SHRI GURU RAM RAI UNIVERSITY

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]

SYLLABUS
FOR

Certificate in Computer Applications – 1 Year

Diploma in Computer Applications – 2 Years

Bachelor in Computer Applications – 3 Years

Bachelor in Computer Applications (Honours with Research/ Academic Project/ Entrepreneurship) – 4 Years

As per NEP 2020

School of Computer Application & Information Technology

(w.e.f. 2023-2024)

Asstt. Regd.

03/07/2023 Pradeep Semwal Asso Prof HOD, Dept of IT

3/7 S.D. Phekkan

Archana Mrs. Archana KCSO

3/7/2023 Harish Sharma

Ordnance of Bachelor in Computer Application

Bachelor of Computer Application is an undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

S.No.	Name of Program	Duration of the program	Remarks
1	**Certificate in Computer Application** after completing 1 year (2 semesters) of study	1 Year	Students who opt to exit after completion of the first year and have secured **44 credits** will be awarded a UG certificate if, in addition, they complete one vocational course/Internship of **4 credits** during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years
2	**Diploma in Computer Application** after 2 years (4 semesters) of study	2 Years	Students who opt to exit after completion of the second year and have secured **88 credits** will be awarded the UG diploma if, in addition, they complete one vocational course/Internship of **4 credits** during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.
3	**Bachelor in Computer Application** after 3-year (6 semesters) programme of study	3 Years	Students who wish to undergo a 3-year UG programme will be awarded UG Degree, Bachelor in Computer Application in the Major discipline after successful completion of three years, securing **132 credits**.
4	**Bachelor in in Computer Application (Honours with Research/ Academic Project/ Entrepreneurship)** after 4 years (8 semester) programme of study	4 Years	A four-year UG Honours degree **(Bachelor in Computer Application (Honours) with Machine Learning)** in the major discipline will be awarded to those who complete a four-year degree programme with **176 credits**. **Students who secure 75% marks and above in the first six semesters can opt for the Honours in Research.**

Eligibility for admission:

Intermediate (Class XII) in any discipline with minimum 45% marks and Maths as compulsory subject at 10+2.

Duration of the Programme: 3/4 years

Examination Scheme:

	Internal Assessment		External Assessment (ESE)
Components	**Internal Exam**	**Assignment & Teacher Assessment**	
Weightage (%)	**15**	**15**	**70**

Programme outcome (POs)

Students will be able to

PO1	Ability to demonstrate knowledge of Computer science and its applications in order to enhancebasic understanding of various software technologies.
PO2	Ability to analyze and identify various business and technical problems to further solve problemswith effective communication.
PO3	Ability to adapt analytical, logical and managerial skills with the technical aspects in order to design and deploy reliable software programs and application for real world problems
PO4	Ability to investigate complex problems and provide computer-based solutions.
PO5	Ability to understand and deliver ethical, social and cultural responsibilities in professional environment as an individual and team.
PO6	Ability to adapt new technologies for upgrading their skills and contributing to a life long learning.
PO7	Ability to create and manage multidisciplinary projects and successfully apply software and project management principles.
PO8	Ability to become employable in a variety of IT companies and government sector and also seek entrepreneurship opportunities for the betterment of an individual and society at large.
PO9	An ability to design and implement database solutions using available technologies.
PO10	Acquired skills and to recognize the need for life-long learning for continuing professional development.
PO11	Excellent verbal communication skills with capability to work in multidisciplinary teams with positive attitude
PO12	An ability to work effectively as an individual as well as a member of a team and provide technical and visionary leadership to others.

Basic Structure of CCA, DCA, BCA (Honors) and BCA (Honours with Research or Honours with Academic Project/Entrepreneurship)

Basic Structure of UG Single Core Discipline Program –

Type of Course

Discipline Specific Core (DSC)

Discipline Specific Elective (DSE)

General Elective (GE)

Ability Enhancement Courses (AEC)

Skill Enhancement Course (SEC)

Internship/Apprenticeship / Project/ Community Outreach (IAPC)

Value Addition course (VAC)

Sem	Core - Discipline Specific Core (DSC)	Elective- Discipline Specific Elective (DSE)	Elective- Generic Elective (GE)	Ability Enhancement Course (AEC)	Skill Enhancement Course (SEC)	(Internship/ Apprenticeship / Project/ Community Outreach) (IAPC)	Value Addition Course (VAC)	Total Credits
	Course/credit distribution (Credits 4) Theory or Theory + Practicum (3T+1L)	**Course/ credit distribution** (Credits 4) Theory or Theory + Practicum/ Lab (3T+1L or 2T+2L)	**Course/ credit distribution** (Credits 4) Theory or Theory + Practicum/ Lab (Credits 4T or 3T+1L or 2T+2L)	**Course/ credit distribution** (Credits 2)	**Course/credit distribution** (Credits 2)	**Course/ credit distribution** (Credits 2)	**Course/ credit distribution** (Credits 2)	
I	**DSC 1- (4)** **DSC 2- (4)** **DSC 3- (4)** (3T+1L)	-	Choose one from a pool of courses **GE – 1 (4)**	**AEC – 1 (2)**	Choose one from a pool of courses **SEC – 1 (2)**		Choose one from a pool of courses **VAC – 1 (2)**	22
II	**DSC 4- (4)** **DSC 5- (4)** **DSC 6- (4)** (3T+1L)		Choose one from a pool of courses **GE – 2 (4)**	**AEC – 2 (2)**	Choose one from a pool of courses **SEC – 2 (2)**		Choose one from a pool of courses **VAC – 2 (2)**	22
	Students on exit shall be awarded Undergraduate Certificate (in the field of study/Discipline) after securing requisite 44 credits in semester I & II							***Total credits = 44***
III	**DSC 7- (4)** **DSC 8- (4)** **DSC 9- (4)** (3T+1L)	Choose one from a pool of courses, **DSE 1 (4)** OR **GE - 3 (4)** (4 T/or 3T+1L/or 2T+2L) OR **MOOC**		**AEC – 3 (2)**	Choose one from **SEC 3 – (2)** OR **Internship/Apprenticeship / Project/ Community Outreach (IAPC) – (2)**		Choose one from a pool of courses **VAC – 3 (2)**	22

IV	**DSC 10- (4)** **DSC 11- (4)** **DSC 12- (4)** (3T+1L)	Choose one from a pool of courses, **DSE 2 (4)** credits) OR **GE - 4 (4)** (4 T/or 3T+1L/or 2T+2L) OR **MOOC**	**AEC – 4 (2)**	Choose one from **SEC 4 – (2)** OR **Internship/Apprenticeship / Project/ Community Outreach (IAPC) – (2)**	Choose one from a pool of courses **VAC – 4 (2)**	22
Students on exit shall be awarded Undergraduate Diploma (in the field of study/Discipline) after securing requisite 88 credits in semester III & IV						**Total credits= 88**
V	**DSC 13- (4)** **DSC 14- (4)** **DSC 15- (4)** (3T+1L)	Choose one from a pool of courses, **DSE 3 (4)** credits) (3T+1L/or 2T+2L) OR **MOOC**	Choose one from a pool of courses **GE – 5 (4)** OR **MOOC**	Choose one from **SEC 5 – (2)** OR **Internship/Apprenticeship / Project/ Community Outreach (IAPC) – (2)**		22
VI	**DSC 16- (4)** **DSC 17- (4)** **DSC 18- (4)** (3T+1L)	Choose one from a pool of courses, **DSE 4 (4)** credits) (3T+1L/or 2T+2L) OR **MOOC (4)**	Choose one from a pool of courses **GE – 6 (4)** **OR** **MOOC**	Choose one from **SEC 5 – (2)** OR **Internship/Apprenticeship / Project/ Community Outreach (IAPC) – (2)**		22
Students on exit shall be awarded Bachelor of (in the field of study) Honours (Discipline) after securing requisite 132 credits on completion of semester VI						**Total credits= 132**
VII	**DSC 19 (4)** (3T+1L)	**Choose 3 DSE** (3x4) courses OR **Choose 2 DSE – (2x4) and one GE (4)** course OR **Choose 1 DSE (4) and 2 GE** (2x4) courses **(Total= 12)**		Dissertation on Major/Minor (4+2) OR Academic Project/ Entrepreneurship **(4+2)**		22
VIII	**DSC 20 (4)** (3T+1L)	**Choose 3 DSE** (3x4) courses OR **Choose 2 DSE – (2x4) and one GE (4)** course OR **Choose 1 DSE (4) and 2 GE** (2x4) courses **(Total= 12)**		Dissertation on Major/Minor (4+2) OR Academic Project/ Entrepreneurship **(4+2)**		22
Students on exit shall be awarded Bachelor of (field of study) (Honours with Research or Honours with Academic project/Entrepreneurship) Discipline after securing requisite 176 credits on completion of semester VIII						**Total credits= 176**

STUDY & EVALUATION SCHEME
Choice Based Credit System

Certificate in Computer Application (CCA)

1st Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Discipline Specific core	BCADSC101	Programming in 'C'	3	-	-	3	30	70	100
2	Discipline Specific core	BCADSC102	Computer Fundamental & Information Technology	3	-	-	3	30	70	100
3	Discipline Specific core	BCADSC103	Mathematical Foundation of Computer Science	4	-	-	4	30	70	100
4	Generic Elective		Select from the list of Generic Elective subjects	4	-	-	4	30	70	100
5	Skill enhancement		Select from the list of Skill enhancement subjects	2	-	-	2	30	70	100
6	Ability enhancement		Select from the list of Ability enhancement subjects	2	-	-	2	30	70	100
7	Value Addition course		Select from the list of Value Addition course subjects	2	-	-	2	30	70	100
Practical										
8	Major/Core	BCAP11	Programming in 'C' Lab	-	-	2	1	30	70	100
9	Major/Core	BCAP12	Computer Fundamental Lab	-	-	2	1	30	70	100
			Total	**20**	**-**	**4**	22	**270**	**630**	**900**

