create statement
- Insert rows to individual tables using insert statement
- Alter table section add new field section and update the records
- Delete brown's grade report
- Drop the table section

Activity 2: (Select clause, Arithmetic Operators) Database: Employee

Create Following **tables** and insert **tuples** with suitable constraints

Table: EMPLOYEE

EMPID	FIRSTANAME	LASTNAME	Hire_Date	ADDRESS	CITY
1001	George	Smith	11-May-06	83 first street	Paris
1002	Mary	Jones	25-Feb-08	842 Vine Ave	Losantiville
1012	Sam	Tones	12-Sep-05	33 Elm St.	Paris
1015	Peter	Thompson	19-Dec-06	11 Red Road	Paris
1016	Sarath	Sharma	22-Aug-07	440 MG Road	New Delhi
1020	Monika	Gupta	07-Jun-08	9 Bandra	Mumbai

Table:EMP SALA RY

EMPID	SALARY	BENEFITS	DESIGNATION
1001	10000	3000	Manager
1002	8000	1200	Salesman
1012	20000	5000	Director
1015	6500	1300	Clerk
1016	6000	1000	Clerk
1020	8000	1200	Salesman

Write queries for the following

1. To display FIRSTNAME, LASTNAME, ADDRESS AND CITY of all employees living in PARIS.
2. To display the content of employee table in descending order of FIRSTNAME
3. Select FIRSTNAME and SALARY of salesman
4. To display the FIRSTNAME, LASTNAME, AND TOTAL SALARY of all employees from the table EMPLOYEE and EMPSALARY. Where TOTALSALARY is calculated as SALARY+BENEFITS
5. List the Names of employees, who are more than 1 year old in the organization
6. Count number of distinct DESINGATION from EMPSALARY
7. List the employees whose names have exactly 6 characters
8. Add new column PHONE_NO to EMPLOYEE and update the records
9. List employee names, who have joined before 15-Jun-08 and after 16-Jun-07
10. Generate Salary slip with Name, Salary, Benefits, HRA-50%, DA-30%, PF-12%, Calculate gross. Order the result in descending order of the gross.

Activity 3: (Logical, Relational Operators) Database: Library

Create Following **tables** and insert **tuples** with suitable constraints

Book_Id	Book_name	Author_Name	Publishers	Price	Type	Quantity
C0001	The Klone and I	Lata Kappor	EPP	355	Novel	5
F0001	The Tears	WilliamHopkins	First Publ	650	Fiction	20
T0001	My First C++	Brain & Brooke	ERP	350	Text	10
T0002	C++ Brainwork‟s	A.W.Rossaine	TDH	350	Text	15
F0002	Thunderbolts	Ana Roberts	First Publ.	750	Fiction	50

Table: Issued

Book_Id	Quantity_Issued
T0001	4
C0001	5
F0001	2
T0002	5
F0002	8

Write queries for the following

1. To show Book name, Author name and price of books of **First Publ**. publisher
2. Display Book id, Book name and publisher of books having quantity more than 8 and price less than 500
3. Select Book id, book name, author name of books which is published by other than ERP publishers andprice between 300 to 700
4. Generate a Bill with Book_id, Book_name, Publisher, Price, Quantity, 4% of VAT "Total"
5. Display book details with book id"s C0001, F0001, T0002, F0002 (Hint: use IN operator)
6. Display Book list other than, type Novel and Fiction
7. Display book details with author name starts with letter „A"
8. Display book details with author name starts with letter „T" and ends with „S"
9. Select Book_Id, Book_Name, Author Name , Quantity Issued where Books.Books_Id = Issued.Book_Id
10. List the book_name, Author_name, Price. In ascending order of Book_name and then on descending order of price

Activity 4: (Date Functions) Database: Lab

Create Following **table** and insert **tuples** with suitable constraints

Table: Equipment_Details

No.	ItemName	Costperitem	Quantity	Dateofpurchase	Warranty	Operational
1	Computer	30000	9	21/5/07	2	7
2	Printer	5000	3	21/5/06	4	2
3	Scanner	8000	1	29/8/08	3	1
4	Camera	7000	2	13/6/05	1	2
5	UPS	15000	5	21/5/08	1	4
6	Hub	8000	1	31/10/08	2	1
7	Plotter	25000	2	11/1/09	2	2

(Use date functions and aggregate functions)

1. To select the ItemName purchase after 31/10/07
2. Extend the warranty of each item by 6 months
3. Display ItemName , Dateof purchase and number of months between purchase date and present date
4. To list the ItemName in ascending order of the date of purchase where quantity is more than 3.
5. To count the number, average of costperitem of items purchased before 1/1/08
6. To display the minimum warranty, maximum warranty period 7.To Display the day of the date, month, year of purchase in characters
8. To round of the warranty period to month and year format.