2nd Semester

S. No	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (INT)	External (ESE)	
Theory										
1	Discipline Specific core	BCADSC201	Data Structure & File Organization	3	-	-	3	30	70	100
2	Discipline Specific core	BCADSC202	Core Java	3	-	-	3	30	70	100
3	Discipline Specific core	BCADSC203	Digital Electronics	3	1	-	4	30	70	100
4	Generic Elective		Select from the list of Generic Elective subjects	4	-	-	4	30	70	100
5	Skill enhancement		Select from the list of Skill enhancement subjects	2	-		2	30	70	100
6	Ability enhancement		Select from the list of Ability enhancement subjects	2	-	-	2	30	70	100
7	Value Addition course		Select from the list of Value Addition course subjects	2	-	-	2	30	70	100
Practical										
8	Core	BCAP21	Data Structure & File Organization Lab	-	-	2	1	30	70	100
9	Core	BCAP22	Core Java Lab	-	-	2	1	30	70	100
			Total	**19**	**1**	**4**	**22**	**270**	**630**	**900**
Exit option with **Certificate in Computer Applications** (with the completion of courses equivalent to a minimum of **44 credits**) + **4** Exit Credits				**Total Credits (Ist & IInd Sem)**			**44**	**Total Marks (Ist & IInd Sem)**		**1800**

Diploma in Computer Application (DCA)

[CCA & 2nd year]

3rd Semester

S. No	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Discipline Specific core	BCADSC301	Computer Networks	3	-	-	3	30	70	100
2	Discipline Specific core	BCADSC302	Web Programming	3	-	-	3	30	70	100
3	Discipline Specific core	BCADSC303	System Analysis & Design	3	1	-	4	30	70	100
4	Generic Elective		Select from the list of Generic Elective subjects	4	-	-	4	30	70	100
5	Skill enhancement		Select from the list of Skill enhancement subjects	2	-	-	2	30	70	100
6	Ability enhancement		Select from the list of Ability enhancement subjects	2	-	-	2	30	70	100
7	Value Addition course		Select from the list of Value Addition course subjects	2	-	-	2	30	70	100
Practical										
8	Major/ Core	BCAP31	Computer Networks Lab	-	-	2	1	30	70	100
9	Major/ Core	BCAP32	Web Programming Lab	-	-	2	1	30	70	100
			Total	**19**	**1**	**4**	**22**	**270**	**630**	**900**

4th Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Discipline Specific core	BCADSC401	Database Management System	3	-	-	3	30	70	100
2	Discipline Specific core	BCADSC402	Operating System	3	-	-	3	30	70	100
3	Discipline Specific core	BCADSC403	Software Engineering	3	1	-	4	30	70	100
4	Generic Elective		Select from the list of Generic Elective subjects	4	-	-	4	30	70	100
5	Skill enhancement		Select from the list of Skill enhancement subjects	2	-	-	2	30	70	100
6	Ability enhancement		Select from the list of Ability enhancement subjects	2	-	-	2	30	70	100
7	Value Addition course		Select from the list of Value Addition course subjects	2	-	-	2	30	70	100
Practical										
8	Major/Core	BCAP41	Database Management Systems Lab	-	-	2	1	30	70	100
9	Major/Core	BCAP42	UNIX Lab	-	-	2	1	30	70	100
			Total	**19**	**1**	**4**	**22**	**270**	**630**	**900**
Exit option with **Diploma in Computer Applications** (with the completion of courses equivalent to a minimum of 88 credits) + 4 Exit Credits				**Total Credits (Ist to IVth Sem)**			**88**	**Total Marks (Ist to IVth Sem)**		**3600**

Bachelor in Computer Application (BCA)

[DCA & 3rd year]

5th Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Discipline Specific core	BCADSC501	Python Programming	3	-	-	3	30	70	100
2	Discipline Specific core	BCADSC502	PHP Programming	3	-	-	3	30	70	100
3	Discipline Specific core	BCADSC503	Artificial Intelligence	3	1	-	4	30	70	100
4	Discipline Specific Elective	BCADSE504A	Statistics/ MOOC	4	0	-	4	30	70	100
		BCADSE504B	Operations Research/ MOOC							
5	Generic Elective		Select from the list of Generic Elective subjects	4	0	-	4	30	70	100
Practical										
6	Major/Core	BCAP51	Python Programming Lab	-	-	2	1	30	70	100
7	Major/Core	BCAP52	PHP Programming Lab	-	-	2	1	30	70	100
8	Skill Enhancement	BCASM5	Seminar	-	-	4	2	30	70	100
			Total	**17**	**1**	**8**	**22**	**270**	**560**	**800**

6th Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Discipline Specific core	BCADSC601	Advance Java Programming	3	-	-	3	30	70	100
2	Discipline Specific core	BCADSC602	Android Programming	3	-	-	3	30	70	100
3	Discipline Specific core	BCADSC603	Advance Software Engineering	3	1	-	4	30	70	100
4	Discipline Specific Elective	BCADSE604A	Introduction to IOT/ MOOC	4	-	-	4	30	70	100
		BCADSE604B	Introduction to Blockchain/ MOOC							
5	Generic Elective		Select from the list of Generic Elective subjects	4	-	-	4	30	70	100
Practical										
6	Major/Core	BCAP61	Advance Java Programming Lab	-	-	2	1	30	70	100
7	Major/Core	BCAP62	Android Programming Lab	-	-	2	1	30	70	100
8	Skill Enhancement	BCAPR6	Project	-	-	4	2	30	70	100
			Total	**17**	1	**8**	**22**	**240**	**560**	**800**
Exit Option with Bachelor of Computer Applications Degree, BCA Degree (with completion of courses equivalent to a minimum of 132 credits)				**Total Credits (Ist to VIth Sem)**			**132**	**Total Marks (Ist to VIth Sem)**		**5200**

Bachelor in Computer Application (Honors with Research/ Academic Project/ Entrepreneurship)

[BCA & 4th year]

7th Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Discipline Specific core	BCADSC701	Data Science using Python	3	-	-	3	30	70	100
2	Discipline Specific Elective	BCADSE702A	Research Methodology	3	1	-	4	30	70	100
		BCADSE702B	Software Project Management – I							
		BCADSE702C	Entrepreneurship - I							
3	Discipline Specific Elective	BCADSE703A	Data Ware Housing & Data Mining/ MOOC	4	-	-	4	30	70	100
		BCADSE703B	Advance RDBMS/ MOOC							
4	Discipline Specific Elective	BCADSE704A	Multimedia System/ MOOC	4	-	-	4	30	70	100
		BCADSE704B	Network Security & Cryptography/ MOOC							
Practical										
5	Major/Core	BCAP71	Data Science Lab	-	-	2	1	30	70	100
6	Project	BCAPR7	Research/ Academic/ Entrepreneurship Project – I	-	-	12	6	30	70	100
			Total	**14**	**1**	**14**	**22**	**180**	**420**	**600**

8th Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Discipline Specific core	BCADSC801	C# Programming with .Net framework	3	-	-	3	30	70	100
2	Discipline Specific Elective	BCADSE802A	Research Ethics	3	1	-	4	30	70	100
		BCADSE802B	Software Project Management – II							
		BCADSE802C	Entrepreneurship - II							
3	Discipline Specific Elective	BCADSE803A	Machine Learning/ MOOC	4	-	-	4	30	70	100
		BCADSE803B	Cloud Computing/ MOOC							
4	Discipline Specific Elective	BCADSE804A	Algorithm Analysis & Design/ MOOC	4	-	-	4	30	70	100
		BCADSE804B	Computer Graphics/ MOOC							
Practical										
5	Major/Core	BCAP81	C# . Programming Lab	-	-	2	1	30	70	100
6	Project	BCAPR8	Research/ Academic/ Entrepreneurship Project – II	-	-	12	6	30	70	100
			Total	**14**	**1**	**16**	**22**	**180**	**420**	**600**
Exit Option with **Bachelor of Computer Applications (Honors with Research/ Academic Project/ Entrepreneurship)** with completion of courses equivalent to a minimum of 176 credits.				**Total Credits (Ist to VIIIth Sem)**			**176**	**Total Marks (Ist to VIIIth Sem)**		**6400**

Discipline Specific Core

Discipline Specific core

Couse Code	Course Name	L	T	P	C
BCADSC101 BCAP11	Programming in 'C' Programming in 'C' Lab	3	-	1	4
BCADSC102 BCAP12	Computer Fundamental & Information Technology Computer Fundamental Lab	3	-	1	4
BCADC103	Mathematical Foundation of Computer Science	4	-	-	4
BCADSC201 BCAP21	Data Structure & File Organization Data Structure & File Organization Lab	3	-	1	4
BCADSC202 BCAP22	Core Java Core Java Lab	3	-	1	4
BCADSC203	Digital Electronics	3	1	-	4
BCADSC301 BCAP31	Computer Networks Computer Networks Lab	3	-	1	4
BCADSC302 BCAP32	Web Programming Web Programming Lab	3	-	1	4
BCADSC303	System Analysis & Design	3	1	-	4
BCADSC401 BCAP41	Database Management System Database Management Systems Lab	3	-	1	4
BCADSC402 BCAP42	Operating System UNIX Lab	3	-	1	4
BCADSC403	Software Engineering	3	1	-	4
BCADSC501 BCAP51	Python Programming Python Programming Lab	3	-	1	4
BCADSC502 BCAP52	PHP Programming PHP Programming Lab	3	-	1	4
BCADSC503	Artificial Intelligence	3	1	-	4
BCADSC601 BCAP61	Advance Java Programming Advance Java Programming Lab	3	-	1	4
BCADSC602 BCAP62	Android Programming Android Programming Lab	3	-	1	4
BCADSC603	Advance Software Engineering	3	1	-	4
BCADSC701 BCAP71	Data Science using Python Data Science Lab	3	-	1	4
BCADSC801 BCAP81	C# Programming with .Net framework C# Programming Lab	3	-	1	4
	Total Credits	**61**	**05**	**14**	**80**

Course code	**: BCADSC101**				
Course Name	**: PROGRAMMING IN 'C'**				
Semester /Year	**: 1st Semester / 1st Year**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Understand the basics of Programming Paradigms,
2. To learn the basic concepts and syntax of C programming.
3. To be able to develop logics which help them to create programs and applications using C language.
4. To learn the use of C libraries functions in C language.
5. To learn the file handling and basic memory allocation concepts in C language.
6. After learning the C programming they can easily switch over to any other language

COURSE CONTENTS

UNIT-I **[No. of Hours: 7]**

History of 'C' Programming, Types of Programming Languages. Introduction to C and structure of 'C' Program, some simple C programs, Desirable program characteristics. C Fundamentals- C character Set, Identifiers and keywords, datatypes, constants, variables and arrays, Declarations, expressions, statements, Symbolic constants.