9. To display the next Sunday from the date "07-JUN-96"
10. To list the ItemName, which are within the warranty period till present date

Activity 5: (Numeric, character functions) Use Functions for the following

1. Find the mod of 165,16
2. Find Square Root of 5000
3. Truncate the value 128.3285 to 2 and -1 decimal places
4. Round the value 92.7683 to 2 and -1 decimal places
5. Convert the string „Department" to uppercase and lowercase
6. Display your address convert the first character of each word to uppercase and rest are in lowercase
7. Combine your first name and last name under the title Full name
8. A) Take a string length maximum of 15 displays your name to the left. The remaining space should be filled with '*'
9. Take a string length maximum of 20 displays your name to the right. The remaining space should be filled with '#'
10. Find the length of the string 'JSS College, Mysore'
11. Display substring 'BASE' from 'DATABASE'
12. Display the position of the first occurrence of character 'o' in Position and Length

13. Replace string Database with Data type
14. Display the ASCII value of ‘ ‘ (Space)
15. Display the Character equivalent of 42

6: Database Activity: subject

Create Following table and insert tuples with suitable constraints

Table – Physics

RegNo	Name	Year	Combination
AJ00325	Ashwin	First	PCM
AJ00225	Swaroop	Second	PMCs
AJ00385	Sarika	Third	PME
AJ00388	Hamsa	First	PMCs

Table - Computer Science

RegNo	Name	Year	Combination
AJ00225	Swaroop	Second	PMCs
AJ00296	Tajas	Second	BCA
AJ00112	Geetha	First	BCA
AJ00388	Hamsa	First	PMCs

1. Select all students from physics and Computer Science
2. Select student common in physics and Computer Science
3. Display all student details those are studying in second year
4. Display student those who are studying both physics and computer science in second year
5. Display the students studying only physics
6. Display the students studying only Computer Science
7. select all student having PMCs combination
8. select all student having BCA combination
9. select all student studying in Third year
10. Rename table Computer Science to CS

Activity 7: (views) Database: Railway Reservation System

Create Following **table** and insert **tuples** with suitable constraints

Table: Train Details

Train_No	Train_Name	Start_Place	Destination
RJD16	Rajdhani Express	Bangalore	Mumbai
UDE04	Udhyan Express	Chennai	Hyderabad
KKE55	Karnataka Express	Bangalore	Chennai
CSE3	Shivaji Express	Coimbatore	Bangalore
JNS8	Janashatabdi	Bangalore	Salem

Table: Availability

Train_No	Class	Start_Place	Destination	No_of_Seats
RJD16	Sleeper Class	Bangalore	Mumbai	15
UDE04	First Class	Chennai	Hyderabad	22
KKE55	First Class AC	Bangalore	Chennai	15
CSE3	Second Class	Coimbatore	Bangalore	8
JNS8	Sleeper Class	Bangalore	Salem	18

1. Create view sleeper to display train no, start place, destination which have sleeper class and perform the following a.insert new record
   b. update destination='Manglore' where train no= 'RJD16'
   c. delete a record which have train no= 'KKE55'
2. Create view details to display train no, train name, class
3. Create view total seats to display train number, start place, use count function to no of seats, group by start place and perform the following a.insert new record
   b. update start place= 'Hubli' where train no= 'JNS8'
   c. delete last row of the view
4. Rename view sleeper to class
5. Delete view details

Activity 8 (group by, having clause)

Create Following **table** and insert **tuples** with suitable constraints

Database: Bank system Table: Account

Account_No	Cust_Name	Brach_ID
AE0012856	Reena	SB002
AE1185698	Akhil	SB001
AE1203996	Daniel	SB004
AE1225889	Roy	SB002
AE8532166	Sowparnika	SB003
AE8552266	Anil	SB003
AE1003996	Saathwik	SB004
AE1100996	Swarna	SB002

Table: Branch

Branch_ID	Branch_Name	Branch_City
SB001	Malleshwaram	Bangalore
SB002	MG Road	Bangalroe
SB003	MG Road	Mysore
SB004	Jainagar	Mysore

Table: Depositor

Account_No	Branch_Id	Balance
AE0012856	SB002	12000
AE1203996	SB004	58900
AE8532166	SB003	40000
AE1225889	SB002	150000

Table: Loan

Account_No	Branch_Id	Balance
AE1185698	SB001	102000
AE8552266	SB003	40000
AE1003996	SB004	15000
AE1100996	SB002	100000

1. Display Total Number of accounts present in each branch
2. Display Total Loan amount in each branch
3. Display Total deposited amount in each branch by descending order
4. Display max, min loan amount present in each city.
5. Display average amount deposited in each branch, each city
6. Display maximum of loan amount in each branch where balance is more than 25000
7. Display Total Number of accounts present in each city
8. Display all customer details in ascending order of brachid
9. Update Balance to 26000 where accno=AE1003996
10. Display Customer Names with their branch Name

Evaluation Scheme for Lab Examination:

Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

Skill Enhancement Course: SEC for B.Sc. & other Subject Students
Semester: III / IV

Course Code: **SEC-2**	Course Title:**Artificial Intelligence**
Course Credits: 1 + 1 = **02**	Hour of Teaching / Week: Theory (**1Hour**) + Practical (**2Hours**)
Formative Assessment Marks: **25**	Total Contact Hours: **(13 T + 26 P Hours)**
Exam Marks: **25**	Exam Duration: **1 Hours**
[FHC210 / FSD210 / FAD210]	

Course Outcomes (COs):

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

- Appraise the theory of Artificial intelligence and list the significance of AI.
- Discuss the various components that are involved in solving an AI problem.
- Illustrate the working of AI Algorithms in the given contrast.
- Analyze the various knowledge representation schemes, Reasoning and Learning techniques of AI.
- Apply the AI concepts to build an expert system to solve the real-world problems.

Course Content	Hours
Unit – 1	
Overview of AI: Definition of Artificial Intelligence, Philosophy of AI, Goals of AI, Elements of AI system, Programming a computer without and with AI, AI Techniques, History of AI. **Intelligent Systems:**Definition and understandingof Intelligence,Types ofIntelligence, Human Intelligence vs Machine Intelligence.	06
Unit – 2	
AI Applications: Virtual assistance, Travel and Navigation, Education and Healthcare, optical character recognition, E-commerce and mobile payment systems, Image based search and photo editing. **AI Examples in daily life:** Installation of AI apps and instructions to use AI apps.Introduction to Robotics.	07
Unit – 3 Laboratory Activities:	
Amazon Alexa: https://play.google.com/store/apps/details?id=com.amazon.dee.app&hl=en&gl=US **Google Lens:** https://play.google.com/store/search?q=google+lens&c=apps&hl=en&gl=US **Image to Text to Speech ML OCR:** https://play.google.com/store/apps/details?id=com.mlscanner.image.text.spech&hl=en_IN&gl=US **Google Pay:** https://play.google.com/store/apps/details?id=com.google.android.apps.nbu.paisauser&hl=enIN&gl=US **Grammarly:**https://play.google.com/store/search?q=grammarly&c=apps&hl=enIN&gl **Google Map:**https://play.google.com/store/search?q=google+maps&c=apps&hl=en&gl=US **FaceApp:**https://play.google.com/store/apps/details?id=io.faceapp&hl=en_IN&gl=US **Socratic:**https://play.google.com/store/apps/details?id=com.google.socratic&hl=en_IN&gl=US **Google Fit: Activity Tracking:** https://play.google.com/store/apps/details?id=com.google.android.apps.fitness&hl=enIN&gl=US **SwiftKey Keyboard:**https://swiftkey-keyboard.en.uptodown.com/android **E-commerce App:** https://play.google.com/store/apps/details?id=com.jpl.jiomart&hl=enIN&gl=US	26

Text Books:

1. Wolfgang Ertel, “Introduction to Artificial Intelligence”, 2nd Edition, Springer International Publishing2017.
2. Michael Negnevitsky, “Artificial Intelligence A Guide to Intelligent Systems”, 2nd Edition, Pearson Education Limited 2005.

References:

1. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_tutorial.pdf
2. Kevin Knight, Elaine Rich, Shivashankar B. Nair, ”Artificial Intelligence”, 3rd Edition, July 2017.

Reference Links:

1. Voice Assistant: https://alan.app/blog/voiceassistant-2/
2. Browse with image: https://www.pocket-lint.com/apps/news/google/141075-what-is- google-lensand-how-does-it-work-and-which-devices-have-it
3. OCR: https://aws.amazon.com/what-is/ocr/
4. Mobile Payment system: https://gocardless.com/en-us/guides/posts/how-do-mobile- paymentsystems-work/
5. Grammarly: https://techjury.net/blog/how-to-use-grammarly/#gref
6. Travel & Navigation: https://blog.google/products/maps/google-maps-101-ai-power- newfeatures-io-2021/
7. AI in photo editing: https://digital-photography-school.com/artificial-intelligence- changed-photoediting/
8. AI in education: https://www.makeuseof.com/what-is-google-socratic-how-does-it- work/
9. AI in health and fitness: https://cubettech.com/resources/blog/implementing-machine- learningand-ai-in-health-and-fitness/
10. E-commerce and online shopping: https://medium.com/@nyxonedigital/importance- 2 of-ecommerce-and-online-shopping-and-why-to-sell-online-5a3fd8e6f416

Open Elective Courses offered by the Department of Computer Science Semester: III

Course Code: **OE-5 [FSC 880]**	Course Title:**Python Programming Concepts**
Course Credits: **03**	Hour of Teaching / Week: **03Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42 Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

- Explain the fundamentals of Computers.
- Explain the basic concepts of Python Programming.
- Demonstrate proficiency in the handling of loops and the creation of functions.
- Identify the methods to create and store strings.

Course Content	Hours
Unit – 1 Fundamentals of Computers	
Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organization of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples. Python Basics: - Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association;	14
Unit – 2 Data types and control structure	
Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples; Illustrative programs. Python Control Flow: Types of Control Flow; Control Flow Statements- if, else, elif, while loop, break, continue statements, for loop Statement; range() and exit () functions; Illustrative programs.	14
Unit – 3 Functions and Strings	
Python Functions: Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Illustrative programs. Srings: Creating and Storing Strings; Accessing Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods; Illustrative programs.	14

References

1. Computer Fundamentals (BPB), P. K. Sinha & Priti Sinha
2. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition, Green Tea Press. Freely available online 2015. @https://www.greenteapress.com/thinkpython/thinkCSpy.pdf
3. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
4. http://www.ibiblio.org/g2swap/byteofpython/read/
5. http://scipy-lectures.org/intro/language/python language.html
6. https://docs.python.org/3/tutorial/index.html

Course Code: **OE-6 [FSC 890]**	Course Title:**Fundamentals of Multimedia**
Course Credits: **03**	Hour of Teaching / Week: **03Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42 Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

- Students will learn about multimedia, which is a field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images(video), animation, audio and any other media where every type of information can be represented, stored, transmitted and processed digitally.