UNIT –II **[No. of Hours: 10]**

Operators and expressions- Arithmetic operators, unary operator, Relational and logical operators, assignment operators, conditional operators, Library Functions. Data Input and Output- Preliminaries, singe character input, singe character output, entering input data, writing output data, the gets and puts function. Precedence and associatively of operators, Side effects, Type conversion, Managing input and output.

UNIT-III **[No. of Hours: 10]**

Control Statements- Preliminaries, Branching, Looping, Nested control statements, switch statement, break statement, the continue statement. Arrays: Defining an array, processing an array, passing arrays to functions, Multidimensional arrays, Arrays and strings. **Functions:** A brief overview, defining a function, accessing a function, function prototypes, passing arguments to a function, recursion. Storage classes.

UNIT-IV **[No. of Hours:6]**

Pointers- Fundamentals, Pointer declarations, Passing pointers to the functions, pointers and one-dimensional array, dynamic memory allocation, Operations on pointers, arrays of pointers. Pointer to Pointer, call by value call by reference, pointer to function.

UNIT-V **[No. of Hours: 7]**

Structure &Union: Declaration & Initialization of Structure & Union, Array of Structure, passing structure to a function, union and array as member, of union, concept of memory saving and union.

Data files- Opening and closing a data file, creating a data file, processing a data file, unformatted data files. Command line argument in 'C'.

Text Books:

TB1. Pointers in C, KanetkarY.P. , BPB Publications
TB2. Kanetkar Y.P., Let us C, BPB Publications

Reference Books:

RB1. The C programming language, Kernighan and Ritchie, PHI
RB2. The Spirit of C, Cooper Mullish, Jaico Publishing House, Delhi

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Identify the basic concepts of C programming language & improve the understanding, remembering of using data types, variables and arithmetic operations in C programming.
CO2	Understanding Array String, Functions concepts and implement array and string using functions.
CO3	Apply the concept of pointer & preprocessor directives. In addition, resolve real world problems Able to design and develop various programming problems using C programming concepts.
CO4	Analyze the concepts of structure and union & dynamic memory allocation by using malloc and calloc function etc.
CO5	Evaluate file handling using C Programming language.
CO6	plan a project using C programming language.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	1	1	1					
CO2	2	2	1	1	1	1	1					
CO3	1	2	2	2	1	1	1	1				
CO4	1	2	2	2	1	1	1					
CO5	2	1	1		1	1	1	2				
CO6			1		2	2	3					
AVG	1.3	1.3	1.5	1.1	1.1	1.1	1.3	0.5				

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP11 (Practical based on BCADSEC101)**				
Course Name	**: PROGRAMMING IN C LAB**				
Semester / Year	**: 1st Semester / 1st Year**				
		L	**T**	**P**	**C**
		0	**0**	**2**	**1**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To understand basic concepts of C programming, operators and expressions.
2. To learn the Concept of Various Decision Control statements and loops.
3. To understand the Concept of Arrays and String Operations.
4. To understand Concept of Functions, Pointers, Structure, Union and Enumeration.
5. To understand Concept of File Handling

COURSE CONTENTS

- Simple Program based on operators
- Simple Program based on Loops
- Program based on arrays
- Program based on strings
- Program based on function
- Program based on pointers
- Program based on structure & union
- Program based on File handling

Course Outcomes (CO):
After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Simple programs to understand & create the concepts of data types, operations and expressions.
CO2	By analyze and applying conditional and control statements.
CO3	Implementing Concept of array and String to solve problem.
CO4	Analyze and Implementation of functions, pointers, operation on pointers and dynamic storage allocation.
CO5	Defining, applying and handling structures, array of structures, union and processing data
CO6	To create a project using c programming language.

CO-PO Mapping:

CO	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	3	2	1					
CO2	2	2	3	2	3	1	2	1				
CO3	1	3	3	2	2	1	1	1			1	
CO4	1	2	3	2	2	1	2	1			1	
CO5	3	1	2	2	2	1	2	1				
CO6			1		2	2	3					
AVG	**1.5**	**1.5**	**2.5**	**1.6**	**2.3**	**1.3**	**1.8**	**0.6**			**0.3**	

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	: **BCADSC102**				
Course Name	: **COMPUTER FUNDAMENTAL & INFORMATION TECHNOLOGY**				
Semester /Year	: **1st Semester / 1st Year**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To provide understanding of the various components and functional units of computers, their design and working.
2. To provide insight into digital systems and logic circuit design.

COURSE CONTENTS

UNIT I Introduction to Computers **[No. of Hours: 8]**

Generation of Computer, Hardware Components, Memory Devices, Magnetic Disk, Floppy Disk, Compact Disc/ DVD; Input Devices- Keyboard, Mouse, Scanner, OCR, OMR, MICR. Output Devices- Printer, Types of Printer, Plotter, Monitor: CRT; Central Processing Unit, CPU- Arithmetic Logic Unit, Control Unit, Instruction Set, Registers, Processor Speed, Type Of Processors; Memory- Main Memory Organization, Main Memory Capacity, RAM, ROM, EPROM, PROM, Cache Memory, OCR, OMR, MICR.

UNIT II Number Systems **[No. of Hours: 6]**

Number Systems: Binary, Decimal, Octal, Hexadecimal, Binary Arithmetic, Character Codes (BCD), Excess-3, Gray Code, ASCII

UNIT III –System Software and Application Software **[No. of Hours: 10]**

System software, utility packages, compilers, interpreters, Operating Systems, Elementary commands of DOS, Booting.

Application softwares– word-processing, spreadsheet, presentation graphics, Data Base Management Software, Characteristics, Virus- working, features, types of viruses, virus detection prevention and cure.

UNIT IV - Programming Languages and Algorithms **[No. of Hours: 8]**

Generation of Languages: Machine language, Assembly languages, High level languages, Language translators (Compiler, Interpreter, Assembler) , Syntax error, Logical error, runtime error, General concepts of OOPS (Object oriented programming), Structured Query Language Algorithm development, techniques of problem solving- Flowchart, Pseudo-code, Decision trees, Programming paradigms: Top-down, bottom-up etc.

UNIT V – Computer Network & Communication Technologies **[No. of Hours: 8]**

Communication system elements, communication modes (simplex, half duplex and full duplex analog and digital, synchronous and Asynchronous, Communication media: wired and wireless, LAN WAN, MAN, network topologies.

Text Books:

TB1. Pradeep K. Sinha, Priti Sinha, "Computer Fundamentals". BPB Publications.
TB2. Rajaraman, V., "Fundamental of Computers". Prentice Hall India, New Delhi
TB3. Dorothy House(2015), "Microsoft Word, Excel, and PowerPoint: Just for Beginners. Outskirts
TB4. Press 2 Peter Norton(2017), "Introduction to Computers",4th Edition, TMH Ltd, New Delhi.

Reference Books:

RB1. Sanders D.H, Computers Today

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Describe the knowledge of basic components of computer systems and its functionality.
CO2	Understand the classification of various types of memory in computer and concept of input and output devices and.
CO3	Solve the number systems by applying various types of conversion techniques and their representations.
CO4	Illustrate an operating system by analyzing its working learn basic word processing, spreadsheet and presentation graphics and learn about various viruses and prevention from them.
CO5	Evaluate various problem solving techniques like algorithm, flowchart etc. and Learn generation of languages, basic concepts of OOPs, SQL etc.
CO6	Design and Develop computer network and various communication modes, communication media like LAN, MAN, WAN etc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1			1						1	1	1
CO2	2				1		1	1		1	1	1
CO3	2	1	1	3	1	1		1		1	1	1
CO4	3	2	2	2	1	2	1	2	1	1	1	1
CO5	3	1	1	2	2	2	2	3	2	2	2	2
CO6	3	1	1	2	2	2	2	3	2	2	2	2
AVG	**2.3**	**0.8**	**0.8**	**1.6**	**1.1**	**1.1**	**1**	1.6	0.8	1.3	1.3	1.3

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP12 (Lab based on BCADSC102)**				
Course Name	**: COMPUTER FUNDAMENTAL LAB**				
Semester / Year	**: 1st Semester / 1st Year**				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To provide understanding of the various components and functional units of computers, their design and working.
2. To provide insight into digital systems and logic circuit design.

COURSE CONTENTS

- Various Components of Computer
- Internal And External DOS Commands
- Windows Operating System
- MS Word
- MS Excel
- MS Power Point
- Web Browser and E-mail

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Name, define, find, relate, show the basics of computer
CO2	Illustrate, outline, show, summarize word processing techniques
CO3	Implement or apply word processing using spread sheets
CO4	Analyze, compare examine the MS-Office techniques
CO5	Assess MS-office tools and techniques
CO6	Build, Design, develop new spreadsheets, PowerPoint presentation, word documents for give problem or case study

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2			1						
CO2	3	3	2	2								
CO3	3	3	2		1							
CO4	2	3	3									
CO5	3	3	3			2						
CO6	3	3	3	2	1	1						
AVG	**2.8**	**3**	**2,5**	**0.6**	**0.3**	**0.6**						

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC103**				
Course Name	**: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE**				
Semester /Year	**: 1st Semester / 1st Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Know the basic principle of set theory, relations, function and its operations.
2. Able to Understand the concepts of groups, and elementary properties of Rings and Fields.
3. Learn the logical notation and determine if the argument is or is not valid in preposition and predicate logic.
4. Learn the representation of lattices with POSET.
5. Learn the concepts of graphs, trees and it's traversal, and recurrence relations.

COURSE CONTENTS

UNIT I **[No. of Hours: 8]**

Set Theory: Set, Subset, Operation on sets, DeMorgan's Law, Power set of set. Matrices: Matrices operations, Transpose, Inverse and power of Matrices.

UNIT II **[No. of Hours: 8]**

Relation: Type and compositions of relations, Pictorial representation of relations, Equivalence relations, Partial ordering relation. Function: Types, Composition of function, Recursively defined function.