Course Content	Hours
Unit – 1 Introduction to Multimedia	
Concepts of Multimedia, Multimedia applications, Advantage of Digital Multimedia, Multimedia system Architecture, Objects of Multimedia. Introduction to Compression and Decompression Techniques and its types. File format standards- RTF, TIFF, RIFF, MIDI, JPEG, AVI, JPEG, TWAIN Architecture.	14
Unit – 2 Multimedia input and output technologies	
Key Technology Issues, Pen Input, Video and Image Display Systems, Print Output Technologies, Image Scanners, Digital Voice and Audio, Video Images and Animation, Full Motion Video.	14
Unit – 3 Secured Multimedia and Authentication	
Secured Multimedia, Digital Rights Management Systems, and Technical Trends - Multimedia encryption - Digital Watermarking – Security Attacks. Multimedia Authentication - Pattern, Speaker and Behavior Recognition – Speaker Recognition - Face Recognition	14

References

1. Wenjun Zeng, Heather Yu and Ching – Yung Lin, “Multimedia Security technologies for Digital rights Management”, Elsevier Inc 2006.
2. Chun-Shien Lu, “Multimedia Security : Steganography and Digital Watermarking techniques for Protection of Intellectual Property”, Springer Inc 2007.
3. Andleigh PK and Thakrar K, “Multimedia Systems”, Addison Wesley Longman, 1999.
4. Fred Halsall, “Multimedia Communications”, Addison Wesley, 2000.
5. https://www.tutorialspoint.com/multimedia/multimedia introduction.html
6. https://www.tutorialspoint.com/multimedia/multimedia images graphics.html

Semester: IV

Course Code: **OE-7 [FSD 880]**	Course Title:**Cloud Computing**
Course Credits: **03**	Hour of Teaching / Week: **03Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42 Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

- After successful completion of the course, the student is able to
- Learn in depth Fundamentals of Cloud Computing
- Understand the details of Cloud Services and File System
- Learn in depth Concept of Collaborating with Cloud
- Understand the details of Virtualization in cloud
- Learn the classification and characteristics of Security challenges in Cloud Computing
- Specify the classification and characteristics of Security challenges in Cloud Computing

Course Content	Hours
Unit – 1	
Cloud Introduction: Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing, usage scenarios and Applications, Business models around Cloud– Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus - Open Nebula, CloudSim. Cloud Services and File System: Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as services.	14
Unit – 2	
Service providers- Google App Engine, Amazon EC2, Microsoft Azure, Sales force. Collaborating With Cloud: Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing, Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis.	14
Unit – 3	
Virtualization For Cloud: Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM, VMWare, Virtual Box, Hyper-V.	14

Reference Books:

1. Bloor R., Kanfman M., Halper F. Judith Hurwitz "Cloud Computing" Wiley India Edition,2010
2. John Rittinghouse& James Ransome, "Cloud Computing Implementation Management and Strategy", CRC Press, 2010
3. Antohy T Velte,Cloud Computing: "A Practical Approach", McGraw Hill,2009
4. Michael Miller, Cloud Computing: "Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008.
5. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers, 2006.

Online Reading/Supporting Material

Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing", Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008
Webpages.iust.ac.ir/hsalimi/.../89.../Cloud%20Common%20standards.pptop ennebula.org, www.cloudbus.org/cloudsim/, http://www.eucalyptus.com/ hadoop.apache.org
http://hadoop.apache.org/docs/stable/hdfs_design.html
http://static.googleusercontent.com/external_content/untrusted_dlcp/research.google.com/en//archive/mapreduce-osdi04.pdf

Course Code: **OE-8 [FSD 890]**	Course Title: **Fundamentals of Mobile Application**
Course Credits: **03**	Hour of Teaching / Week: **03Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42 Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

After successful completion of the course, the student is able to

- Deliberate the details of Concepts of Event Driven Programming
- Learn in details with examples issues of Mobile applications
- Specify the details of Mobile applications Development tools and Frameworks
- Deliberate in details with examples common Mobile device UI's

Course Content	Hours
Unit – 1	
Event Driven Programming: UI event loop, Threading for background tasks, Outlets / actions, delegation, notification, Model View Controller (MVC) design pattern. Mobile application issues: limited resources (memory, display, network, file system), input / output (multi-touch and gestures), sensors (camera, compass, accelerometer, GPS)	14
Unit – 2	
Development tools: Apple iOS toolchain: Objective-C, Xcode IDE, Interface Builder, Device simulator. Frameworks: Objective-C and Foundation Frameworks, Cocoa Touch, UI Kit, Others: Core Graphics, Core Animation, Core Location and Maps, Basic Interaction. Common UI's for mobile devices: Navigation Controllers, Tab Bars, Table Views, Modal views, UI Layout.	14
Unit – 3	
Data Persistence: Maintaining state between application invocations, File system, Property Lists, SQLite, Core Data. Remote Data-Storage and Communication: "Back End" / server side of application, RESTful programming, HTTP get, post, put, delete, database design, server-side JavaScript / JSON. Code signing: security, Keychain, Developers and App Store License Agreement	14

Reference:

1. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK 3 for Dummies, Wiley, 2011.
2. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.
3. Brian Fling, Mobile Design and Development, O'Reilly Media, 2009. Maximiliano
4. Firtman, Programming the Mobile Web, O'Reilly Media, 2010.
5. Christian Crumlish and Erin Malone, Designing Social Interfaces, O'Reilly Media, 2009.
6. James E Smith, Ravi Nair, “Virtual Machines”, Morgan Kaufmann Publishers, 2006.

NEP-2020 Model Syllabus for BSc (Basic and Honors), Semesters V and VI

Semester: V

Course Code: **DSC-5 [FSE 450]**	Course Title: **Programming in Python**
Course Credits: **04**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **52Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

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

CO1 Setup python to develop simple applications

CO2 Understand the basic concepts in Python Programming

CO3 Learn how to write, debug and execute Python programs

CO4 Understand and demonstrate the use of advanced data types such as tuples, dictionaries and lists, Tuples and Sets

CO5 Design solutions for problems using object-oriented concepts in Python

CO6 Use and apply the different Python Libraries for GUI Interface, Data Analysis and Data Visualization.

C07 Extend the knowledge of python programming to build successful career in software development.

Course Content	Hours
Unit – 1	
Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. **Python Basics:** Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples. **Python Control Flow:** Types of Control Flow; Control Flow Statements- if, else, elif, while loop, break, continue statements, for loop Statement; range () and exit () functions. **Exception Handling:** Types of Errors; Exceptions; Exception Handling using try, except and finally.	13
Unit – 2	
Python Functions: Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Recursive Functions; Scope and Lifetime of Variables in Functions. **Strings:** Creating and Storing Strings; Accessing Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods. **Lists:** Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists **Dictionaries:** Creating Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries.	13
Unit – 3	
Tuples and Sets: Creating Tuples; Operations on Tuples; Built-in Functions on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods. **File Handling:** File Types; Operations on Files– Create, Open, Read, Write, Close Files; File Names and Paths; Format Operator. **Object Oriented Programming:** Classes and Objects; Creating Classes and Objects; Constructor Method; Classes with Multiple Objects; Objects as Arguments; Objects as Return Values; Inheritance- Single and Multiple Inheritance, Multilevel and Multipath Inheritance; Encapsulation- Definition, Private Instance Variables; Polymorphism- Definition, Operator Overloading.	13

Unit – 4	
GU Interface: The Tkinter Module; Window and Widgets; Layout Management- pack, grid and place. **Python SQLite:** The SQLite3 module; SQLite Methods- connect, cursor, execute, close; Connect to Database; Create Table; Operations on Tables- Insert, Select, Update. Delete and Drop Records. **Data Analysis:** NumPy- Introduction to NumPy, Array Creation using NumPy, Operations on Arrays; Pandas- Introduction to Pandas, Series and DataFrames, Creating DataFrames from Excel Sheet and .csv file, Dictionary and Tuples. Operations on DataFrames. **Data Visualisation:** Introduction to Data Visualisation; Matplotlib Library; Different Types of Charts using Pyplot- Line chart, Bar chart and Histogram and Pie chart	13

References:

1. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition, 2015, Green Tea Press.Freely available online @ https://www.greenteapress.com/thinkpython/thinkCSpy.pdf
2. Introduction to Python Programming, Gowrishankar S et al.,2019, CRC Press
3. Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python Programming Language, Fabio Nelli, 2015, Apress®
4. Advance Core Python Programming, Meenu Kohli, 2021, BPB Publications
5. Core PYTHON Applications Programming, Wesley J. Chun, 3rd Edition, 2012, Prentice Hall
6. Automate the Boring Stuff, Al Sweigart, 2015, No Starch Press, Inc.
7. Data Structures and Program Design Using Python, D Malhotra et al., 2021, Mercury Learning and Information LLC
8. http://www.ibiblio.org/g2swap/byteofpython/read/
9. https://docs.python.org/3/tutorial/index.html

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe- Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10%
Internal Assessment Test 2	10%
Quiz/ Assignment/ Small Project	10%
Seminar	10%
Total	**40 Marks**
Formative Assessment as per guidelines.	

Course Code: **DSC-5L [FSC 451]**	Course Title: **Python Programming Lab**
Course Credits: **02**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **25**	Total Contact Hours: **52Hours**
Exam Marks: **25**	Exam Duration: **03Hours**

Practical Content

Part-A

1. Check if a number belongs to the Fibonacci Sequence
2. Solve Quadratic Equations
3. Find the sum of n natural numbers
4. Display Multiplication Tables
5. Check if a given number is a Prime Number or not
6. Implement a sequential search
7. Create a calculator program
8. Explore string functions
9. Implement Selection Sort 10.Implement Stack

11.Read and write into a file

Part-B

1. Demonstrate usage of basic regular expression
2. Demonstrate use of advanced regular expressions for data validation.
3. Demonstrate use of List
4. Demonstrate use of Dictionaries
5. Create SQLite Database and Perform Operations on Tables
6. Create a GUI using Tkinter module
7. Demonstrate Exceptions in Python
8. Drawing Line chart and Bar chart using Matplotlib
9. Drawing Histogram and Pie chart using Matplotlib
10. Create Array using NumPy and Perform Operations on Array
11. Create Data Frame from Excel sheet using Pandas and Perform Operations on DataFrames

Note: A minimum of 10 Programs should be done in each Part.