UNIT III **[No. of Hours: 8]**

Mathematical Induction: Piano's axioms, Mathematical Induction, Discrete Numeric Functions and Generating functions, Simple Recurrence relation with constant coefficients, Linear recurrence relation without constant coefficients, Asymptotic Behaviour of functions

UNIT IV **[No. of Hours: 8]**

Algebric Structures: Properties, Semi group, monoid, Group, Abelian group, properties of group, Subgroup, Cyclic group, Cosets, Permutation groups.

UNIT V **[No. of Hours: 8]**

Prepositional Logic: Preposition, First order logic, Basic logical operations, Tautologies, Contradictions, Algebra of Proposition, Logical implication, Logical equivalence, Normal forms, Inference Theory, Predicates and quantifiers, Posets, Hasse Diagram.

Text Books:

TB3. Kenneth H. Rosen, "Discrete Mathematics and its applications', TMH.
TB4. Liptschutz, Seymour, "Discrete Mathematics", TMH.".

Reference Books:

RB1. Hopcroft J.E. Uliman J.D., "Introduction to Automata Theory, Language and Computation" Narosa Pub. House, New Delhi.

RB2. C.L.Liu "Elements of Discrete Mathematics", McGraw Hill.

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Illustrate the basic concepts of sets, matrices
CO2	Understand the various concepts of relations and functions
CO3	Teach to use mathematical induction to solve various linear and non-linear, asymptotic behaviour of a function etc.
CO4	Analyse and illustrate representation of lattices and be able to determine their properties with Boolean algebra.
CO5	Able to evaluate the use Algebraic Structures like various types of groups and permutation groups
CO6	design posset and hasse diagrams and solve various types of logic by using prepositional logic

CO-PO Mapping:

	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1		1		2	1					1
CO2	1	1		2	1	1	2					1
CO3	1	2	2	2	2	1	2	1				2
CO4	2	1		2		2	1	1				1
CO5	1	3	2	1	1	2	1	1				2
CO6	1	3	2	1	2	2	2	2	1	1	1	1
AVG	**1.1**	**1.8**	**1**	**1.5**	**1**	**1.6**	**1.5**	**0.8**	**0.1**	**0.1**	**0.1**	**1.3**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	:	**BCADSC201**			
Course Name	:	**DATA STRUCTURE & FILE ORGANIZATION**			
Semester / Year	:	**2nd Semester / 1st Year**			
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To learn basic knowledge about data structure and arrays.
2. To learn how to create and use linked list and its applications.
3. To learn the importance of static and dynamic use of stack and queues.
4. To learn the basic terminology of trees.
5. To learn basics of sorting and searching techniques

COURSE CONTENTS

UNIT I

[No. of Hours: 6]

Introduction: Basic Terminology, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time-Space trade-off. Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered list, Sparse Matrices, and Vector.

UNIT II

[No. of Hours: 8]

Link List: Representation and implementation of Singly linked lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List of Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.

UNIT III

[No. of Hours: 8]

Stacks: Array Representation and Implementation of stack, Operations and Stacks: Push and POP, Array Representation of Stack, Linked Representation of stack, Operations Associated with Stacks, Application of stack, Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Recursion: Recursive definition and processes. Queues: Array and linked representation and implementation of queues, Operations on Queue; Create, Add, Delete, Full and Empty, Circular queue, Dequeue and Priority Queue.

UNIT IV

[No. of Hours: 10]

Trees: Basic terminology, Binary Tree, Binary tree representation algebraic Expressions, Complete Binary Tree, Extended Binary Tree, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees. Tree traversing, Threaded Binary tree, Huffman algorithm. Searching and Hashing: Sequential search, comparison and analysis, Hash Table, Hash Function, Collection Resolution Strategies, Hash Table Implementation.

UNIT V **[No. of Hours: 8]**

Sorting: Insertion Sort, Bubble sorting, Quick Sort, Two way Merge Sort, Trees: Binary Search (BST), Insertion and Deletion in BST.

Text Books:

TB1. Lipschutz, "Data Structure", TMH

Reference Books:

RB1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia

RB2. R. Kruseetal, "Data Structures and Program Design in C" Pearson Education

COURSEOUTCOMES(CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Able to understand& remember basics of C programming language and arrays & able to apply basic concepts of linked list & its types
CO2	Able to understand & apply basic concepts of stack and queues through array and linked list
CO3	To understand & apply the basic knowledge of Binary trees & its representation, traversing in BST, Threaded binary tree, Huffman algorithm etc.
CO4	Able to understand the concepts of sorting and searching & Hashing techniques.
CO5	Apply the basic knowledge of to implement File Structure
CO6	Create the structure of stack, queues, trees etc. using array and linked list.

CO-PO Mapping:

	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1		1							
CO2	2	2	1		1		1					
CO3	2	1	2		2		1					
CO4	2	1	1	1		1	1					
CO5	2	1		1		2	1					
CO6	2	2	2	2	2	1	1					
AVG	**2**	**1.3**	**1.4**	**1.3**	**1.5**	**1.3**	**1.0**					

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	:	**BCAP21 (Lab based on BCADSC201)**			
Course Name	:	**DATA STRUCTURE & FILE ORGANIZATION LAB**			
Semester / Year	:	**2nd Semester / 1st Year**			
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To learn how to design the algorithms to solve the programming problems.
2. To learn how to discriminate the usage of various structures in approaching the problem solution.
3. To learn how to use effective and efficient data structures in solving various Computer Engineering domain problems
4. To learn how to analyse the problems to apply suitable algorithm and data structure.
5. To learn how to use appropriate algorithmic strategy for better efficiency

COURSE CONTENTS

- Program based on arrays
- Program based on strings
- Program based on Link List & types of Link List
- Program based on stack
- Program based on Queues
- Program based on Trees
- Program based on different types of sorting

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Analyze & understand the difference between linear and non linear DS &
CO2	Implement array & link list and its types
CO3	Understand and implement stack and queues using array and link list
CO4	Understand and implement BST, addition and deletion of nodes, Huffman algorithm etc.
CO5	To implement different sorting techniques like selection Bubble, insertion, merge quick sort etc.
CO6	To create the data using linked list.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2				1					
CO2	3	1	2			1	1					
CO3	3	2	3	1	1	2	2					
CO4	1	1	3	1		2	2					
CO5	1	1	3	1		1	2					
CO6		2	3	1	1	2	3					
AVG	**1.6**	**1.6**	**2.6**	**0.6**	**0.3**	**1.3**	**1.8**					

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC202**				
Course Name	**: CORE JAVA**				
Semester / Year	**: 2nd Semester / 1st Year**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To learn why Java is useful for the design of desktop and web applications.
2. To learn how to implement object-oriented designs with Java.
3. To identify Java language components and how they work together in applications.
4. To design and program stand-alone Java applications.

COURSE CONTENT

Unit I **[No. of Hours: 8]**

Introduction to Java programming–Java Buzzword, The Java Virtual Machine, Variables and data types, Operators and Expressions- Introduction, Arithmetic Operators, Relational Operators Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversion and Associativity,

Unit II **[No. of Hours: 8]**

Decision Making and Branching- Introduction, Decision Making with if Statement, Simple if Statement, The if…..else Statement, Nesting of if .Else Statements, The else if Ladder, The Switch Statement, The ?: Operator. Decision Making and Looping – Introduction, while Statement, do Statement, for Statement, Jumps in Loops Labeled Loops

Unit III **[No. of Hours: 8]**

Classes, Objects and Methods- Introduction, Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods, Inheritance- Types of inheritance single, multiple, multi-level, hierarchical, Interfaces, Extending a Class Overriding Methods, Final Variables and Methods, Finalizer methods, Abstract Methods and Classes, Visibility Control. Arrays, Strings and Vectors- Arrays, One-dimensional Arrays, Creating an Array, Two -Dimensional Arrays, Creating an Array, Two – dimensional Arrays, Strings, Vectors, Wrapper Classes.

Unit IV **[No. of Hours: 8]**

Multithreaded Programming- Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a thread, Life Cycle of a thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface. Packages - Using a Package, Adding a Class to a Package, Exceptions Handling - Introduction, Types of Exception Handling Code, Multiple Catch Statements, Using Finally Statement,

Unit V **[No. of Hours: 8]**

Applet Programming - Introduction, How Applets Differ from Applications, , Applet Life Cycle, Creating Applet Tag, Adding Applet to HTML File, running the Applet, Input/OutputFiles in JAVA:- Introduction, Concept of Streams, Stream Classes, Byte Stream Classes, Character Stream Classes, Using Streams, Using the File Class

Text Books:

TB1. A. Balaguruswamy, "Programming with JAVA", A Primer, TMH, 1999.

Reference Books:

RB1. Thomas Boutel, "CGI programming in C and Perl", Addison – Wesley, 1996.
RB2. Jefry Dwight et al, Using CGI, Second Edition, Prentice Hall, India, 1997.
RB3. Patrick Naughton& Herbert Schildt, JAVA 2: The Complete Reference, THM, 1999.
RB4. Schildt, "JAVA The Complete Reference", 7th Edition.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Understand the object-oriented concepts
CO2	Implement multi-threading programs
CO3	Implement Exception handling
CO4	Develop GUI based applications
CO5	Understand file handling
CO6	Design program based on files

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					2						
CO2	2	2		1			2		2	2	1	
CO3	1		3		2	2						
CO4	2	2										
CO5	1			2								
CO6	1	1	2	2	2	2						
AVG	**2.0**	**0.83**	**0.83**	**0.83**	**0.66**	**1.0**	**0.4**		**0.4**	**0.4**	**0.2**	

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP22 (Lab based on BCADSC 202)**				
Course Name	**: CORE JAVA LAB**				
Semester / Year	**: 2nd Semester / 1st Year**				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To teach the students basics of JAVA programs and its execution.
2. To teach the students the differences between C++ and Java programming.
3. To make the students learn concepts like packages and interfaces.
4. To make the students understand threads.
5. To make the students understand the usage util package.
6. To teach the student, to develop java programs using inheritance and interfaces.
7. To understand exceptional handling, command line arguments and file handling

Course Outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Define basic data types and class objects and understand multithreading
CO2	Understand exception handling
CO3	Compare and contrast method overloading with method overriding
CO4	Implement event handling
CO5	Create java applet
CO6	Plan java applets

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					2						
CO2		2		2			2	2				
CO3			2		1							
CO4				2								
CO5		2			2							
CO6	1	1	2			2						
AVG	0.7	0.8	0.7	0.8	0.6	0.7	0.4	0.4				

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC203**				
Course Name	**: DIGITAL ELECTRONICS**				
Semester / Year	**: 2nd semester / 1st year**				
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
3. To implement simple logical operations using combinational logic circuits.
4. To design combinational logic circuits, sequential logic circuits.

COURSE CONTENTS

Unit 1 **[No. of Hours: 6]**

Binary Systems and Logic Circuits: The Advantage of Binary, Number Systems- Binary, Octal, Decimal and Hexadecimal. Conversions between number systems. Use of Binary in Digital Systems, Logic Gates, Logic Family Terminology.

Unit 2 **[No. of Hours: 6]**

Binary Arithmetic: Binary Addition, Subtraction, Multiplication and Division. Complements, Representation of Signed and Unsigned numbers – Signed magnitude , Signed 1's Complement, Signed 2's complement, Decimal subtraction using 9's and 10's complement, Binary subtraction using 1's and 2's complement.

Unit 3 **[No. of Hours: 8]**

Boolean Algebra and Mapping Methods: Boolean Algebra, SOP and POS forms of representation, minterms and maxterms, Simplification of logic functions by theorems and Karnaugh's map, don't care conditions, Realizing Logic Function with Gates, Combinational Design Examples.

Unit 4 **[No. of Hours: 10]**

Combinational Logic: Adders- Half adder and full adders, Subtractors- Half and Full Subtractors, Encoders and Decoders, Multiplexers and De-multiplexers.

Unit 5 **[No. of Hours: 10]**

Sequential Logic: Latch, Flip Flops- SR, Data, JK & Toggle

Registers: Serial-in-Serial-Out, Serial-in-Parallel-Out, Parallel-in-Serial-Out, Parallel-in-Parallel-Out Shift registers

Counters- Synchronous and Asynchronous/ Ripple counters, Design of Ripple counter - Modulo-n counter.

Text Books:

TB5. M. M. Mano, Digital Design, 3rd ed., Pearson Education, Delhi, 2003.

TB6. D.P. Leach, Malvino, Guha, Digital Principles and Applications, TMH, New Delhi, 2011.

Reference Books:

RB1. T. L. Floyd and Jain, Digital Fundamentals, Pearson Education, 2003.
RB2. R.J. Tocci and N.S. Widner, Digital Systems - Principles & Applications, PHI, 10th Ed., 2007

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Recall the advantages of binary systems and understand different number systems (binary, octal, decimal, hexadecimal). Recall the properties of logic gates and different logic family terminologies. Recall binary arithmetic operations, such as addition, subtraction, multiplication, and division. Recall the representations of signed and unsigned numbers, including signed magnitude, signed 1's complement, and signed 2's complement.
CO2	Explain the significance of binary systems in digital systems. Demonstrate understanding of Boolean algebra and its application in logic circuits. Understand and interpret minterms, maxterms, and Boolean expressions. Explain the concepts and applications of encoders, decoders, multiplexers, and demultiplexers.
CO3	Apply the conversion techniques between different number systems. Apply binary arithmetic operations and perform conversions between different number representations. Apply Boolean algebra theorems and Karnaugh's map for logic function simplification. Design and implement combinational circuits using logic gates and multiplexers.
CO4	Analyze complex logic functions and simplify them using Boolean algebra theorems and Karnaugh's map. Analyze the behavior and functionality of different types of flip-flops and registers. Analyze the operation of synchronous and asynchronous counters.
CO5	Evaluate the correctness and efficiency of logic circuit designs. Evaluate the suitability of different logic gates and components for specific applications. Evaluate the performance and limitations of sequential circuits. Critically evaluate the design choices made for combinational and sequential circuits.
CO6	Design and create combinational logic circuits to solve specific problems. Design and implement sequential circuits using flip-flops, registers, and counters.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	2	2	1	3	1	2	1	1
CO2	3	1	1	1	2	2	1	3	1	2	1	1
CO3	2	1	2	2	2	2	2	2	2	2	1	1
CO4	1	2	2	3	2	2	2	2	2	2	1	2
CO5	1	2	1	2	3	2	2	2	1	2	1	2
CO6	1	2	2	2	2	3	2	2	1	2	1	2
AVG	**1.83**	**1.5**	**1.5**	**1.83**	**2.17**	**2.17**	**1.67**	**2.33**	**1.33**	**2**	**1**	**1.5**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC301**				
Course Name	**: COMPUTER NETWORKS**				
Semester / Year	**: 3rd Semester / 2nd Year**				
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Build an Understanding of the Fundamental Concepts of Computer Networking.
2. Familiarize the Student with the Basic Taxonomy and Terminology of the Computer Networking Area.
3. Introduce the Student to Advanced Networking Concepts
4. Preparing the Student for Advanced Courses in Computer Networking.

COURSE CONTENTS

Unit I **[No. of Hours: 8]**

Introductory Concepts: Goals and Applications of Networks, Network structure and transmission, switching methods, Integrated services digital networks, terminal handling.

Unit II **[No. of Hours: 8]**

Medium Access sub Layer: Channel allocations, LAN protocols, ALOHA Protocols-Pure Aloha, slotted ALOHA, Carrier Sense Multiple Access Protocols, CSMA with Collision Detection, Collision free Protocols, IEEE standards, FDDI, Data Linked Layer elementary data link protocols, sliding windows protocols, error handling, High Level Data Link Control.

Unit III **[No. of Hours: 8]**

Network Layer: Point-to Point networks, routing algorithms, congestion control algorithms, internetworking, TCP/IP packet, IP addresses, Ipv6.

Unit IV **[No. of Hours: 8]**

Transport Layer: Design issues, connection management, TCP window Management, User Datagram Protocol, Transmission Control Protocol.

Unit V **[No. of Hours: 8]**

Application Layer: Network Security, DES, RSA algorithms, Domain Name System, Simple Network Management Protocol, Electronic mail, File Transfer Protocol, Hyper Text Transfer Protocol, Cryptography and compression Techniques.

Text Books:

TB1. Forouzan, "Data Communication and Networking:. TMH
TB2. A.S. Tanenbaum, "Computer Networks, 3rd Edition," PHI

Reference Books:

RB1. Comer, "Internetworking with TCP/IP" PHI
RB2. Comer, "Computer networks & Inter" PHI

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Define and state the functions of each layer in the OSIreference model and TCP/IP protocol suite while illustrating the process of data encoding and multiplexing.
CO2	Explain the fundamentals of data communication andnetworking identify the topologies and connecting devices of networks
CO3	Identify the appropriate MAC layer/ data link layerprotocols for the given network
CO4	Classify IPv4& IPv6 protocols, along with their characteristics and functionality.
CO5	Evaluate and implement routing algorithms and multicasting.
CO6	Adapt transport and application layer protocols along with concepts of mobility and security in networks

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3								
CO2	3	3	2	3								
CO3	3	3	2	3								
CO4	3	3	2									
CO5	3	3	2	3		2				2		
CO6	3	3	3	3	3	2				2		
AVG	**3**	**3**	**2.5**	**2.5**	**0.5**	**0.6**	**0**	**0**	**0**	**0.6**	**0**	**0**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP31 (Lab based on BCADSC301)**				
Course Name	**: COMPUTER NETWORKS LAB**				
Semester / Year	**: 3rd Semester / 2nd Year**				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To teach various networking commands to students
2. To teach Cisco Packet Tracer to students.

COURSE CONTENTS

Part1 : Networking Commands **[No. of Hours:10]**

1. Ping, tracert, arp, pathping, getmac, hostname etc. networking commands.

Part2 : Cisco Packet Tracer **[No. of Hours:10]**

2. Bus Topology
3. Star Topology
4. Ring Topology
5. Hybrid Topology
6. Configuring a router in a network

Text Books:

TB1. Forouzan, "Data Communication and Networking:. TMH
TB2. A.S. Tanenbaum, "Computer Networks, 3rd Edition," PHI

Reference Books:

RB1. Comer, "Internetworking with TCP/IP" PHI
RB2. Comer, "Computer networks & Inter" PHI

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Select suitable Network Simulator.
CO2	Demonstrate network configuration skills to design specific network scenarios.
CO3	Utilize various connecting devices and LAN connectivity to build networks.
CO4	Examine the various network commands
CO5	Determine various connecting devices and LAN connectivity for network topologies.
CO6	Create various network topologies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	3						
CO2	3	3	3	2		3		2		2		
CO3	3	3	3	2		3						
CO4	3	3	3	2	3	3		2		2		
CO5	3	3	3	2		3				2		
CO6	3	3	3	3	3			2				
AVG	**3**	**3**	**3**	**2.3**	**1.5**	**2.5**	**0**	**1**	**0**	**1**	**0**	**0**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC302**				
Course Name	**: WEB PROGRAMMING**				
Semester / Year	**: 3rd Semester / 2nd Year**				
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

1. To learn the basic concepts of world wide web.
2. To learn the basic concepts and syntax of HTML and CSS programming.
3. To be able to develop logics which help them to create programs and applications using HTML & CSS language.
4. To use the types of CSS and CSS Overriding in a web site.
5. To learn the skills that will help the students in creating websites with great look and feel using CSS.

COURSE CONTENTS

Unit-I **[No. of Hours: 4]**

Introduction- Introduction to the Internet, Introduction to HTML Terminology, Designing a Webpage: Design Considerations and Planning, Basic Tags and Document Structure, HTML Tags, Head Tags, Title Tags, Body Tags, Metadata, Saving an HTML Page

Unit II **[No. of Hours: 8]**

Page Formatting- Adding a New Paragraph, Adding a Line Break, Inserting Blank Space, Preformatted Text, Changing a Page's Background Color, Div Element. Text Items and Objects: Headings, Comments, Block Quotes, Horizontal Lines. Special Characters, Creating Lists-Numbered (Ordered) Lists, Bulleted (Unordered) Lists, Nested Lists, Definition Lists.