Evaluation Scheme for Lab Examination:

Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

Course Code: **DSC-6 [FSE 452]**	Course Title: **Computer Networks**
Course Credits: **04**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **52Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

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

CO1 Define various data communication components in networking.

CO2 Describe networking with reference to different types of models and topologies.

CO3 Understand the need for Network and various layers of OSI and TCP/IP reference model.

CO4 Explain various Data Communications media.

CO5 Describe the physical layer functions and components

CO6 Identify the different types of network topologies and Switching methods.

CO7 Describe various Data link Layer Protocols.

CO8 Identify the different types of network devices and their functions within a network.

CO9 Analyze and Interpret various Data Kink Layer and Transport Layer protocols.

CO10 Explain different application layer protocols.

Course Content	Hours
Unit – 1	
Introduction: Computer Network: Definition, Goals, Structure; Broadcast and Point-To-Point Networks; Network Topology and their various Types; Types of Networks, Network software, Design issues for the layers, Connection-oriented vs. Connectionless service, Applications of Computer network, Protocols and Standards, The OSI Reference Model, The TCP/IP Protocol suite, Comparison between OSI and TCP/IP Reference model. **Physical Layer:** Functions of Physical Layer**,** Analog signals, Digital signals, Transmission Impairment, Data Rate Limits, and Performance.	13
Unit – 2	
Data Transmission Media: Guided Transmission Media, Magnetic Media, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Wireless Transmission, Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared Transmission, Light Transmission, Digital Modulation and Multiplexing, Public Switched Telephone Networks. Switching: Circuit switching, Message switching & Packet switching **Data Link Layer:** Functions of Data Link Layer, Data Link Control: Framing, Flow and Error Control, Error Detection and Correction, High-Level Data Link Control (HDLC) & point to Point protocol (PPP), Channel Allocation Problem	13
Unit – 3	
Multiple Access: Radom Access (ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access (Reservation, Polling, Token Passing), Channelization (FDMA, TDMA, CDMA), **Wired LAN:** Ethernet Standards and FDDI, Wireless LAN: IEEE 802.1 Ix and Bluetooth Standards. **Transport Layer:** Functions of Transport Layer, Elements of Transport Protocols: Addressing, Establishing and Releasing Connection, Flow Control & Buffering, Error Control, Multiplexing & De-multiplexing, Crash Recovery,	13
Unit – 4	
User Datagram Protocol (UDP): User Datagram, UDP Operations, Uses of UDP, RPC, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocol, Go Back-N(GBN), Selective Repeat (SR). **Application layer:** Functions of Application layer, Application Layer Protocols: DNS, DHCP, WWW, HTTP, HTTPs, TELNET, FTP, SMTP, POP, IIMAP	13

References:

1. Andrew S Tanenbaum, David. J. Wetherall, ―Computer Networks‖, Pearson Education, 5th Edition,
2. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, Fourth Edition
3. Kurose and Ross, Computer Networking- A Top-Down approach, Pearson, 5th edition
4. William Stallings, Data and Computer Communications, 7th Edition,PHI.
5. http://highered.mheducation.com/sites/0072967757/index.html
6. Larry L.Peterson, Bruce S. Davie, ―Computer Networks: A Systems Approach‖, Morgan Kaufmann Publishers, Fifth Edition, 2011.
7. Brijendrasingh, Data Communication and Computer Networks,PHI.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe- Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10%
Internal Assessment Test 2	10%
Quiz/ Assignment/ Small Project	10%
Seminar	10%
Total	**40 Marks**
Formative Assessment as per guidelines.	

Course Code: **DSC-5L [FSC 451]**	Course Title: **Computer Networks Lab**
Course Credits: **02**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **25**	Total Contact Hours: **52Hours**
Exam Marks: **25**	Exam Duration: **03Hours**

Practical Content

Part A:

1. Prepare hardware and software specification for basic computer system and Networking.
2. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
3. Identifying the networking devices on a network.
4. Configure the IP address of the computer.
5. Create a basic network and share file and folders.
6. Study of basic network command and Network configuration commands.
7. Installation process of any open-source network simulation software.

Part B:

1. Implement connecting two nodes using network simulator.
2. Implement connecting three nodes considering one node as a central node using network simulator. Implement a network to connect three nodes considering one node as a central node using network simulator
3. Implement bus topology using network simulator.
4. Implement star topology using network simulator.
5. Implement ring topology using network simulator.
6. Demonstrate the use of wireless LAN using network simulator.
7. Implement FTP using TCP bulk transfer using network simulator.
8. Implement connecting multiple routers and nodes and building a Hybrid topology network simulator.