Unit III **[No. of Hours: 10]**

Links-What are Links?, Text Links, Image Links, Opening a Page in a New Window or Tab, Setting all Links on a Page to Open in a New Window or Tab, Linking to an Area on the Same Page (Bookmarks), Linking to an E-mail Address, Linking to Other Types of Files, Images-Introduction to Images for Webpages, Adding Images to Webpages, Resizing an Image, Alternative (ALT) Text, Image Labels.

Unit IV **[No. of Hours: 8]**

Basic Tables-Inserting a Table, Table Borders, Table Headers, Col and row span, IFrames: What is an Iframe, Inserting Iframes, Setting Height and Width, Using an Iframe for a link target. Forms: About Forms, Text Boxes, Text Areas, Check Boxes, Menu Lists, Radio Buttons, The Submit Button, The Reset Button, Changing the Tab Order, Sending to E-mail, event handling

Unit V **[No. of Hours: 10]**

Cascading Style Sheets- CSS Introduction, CSS Syntax, Creating an External CSS, Linking to a CSS, Adding Comments and Notes to a CSS, Creating an Internal Style Sheet, ID and Class, Inline

Styling. Working With Text in CSS: Emphasizing Text (Bold and Italic), Decoration, Indentation, Transformation, Text Alignment, Fonts, Font Sizes, Letter Spacing, Text Color, Margins, Padding, Borders, Styling Links, Number and Bullet Styles, Sizing Elements, Text Wrapping, Shadowing.

Text Books:

TB1. HTML & CSS: The Complete Reference, Fifth Edition, Thomas A. Powell.
TB2. IvanBayross, "Web Technologies Part-I" BPB Publications

Reference Books:

RB1. Burdman, "Collaborative Web Development", Addison Wesley
RB2. Sharma & Sharma, "Developing E-Commerce Sites" Addison Wesley

Course Outcomes (COs):

After completion of the course, a student will be able to

CO#	DESCRIPTION
CO1	Define Internet and basic internet and HTML terminology
CO2	Explain the basic concepts and write HTML programs.
CO3	Develop various programming problems using CSS programming concepts.
CO4	Discover the change in look-n-feel of the multiple web pages from single source using CSS.
CO5	Decide which type of style sheet is suitable to use in particular case by analyzing the inline, internal and external type of CSS.
CO6	Create and evaluate the websites with professional look and feel using both HTML and CSS.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1								
CO2	3	2	3	1	1		1		2			
CO3	2	2	3	1			1		1			
CO4	1	3	3						2			
CO5	2	3	3									
CO6	3	3	1									
AVG	2.3	2.6	2.6	0.5	0.1	0	0.3	0	0.8	0	0	0

3: Highest Correlated, 2: Medium Correlated, 1: Lowest

Course code	**: BCAP32 (Lab based on BCADSC302)**				
Course Name	**: WEB PROGRAMMING LAB**				
Semester / Year	**: 3rd Semester / 2nd Year**				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

1. To implement the HTML to develop webpages.
2. To write the websites using HTML and CSS programming altogether.
3. To be able to apply logics for better look and feel for websites.
4. To use the types of CSS and CSS Overriding in a web site.
5. To learn the skills that will help the students in creating websites with great look and feel using CSS.

Course Outcomes (COs):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Identify HTML tags and programs and thereby website.
CO2	Illustrate programming solutions using CSS programming concepts.
CO3	Apply concepts like changing look-n-feel of the multiple web pages from single source using CSS.
CO4	Compare style sheet and decide which is suitable to use in particular case by analyzing the inline, internal and external type of CSS.
CO5	Appraise the websites with professional look and feel.
CO6	Create Professional websites using both HTML and CSS

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1		1					
CO2	2	3	2	1			1					1
CO3	1	3	3									
CO4	2	3	3									
CO5	3	2	2							2		1
CO6	3	2	2							2		1
AVG	**2.1**	**2.5**	**2.3**	**0.3**	**0.1**	**0**	**0.3**	**0**	**0**	**0.6**	**0**	**0.5**

Course code	**: BCADSC303**				
Course Name	**: SYSTEM ANALYSIS & DESIGN**				
Semester / Year	**: 3rd Semester / 2nd Year**				
	L	**T**	**P**	**C**	
	3	**1**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To study different types of system and life cycle of system development.
2. To learn roles of system analyst and different information gathering tools.
3. To learn use tools for structured analysis, cost/benefit strategies and feasibility study.
4. To learn process and stages of system design and form design.
5. To learn system testing and quality assurance with proper hardware and software selection.

COURSE CONTENTS

Unit I **[No. of Hours: 6]**

System Concepts and Information System Environment- The System Concept, Definition, Characteristics of Systems, Elements of a System, Open and Closed and closed system, Formal and Informal Information Systems, Computer based Information Systems, Management Information System, Decision Support System

Unit II **[No. of Hours: 10]**

The System Development Life Cycle- Recognition of needs, Impetus for System Change, Feasibility Study, Analysis, Design, Implementation, Post implementation and Maintenance. The Role of the Systems Analyst, Academic and Personal Qualifications, Skills of System Analyst

Unit III **[No. of Hours: 12]**

Systems Planning and Initial Investigation- Strategies for Determining Information Requirement, Problem Definition and Project initiation, Background Analysis, Fact Analysis, Review of Written Documents, Onsite Observations, Interviews and Questionnaires, Fact Analysis, Performance Analysis, Efficiency Analysis, Service Analysis. Information Gathering- Kind of Information needed. Information about the firms, Information gathering tools, the art of Interviewing, Arranging the Interview, Guides to Successful Interview, Types of Interviews and Questionnaires, The Structured and Unstructured Alternatives.

Unit IV **[No. of Hours: 8]**

The Tools of Structured Analysis- The Dataflow Diagram (DFD), Data Dictionary, Decision Table, Decision Trees and Structured English.

Unit V **[No. of Hours: 4]**

Input/Output and Forms Design- Input Design, CRT Screen Design, Output Design, Requirements form Design.

Text Books:

TB1. Elias M.Awad, "Systems Analysis and Design" Galgotia Publication
TB2. System Analysis and Design Handbook: V. K. Jain, Wiley dreamtech

Reference Books:

RB1. Hoffer, "Modern Systems Analysis and Design" Addision Wesley
RB2. Kendall, "Introduction to System Analysis and Desogm", McGraw Hill

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO #	Detailed Statement of the CO
CO1	Defining the concept of system, analysis, design, system analyst and system development life cycle.
CO2	Understand and describe the work done during the development of a system.
CO3	Apply the fact-finding techniques to collect information to generate the system's requirements for the development of a system constructs.
CO4	Analyze the system using data flow diagram, data dictionary and process specification tools to understand how each process is working and connected to others. Analyze the GUI, input/output screen and reports layouts.
CO5	Evaluate the system planning tools and techniques and testing of software projects to ensure its correctness and completeness.
CO6	Implement the newly developed system and giving training to the users.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1			1				
CO2	2	3	2	2		2	3			1	1	1
CO3	1	3	2	3	1		1			1	2	1
CO4	2	3	1	3			2	1		1	2	1
CO5		1	1	1		2	1			1		
CO6	2	1		1	2	2	3	1		1	3	1
AVG	**1.5**	**2**	**1.2**	**1.8**	**0.7**	**1**	**1.7**	**0.5**		**0.8**	**1.3**	**0.7**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC401**				
Course Name	**: DATABASE MANAGEMENT SYSTEM**				
Semester / Year	**: 4th Semester / 2nd Year**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

In this course, the learners will be able to develop expertise related to the following:-

1. Develop a broad understanding of database concepts and database management system software, data models, schemas and instances, data constraints, relational algebra and calculus.
2. Acquire Knowledge to model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.
3. Be able to write SQL commands to create and manipulate databaseobjects.
4. Be able to discuss importance of normalization and improve the database design by applying various normal forms.

COURSE CONTENT

Unit I **[No. of Hours: 7]**

Database fundamental concepts, Advantages and Disadvantages of DBMS, Database Administrator, Architecture of DBMS, Schema and Sub Schema, Data Models: Hierarchical data Model, Network Data Model, Relational Data Model.

Unit II **[No. of Hours: 7]**

Keys: Super Key, candidate key, Primary key, Foreign Key; Referential Integrity, Entity, Attribute, Relationship, Generalization and Specialization, Entity – Relationship (E-R) Data Model,

Unit III **[No. of Hours: 8]**

Relationship Degree, Relational Algebra, Relational calculus: Tuple relational calculus, Domain relational calculus.

Unit IV **[No. of Hours: 10]**

Database design and Normalization: Function Dependency, Lossless – Join Decomposition, Dependency Preservation, Anomalies in a database, Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF

Unit V **[No. of Hours: 10]**

SQL: Creating table, DDL, DML, Restricting and Sorting Data, Single-Row Functions, Aggregated Data Using the Group Functions, Joining, Sub queries, Keys.

Text Books:

TB1. Elmsari and Navathe, "Fundamental of Database System", Addison Wesley. New York.
TB2. H.Korth & A. Silberschatz, "DATABASE SYSTEM CONCEPTS", TMH.

Reference Books:

RB1. Date. CJ, "An Introduction to Database System", Narosa Publishing House. New Delhi.
RB2. Desai, B, "An Introduction to Database Concepts", Galgotia Publications. New Delhi.
RB3. Ullman. J.D, "Principles of Database Systems", Galgotia Publications, New Delhi.

Course Outcome (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the fundamental concepts and advantages, disadvantages of DBMS. Identify the different data models and their strengths and weaknesses. Identify the types of keys and their significance in a database.
CO2	Explain the role and responsibilities of a Database Administrator. Comprehend the architecture of DBMS and the concept of schema and sub-schema. Explain the concepts of keys, referential integrity, and normalization. Understand the relationship between entity-relationship diagrams and relational databases. Interpret relational algebra and relational calculus expressions.
CO3	Utilize normalization techniques (1NF, 2NF, 3NF, BCNF, 4NF, 5NF) to design and optimize databases. Create SQL statements to create tables, define data types, and perform data manipulation operations.
CO4	Analyze the relationship degree and dependency preservation, lossless decomposition in a database. Examine the anomalies that can occur in a database and their impact. Evaluate the trade-offs involved in different database design decisions.
CO5	Evaluate the efficiency and effectiveness of normalization techniques in database design. Examine the use of normalization and functional dependency for database design. Critically evaluate the use of SQL statements, including joins and subqueries, for data retrieval.
CO6	Design and create a well-structured database schema based on the given requirements. Construct complex SQL queries to extract and manipulate data from multiple tables.

Mapping of PO and CO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	1	1	1	3	1	2	2
CO2	1	2	2	2	1	1	1	1	1	1	2	1
CO3	2	2	3	3	1	2	2	2	3	1	2	2
CO4	2	2	3	3	1	2	2	2	3	1	2	2
CO5	2	2	3	3	2	2	2	2	3	1	2	2
CO6	3	3	3	3	2	3	3	3	3	1	2	3
AVG	**2.2**	**2.2**	**2.8**	**2.6**	**1.6**	**2**	**2**	**2**	**2.8**	**1.2**	**2**	**2.2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP41 (Lab based on BCADSC401)**				
Course Name	**: DATABASE MANAGEMENT SYSTEM LAB**				
Semester / Year	**: 4th Semester / 2nd Year**				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Working expertise of DDL and DML commands with their application on solving real time problems.
2. Ability to apply filters using where clause and nested queries, integrity constraints at table level and column level and to use built-in functions including numeric, character and date functions.
3. Adequate knowledge to fetch data from multiple tables using different types of JOIN operations.

Course contents

- SQL queries for Data Definition and Data Manipulation Language.
- SQL queries using logical operations (=,<,>,etc)
- SQL queries using SQL operators
- SQL query using character, number, date and group functions
- SQL queries for relational algebra
- SQL queries for extracting data from more than one table
- SQL queries for sub queries, nested queries

COURSE OUTCOMES (COs):

After completion of this course, the learners will be able to: -

CO #	Detailed Statement of the CO
CO1	Recall and identify the basic syntax and structure of SQL queries for data definition and data manipulation language.
CO2	Explain the logical operations (=, <, >, etc.) used in SQL queries and understand their significance in filtering and retrieving data from a database.
CO3	Write SQL queries using SQL operators to perform various data manipulation tasks, such as sorting, filtering, and joining tables.
CO4	Analyze complex SQL queries and evaluate their efficiency and effectiveness in extracting and manipulating data from databases.
CO5	Evaluate the results of SQL queries by applying character, number, date, and group functions and determining their impact on the output data.
CO6	Design and create advanced SQL queries, including subqueries and nested queries, to extract and manipulate data from multiple tables, demonstrating their mastery of the relational algebra concepts.

Mapping of PO and CO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	1	1	1	1	3	1	2	2
CO2	1	2	2	2	1	1	1	1	1	1	2	1
CO3	2	2	3	3	1	2	2	2	3	1	2	2
CO4	2	2	3	3	1	2	2	2	3	1	2	2
CO5	2	2	3	3	1	2	2	2	3	1	2	2
CO6	3	2	3	3	1	3	3	3	3	1	2	3
AVG	**1.8**	**2**	**2.8**	**2.6**	**1.2**	**2**	**2**	**2**	**2.8**	**1.2**	**2**	**2.2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC402**				
Course Name	**: OPERATING SYSTEM**				
Semester / Year	**: 4th Semester / 2nd Year**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

COURSE OBJECTIVES:

1. To study types of Operating System and Process Management.
2. To learn Scheduling and Process Synchronization.
3. To study Deadlock and its prevention and avoidance.
4. To study about Virtual Memory and File Management.
5. To learn Disc Management.

COURSE CONTENTS

UNIT 1 **[No. of Hours: 8]**

Introduction: Operating System- Definition, Types of OS- Simple batch system, Time sharing systems, Real time systems, Multiprocessor systems, Distributed systems, System components - OS Services, System Calls.

UNIT 2 **[No. of Hours: 8]**

Process concepts: PCB, Process Scheduling, Operations on Processes, Co-operating process, IPC, Threads- Overview, Benefits, User & Kernel Threads.
CPU Scheduling, Scheduling criteria, Pre-emptive & Non-preemptive scheduling, Scheduling algorithms

UNIT 3 **[No. of Hours: 8]**

Process Synchronization: Background, Critical Section problem, Critical Regions, Synchronization hardware, Semaphores, Classic Problems of Synchronization
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

UNIT 4 **[No. of Hours: 8]**

Memory Management: Logical vs. Physical address space, Swapping, Contiguous memory allocation, Non-Contiguous memory allocation- Paging, Segmentation, Segmentation with paging.
Virtual Memory: Background, Demand paging - Performance, Page replacement, Page replacement algorithms (FCFS, LRU, Optimum), Allocation of frames, Thrashing.

UNIT 5 **[No. of Hours: 8]**

File Systems: File concept, access methods, Allocation methods-contiguous, linked and index allocation, Directory System – single level, tree structured, File protection.
Disk Management: Secondary storage structure: Disk structures, Disk Scheduling, Disk Performance Parameter.

Text Books:

TB1. Abraham Silberschatz, Peter Baer Galvin & Greg Gagne , "Operating System Concepts", Sixth Edition, John Wiley & Sons, Inc.

Reference Books:

RB1. Milankovic M "Operating System concepts and Design", 2nd edition, Tata Mcgraw hill.
RB2. Deitel H.M. "An Introduction to Operating Sysems" ,2nd edition, Pearson Education.

Course Outcomes (COs):

After completion of the course, a student will be able to

CO	Detailed Statement of the CO
CO1	Explain the types of operating system and ability to create threads and perform interposes communication.
CO2	Understand process management, resource management, memory management, Disk management problems.
CO3	Apply issues surrounding process management, resource management, memory management, Disk management problems.
CO4	Analyse issue pertaining to process management, resource management, memory management, Disk management problems
CO5	Be able to evaluate to process management, resource management, memory management, Disk management problems.
CO6	To create design and develop algorithms related to process management, resource management, memory management, Disk management problems

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	1	1	2	1					
CO2	3	1		2		1	2	1				
CO3	3	2	1	1		2	1					
CO4	2	1	2	2	1	2	3	1			1	1
CO5	1	2	1	3	2	2	2				1	
CO6						2						1
AVG	**2.2**	**1.4**	**1.4**	**1.8**	**0.8**	**1.8**	**1.8**	**0.4**	**0**	**0**	**0.4**	**1**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP42 (Lab based on BCADSC402)**				
Course Name	**: UNIX LAB**				
Semester / Year	**: 4th Semester / 2nd Year**				
		L	**T**	**P**	**C**
		0	**0**	**2**	**1**

Course Objectives:

The objectives of this course are

1. To learn basic knowledge about architecture of Unix and different basic Commands of Unix
2. To learn how to use process management.
3. To learn basic structure and various commands of UNIX system.
4. To learn the importance of system administration tasks.
5. To learn the shell programming.
6. To learn basics of filter commands and Tools of UNIX system

COURSE CONTENTS:

- How to apply basic commands of UNIX
- How to apply filter commands.
- How to apply UNIX system administration commands
- Unix shell program based on conditional statements
- Unix shell program based on loops
- Unix shell program based on filters
- Unix shell program based on arrays

Course Outcomes (COs):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Able to acquire knowledge and remember basic commands of UNIX and shell programming constructs
CO2	Able to understand basic commands of UNIX and shell programming constructs.
CO3	To apply basic commands of UNIX and shell programming constructs.
CO4	To analyse difference between basic commands of UNIX and shell programming constructs
CO5	Able to evaluate expressions using basic commands of UNIX and shell programming constructs.
CO6	Able to create applications/software using shell programming constructs

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1		1			1				
CO2	3	1	2	1		2	1					
CO3	1	1	3		1		2		2			
CO4	2	1	1	1		2				1	2	
CO5	2	1	2		1		1					2
CO6		1				2						2
AVG	**2.2**	**1**	**1.8**	**0.4**	**0.6**	**1**	**0.8**	**0.2**	**0.4**	**0.2**	**0.4**	**0.66**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC403**				
Course Name	**: SOFTWARE ENGINEERING**				
Semester / Year	**: 4th Semester / 2nd Year**				
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To understand the nature of software development and software life cycle.
2. Explain methods for capturing specifying, visualizing analyzing software requirement.
3. To know basic of testing and understanding concept of software quality assurance.
4. To understand the concept of software cost model.
5. To develop good quality software and able to maintain quality of software
6. To develop knowledge of tools available for software development.

COURSE CONTENTS

Unit I **[No. of Hours: 6]**

Introduction: Introduction to software engineering, Importance of software, evolving role of software, Software Characteristics, Software Components, Software Applications, Software Crisis, Software engineering problems, Software Development Life Cycle, Software Process.

Unit II **[No. of Hours: 8]**

Software Requirement Specification: Analysis, Principles, Water Fall Model, The Incremental Model, Prototyping, Spiral Model, Role of management in software development, Role of matrices and Measurement, Problem Analysis, Requirement specification, Monitoring and Control.

Unit III **[No. of Hours: 8]**

Software-Design: Design principles, problem partitioning, abstraction, top down and bottom up-design, Structured approach functional versus object oriented approach, design specifications and verification, Monitoring and control, Cohesiveness, coupling, Fourth generation techniques, Functional independence, Software Architecture, Transaction and Transform Mapping, Component level Design.

Unit IV **[No. of Hours: 10]**

Coding: Top-Down and Bottom Up programming, structured programming, information hiding, programming style and internal documentation. Testing principles, Levels of testing, functional testing, structural testing, test plane, test case specification, reliability assessment, software testing strategies, Verification and validation, Unit testing, Integration Testing, Alpha & Beta testing, system testing and debugging.

Unit V **[No. of Hours: 8]**

Software Reliability & Quality Assurance: Reliability issues, Reliability metrics, Reliability growth modeling, Software quality, ISO 9000 Certification for software industry, SEI capability maturity model, comparison between ISO & SEI CMM. CASE (Computer Aided Software Engineering):

CASE and its scope, CASE support in software life cycle, documentation, project management, internal interface, Reverse Software Engineering, Architecture of CASE environment.