Links for open-source simulation software:

NS3 software: https://www.nsnam.org/releases/ns-3-30/download/○Packet Tracer Software: https://www.netacad.com/courses/packet-tracer○GNS3 software: https://www.gns3.com/

Pedagogy: Demonstration, Hands on Simulation.

Skill Enhancement Course: SEC for B.Sc. & other Subject Students
Semester: V

Course Code: **SEC-3 [CYE300]**	Course Title: **Cyber Security**
Course Credits: **03**	Hour of Teaching / Week: **03 Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

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

CO1 After completion of this course, students would be able to understand the concept of Cyber security and issues and challenges associated with it.

CO2 Students, at the end of this course, should be able to understand the cybercrimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

CO3 On completion of this course, students should be able to appreciate various privacy and security concerns on online social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.

Course Content	Hours
Unit – 1	
Module-I. Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	14
Unit – 2	
Module-II . Cyber crime and Cyber law: Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.	14
Unit – 3	
Module III. Social Media Overview and Security: Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies	14

Text / References:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra ,Auther Press. Edition 2010 1
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapureand Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
5. Fundamentals of Network Security by E. Maiwald, McGraw Hill.
6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.

Semester: VI

Course Code: **DSC-7 [FSF 450]**	Course Title: **Web Technologies**
Course Credits: **04**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **52Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

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

CO1 Understand basics of web technology

CO2 Recognize the different Client-side Technologies and tools like, HTML, CSS, JavaScript

CO3 Learn Java Servlets and JDBC

CO4 Web Technology for Mobiles and Understand web security

Course Content	Hours
Unit – 1	
Introduction and Web Design: Introduction to Internet, WWW and Web 2.0, Web browsers, Web protocols and Web servers, Web Design Principles and Web site structure, client-server technologies, Client-side tools and technologies, Server-side Scripting, URL, MIME, search engine, web server- Apache, IIS, proxy server, HTTP protocol. Introductions to HTML. HTML5 Basics tags, Formatting tags in HTML, HTML5 Page layout and Navigation concepts, Semantic Elements in HTML, List, type of list tags, tables and form tags in HTML, multimedia basics, images, iframe, map tag, embedding audio and video clips on webpage. **Introduction to XML:** XML Syntax, XML Tree, Elements, Attributes, Namespace, Parser, XSLT DOM, DTD, Schema. Introduction to CSS, CSS syntax, CSS selectors	13
Unit – 2	
CSS Background Cursor, CSS text fonts, CSS-List Tables, CSS Box Modeling, Display Positioning, Floats, CSS Gradients, Shadows, 2D and 3 Transform, Transitions, CSS Animations. **Introduction to JavaScript:** JavaScript Data type and Variables, JavaScript Operators, Conditional Statements, Looping Statements, JavaScript Functions, Number, Strings, Arrays, Objects in JavaScript, Window and Frame objects, Event Handling in JavaScript	13
Unit – 3	
Exception Handling, Form Object and DOM, JSON, Browser Object Model. **Introduction to Servlets:** Common Gateway Interface (CGI), Lifecycle of a Servlets, deploying a Servlets, The Servlets API, Reading Servlets parameters, reading initialization parameters, Handling HTTP Request & Responses, Using Cookies and sessions, connecting to a database using JDBC.	13
Unit – 4	
Web Security: Authentication Techniques, Design Flaws in Authentication, Implementation Flaws in Authentication, Securing Authentication, Path Traversal Attacks. Injecting into Interpreted Contexts, SQL Injection, NoSQL Injection, XPath Injection, LDAP Injection, XML Injection, HTTP Injection, Mail Service Injection. Types of XSS, XSS in Real World, Finding and Exploiting XSS Vulnerabilities, Preventing XSS Attacks.	13

References:

1 Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dremtech

2 Java Server Pages – Hans Bergsten, SPD O'Reilly

3 Java Script, D.Flanagan, O'Reilly, SPD

4 Beginning Web Programming-Jon Duckett WROX.

5 Web Applications : Concepts and Real World Design, Knuckles, Wiley-India

6 Internet and World Wide Web – How to program, Dietel and Nieto, Pearson.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe- Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10%
Internal Assessment Test 2	10%
Quiz/ Assignment/ Small Project	10%
Seminar	10%
Total	**40 Marks**
Formative Assessment as per guidelines.	

Course Code: **DSC-7L [FSC 451]**	Course Title: **Web Technologies Lab**
Course Credits: **02**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **25**	Total Contact Hours: **52Hours**
Exam Marks: **25**	Exam Duration: **03Hours**

Practical Content

Part A

1. Design web pages for your college containing college name and Logo, departments list using href, list tags.
2. Create a class timetable using table tag.
3. Write a HTML code to design Student registrations form for your college Admission 4.Design Web Pages with includes Multimedia data (Image, Audio, Video, GIFs etc)
5. Create a web page using frame.
6. Write code in HTML to develop a webpage having two frames that divide the webpage into two equal rows and then divide the row into equal columns fill each frame with a different background color.
7. Write CSS code to Use Inline CSS to format your ID Card.
8. Using HTML, CSS create display a text called —Hello India! ‖ On top of an image of India-Map using an overlay.

Part B

1. Write a JavaScript Program to perform Basic Arithmetic operations
2. JavaScript Program to Check Prime Number
3. JavaScript Program to implement JavaScript Object Concept
4. JavaScript Program to Create Array and inserting Data into Array
5. JavaScript Program to Validate an Email Address
6. Write a Program for printing System Date & Time using SERVLET
7. Write a serverside SERVLET program for accept number from HTML file and Display.
8. Write a program to Creating the Life-Cycle Servlet Application

Course Code: **DSC-8 [FSE 452]**	Course Title: **Statistical Computing & R Programming**
Course Credits: **04**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **52Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Course Outcomes (COs):

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

CO1 Explore fundamentals of statistical analysis in R environment.

CO2 Describe key terminologies, concepts and techniques employed in Statistical Analysis.

CO3 Define Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.

CO4 Conduct and interpret a variety of Hypothesis Tests to aid Decision Making.

CO5 Understand, Analyse, and Interpret Correlation Probability and Regression to analyse the underlying relationships between different variables.

Course Content	Hours
Unit – 1	
Introduction of the language, numeric, arithmetic, assignment, and vectors, Matrices and Arrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion, Basic Plotting. Reading and writing files, Programming, Calling Functions, Conditions and Loops: stand- alone statement with illustrations in exercise 10.1,	12
Unit – 2	
stacking statements, coding loops, Writing Functions, Exceptions, Timings, and Visibility. Statistics And Probability, basic data visualization, probability, common probability distributions: common probability mass functions, Bernoulli, binomial, Poisson distributions, common probability density functions, uniform, normal, student's t-distribution.	14
Unit – 3	
Statistical testing and modelling, sampling distributions, hypothesis testing, components of hypothesis test, testing means, testing proportions, testing categorical variables, errors and power, Analysis of variance.	13
Unit – 4	
Simple linear regression, multiple linear regression, linear model selection and diagnostics. Advanced graphics: plot customization, plotting regions and margins, point and click coordinate interaction, customizing traditional R plots, specialized text and label notation. Defining colors and plotting in higher dimensions, representing and using color, 3D scatterr plots.	13

References

1. Tilman M.Davies, —The book of R: A first course in programming and ststistics‖, San Francisco, 2016.
2. Vishwas R. Pawgi, —Statistical computing using R software‖, Nirali prakashan publisher, e1 edition, 2022.
3. https://www.youtube.com/watch?v=KlsYCECWEWEhttps://www.geeksforgeeks.org/r-tutorial/https://www.tutorialspoint.com/r/index.htm

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe- Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10%
Internal Assessment Test 2	10%
Quiz/ Assignment/ Small Project	10%
Seminar	10%
Total	**40 Marks**
Formative Assessment as per guidelines.	

Course Code: **DSC-8L [FSC 451]**	Course Title: **R Programming Lab**
Course Credits: **02**	Hour of Teaching / Week: **04Hours**
Formative Assessment Marks: **25**	Total Contact Hours: **52Hours**
Exam Marks: **25**	Exam Duration: **03Hours**

Overview

The following program problematic comprises of R programming basics and application of several Statistical Techniques using it. The module aims to provide exposure in terms of Statistical Analysis, Hypothesis Testing, Regression and Correlation using R programming language.

Learning Objectives

The objective of this Laboratory to make students exercise the fundamentals of statistical analysis in R environment. They would be able to analysis data for the purpose of exploration using Descriptive and Inferential Statistics. Students will understand Probability and Sampling Distributions and learn the creative application of Linear Regression in multivariate context for predictive purpose.

Course Outcomes:

- Install, Code and Use R Programming Language in R Studio IDE to perform basic tasks on Vectors, Matrices and Data frames. Explore fundamentals of statistical analysis in R environment.
- Describe key terminologies, concepts and techniques employed in Statistical Analysis.
- Define Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.
- Conduct and interpret a variety of Hypothesis Tests to aid Decision Making.
- Understand, Analyze, and Interpret Correlation Probability and Regression to analyse the underlying relationships between different variables.

1. Write a R program for different types of data structures in R.
2. Write a R program that include variables, constants, data types.
3. Write a R program that include different operators, control structures, default values for arguments, returning complex objects.
4. Write a R program for quick sort implementation, binary search tree.
5. Write a R program for calculating cumulative sums, and products minima maxima and calculus.
6. Write a R program for finding stationary distribution of markanov chains.
7. Write a R program that include linear algebra operations on vectors and matrices.
8. Write a R program for any visual representation of an object with creating graphs using graphic functions: Plot (), Hist(),Linechart(),Pie(),Boxplot(),Scatterplots().
9. Write a R program for with any dataset containing data frame objects, indexing and subsetting data frames, and employ manipulating and analyzing data.
10. Write a program to create an any application of Linear Regression in multivariate context for predictive purpose.

Skill Enhancement Course: SEC for B.Sc. & other Subject Students
Semester: V /VI

Course Code: **SEC-3 [ESE290]**	Course Title: **Employability Skills**
Course Credits: **03**	Hour of Teaching / Week: **03 Hours**
Formative Assessment Marks: **40**	Total Contact Hours: **42Hours**
Exam Marks: **60**	Exam Duration: **2½ Hours**

Syllabus as Mentioned In Skill Enhancement Courses (SEC) for BCom / BBA (Commerce Department)