Text Books:

TB1. Pressman, Roger S., "Software Engineering: A Practitioner's Approach Ed.Boston: McGraw Hill, 2001
TB2. Jalote, Pankaj, "Software Engineering Ed.2"New Delhi: Narosa 2002

Reference Books:

RB1. Schaum's Series, "Software Engineering" TMH
RB2. Ghezzi Carlo and Others "Fundamentals of Software Engineering" PHI

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Define, label, name, Select, show, software engineering process and software process models.
CO2	Classify, compare, outline, relate, summarize requirements, types of requirements for the development of application.
CO3	Identify various system models for business processes and construct, develop the existing system.
CO4	Analyze and maintains efficient reliable software solutions by creating a blue print for further development.
CO5	Assessing and evaluate SW engineering testing and risk strategies, and develops their appropriate applications.
CO6	Build, create or develop Software engineering tools

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2								
CO2			3									
CO3		1	2		1	2				1		
CO4				3		2				2		
CO5								1	1			
CO6							1					
AVG	**0.5**	**0.16**	**0.8**	**0.8**	**0.16**	**0.66**	**0.16**	**0.16**	**0.16**	**0.5**		

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC501**				
Course Name	**: PYTHON PROGRAMMING**				
Semester / Year	**: 5th Semester / 3rd Year**				
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Master the core of writing Python scripts
2. Understand decision-making and functions in python
3. Interpret Object-oriented programming features in python
4. Gain knowledge of data structures in python
5. Explore file handling and database operations in python

COURSE CONTENTS

Unit I **[No. of Hours: 10]**

Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements: If, If- else, Nested if-else, Looping: For, While, Nested loops, Control Statements: Break, Continue, Pass

Unit II **[No. of Hours: 11]**

String: Accessing Strings, Basic Operations, String slices, Function and Methods. **Lists**: Introduction, accessing list, Operations, working with lists, Function and Methods, sorting, searching. **Tuple**: Introduction, accessing tuples, Operations, Working, Functions and Methods **Sets**: Introduction, Accessing sets, Operations, Working, Functions and Methods. **Dictionaries**: Introduction, accessing values in dictionaries, Working with dictionaries, Properties, Functions. **Sets:** Introduction, accessing values in sets, Working with dictionaries, Properties, Functions

Unit III **[No. of Hours: 7]**

Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables, Python Lambda, recursion. Modules: Importing module, Math module, Random module, Packages, Composition

Unit IV **[No. of Hours: 7]**

Input-Output: Printing on screen, reading data from keyboard, **File Handling:** Opening and closing file, Reading and writing files. **Database handling using SQLite3. Exception Handling:** Exception, Except clause, Try, finally clause, User Defined Exceptions

Unit V **[No. of Hours: 5]**

OOPs concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding.

Text Books:

TB1. Budd T A, "Exploring Python", McGraw-Hill Education, 1st Edition, 2011.
TB2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2013.

TB3. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 1st Edition,2013.

Reference Books:

RB1. Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning, 1st Edition, 2011.
RB2. Allen Downey, "Think Python: How to Think Like a Computer Scientist", O'Reilly, 2nd Edition, 2015.
RB3. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University Press, 1st Edition, 2017.
RB4. Joel Grus, "Data Science from Scratch", O'Reilly, 2nd Edition, 2019.
RB5. Tony Gaddis, "Starting out with Python", Pearson, 3rd Edition, 2014.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO #	Detailed Statement of the CO
CO1	Knowledge and remember the programming constructs used in python.
CO2	Understanding the facts behind the sequences, functions, modules, files, database and object oriented etc. used in Python
CO3	Apply data structure primitives like strings, lists, tuples, sets and dictionaries on various types of data with or without using functions, object-oriented concepts to the programs in Python etc.
CO4	Distinguish and analyze basic constructs of Python and how constructs can be used all together.
CO5	Evaluate the programming constructs of Python to provide verdict on findings.
CO6	Create python programs using various programming constructs of Python.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1		2				2		
CO2	3	3	3	2	1	1				2		
CO3	3	3	3	2	1	1						
CO4	3	3	3	2	1	1	1	1		2	1	
CO5	3	3	3	2	1	1			2			2
CO6	3	3	3	3	1	1	1	1	1	1	1	1
AVG	**3**	**5.3**	**5.3**	**2**	**0.8**	**1.2**	**0.3**	**0.3**	**0.5**	**1.2**	**0.3**	**0.5**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP51 (Lab based on BCADSC501)**				
Course Name	**: PYTHON PROGRAMMING LAB**				
Semester / Year	**: 5th Semester / 3rd Year**				
		L	**T**	**P**	**C**
		0	**0**	**2**	**1**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Basic programming constructs and functions in python.
2. Understand the applicability of data structures like lists, tuples, sets and dictionaries inpython applications.
3. Use object-oriented programming features of python to develop applications.
4. Learn how to use exception handling in applications for error handling.
5. Database and file based programming

COURSE CONTENTS

- Working with Jupyter notebook.
- Programs based on loops and conditional statements.
- Programs based on string manipulations.
- Programs based on List.
- Programs based on tuples.
- Programs based on sets.
- Programs based on dictionary.
- Working with user defined functions.
- Working with lambda, map, filter and reduce functions.
- Programs based on recursion.
- Programs for file handling in Python.
- Programs for Sorting and searching.
- Database handling in Python using SQLite3.
- Working with in built and user defined modules,
- Working with Object Oriented Programming in Python.

Course Outcomes (COs):
Upon successful completion of the course a student will be able to

CO #	Detailed Statement of the CO
CO1	Describe the program creation in Python through usage of appropriate constructs
CO2	Demonstrate the working of basic programming constructors in Python.
CO3	Apply data structure primitives like strings, lists, tuples, sets and dictionaries on various types of data with or without using functions, object-oriented concepts to the programs in Python etc.
CO4	Analyze basic constructs of Python and how constructs can be used all together.
CO5	Evaluate the programs and its logic.
CO6	Develop programs using methods of constructs define in Python.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1			3	1	2				
CO2	3	1	2	3		3	2	3				
CO3	3	2	3	3	1	2	2	3				
CO4	2	1	3	3	2	3	2	3				
CO5	3	1	3	1	2	3	2	3				
CO6	3	2	2	3	1	2	2	3	1	1		1
AVG	**2.8**	**1.3**	**2.3**	**2.2**	**1**	**2.7**	**1.8**	**2.8**	**0.2**	**0.2**		**0.2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC502**				
Course Name	**: PHP PROGRAMMING**				
Semester / Year	**: 5th Semester / 3rd Year**				
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

1. To learn the advance concepts of websites.
2. To learn the basic concepts and syntax of HTML and PHP programming.
3. To be able to develop interactive programs using PHP.
4. To use the types of CSS and CSS Overriding in a web site.
5. To learn the skills that will help the students in creating websites with great look and feel using CSS.

COURSE CONTENTS

UNIT I Introduction to PHP **[No. of Hours: 10]**

History of PHP, basic syntax, variable and constant, datatypes, operators and expressions. Decision making- if-else, switch case, loops, nesting control statements. PHP and HTML together.

UNIT II Function in PHP **[No. of Hours: 10]**

Define a function, call-by-value and call-by-reference, recursive functions, strings and its operations- searching, replacing, formatting, string library functions. PHP arrays- index based and associative arrays, array looping- index and associative based using each () and foreach(). Useful PHP library functions.

UNIT III HTML Forms and Files **[No. of Hours: 10]**

Handling Html form with PHP- capturing form, generating file uploaded form, form redirection. Working with file and directories- opening, closing, copying, renaming and deleting a file. Working with directories- creating and deleting directories. File uploading and downloading.

UNIT IV Session and Cookies **[No. of Hours: 10]**

Session handling in PHP- creating and destroying sessions, session variables. Cookies and session handling, deleting cookies.

UNIT V Database Connectivity **[No. of Hours: 10]**

Introduction to RDBMS, Connection with MySql Database, Performing basic database operation(DML) (Insert, Delete, Update, Select), Setting query parameter, Executing queryJoin (Cross joins, Inner joins, Outer Joins, Self joins) , Exception Handling Understanding Exception and error, Try, catch, throw, Error tracking and debugging.

Text Books:

TB1. Learning PHP, MySQL, books by ' O' riley Press

Course Outcomes (COs):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Understand the basic concepts of PHP and write PHP programs.
CO2	Design and develop interactive websites.
CO3	Implement concepts like session handling, database operations etc.
CO4	Develop professional websites using various PHP tools such as PHP Super Global, Exception handling and other PHP programming constructs.
CO5	Serve the society by creating and evaluating the websites with professional look and feel and use these skills to build successful career.
CO6	Create the connection between PHP with MySql Database2

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	1		1		2			
CO2	2	2	3	1			1		1			
CO3	1	3	3						2			
CO4	2	3	3			2				2		
CO5	3	3	1								3	1
CO6	2	2	2									
AVG	**2.1**	**2.5**	**2.5**	**0.3**	**0.1**	**0.3**	**0.3**		**0.8**	**0.3**	**0.5**	**0.1**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code : **BCAP52 (Lab based on BCADSC502)**				
Course Name : **PHP PROGRAMMING LAB**				
Semester / Year : **5th Semester / 3rd Year**				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

1. To implement the advance concepts in the basic websites.
2. To create and implement the basic concepts and syntax of HTML and PHP programming together.
3. To be able to develop interactive programs using PHP.
4. To apply the various website governing tools such as session handling, exception handling, super globals etc.
5. To learn the skills that will help the students in creating websites with great look and feel using PHP programming constructs.

Course Outcomes (COs):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Understand the basic concepts of PHP and write PHP programs.
CO2	Design and develop interactive websites.
CO3	Implement concepts like session handling, database operations etc.
CO4	Develop professional websites using various PHP tools such as PHP Super Globals, Exception handling and other PHP programming constructs.
CO5	Serve the society by creating and evaluating the websites with professional look and feel and use these skills to build successful career.
CO6	Create the connection between PHP with MySql Database

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	1		1		2			
CO2	2	2	3	1			1		1			
CO3	1	3	3						2			
CO4	2	3	3			2				2		
CO5	3	3	1								3	1
CO6	2	1	1									
AVG	**2.2**	**2.6**	**2.6**	**0.4**	**0.2**	**0.4**	**0.4**	**0**	**1**	**0.4**	**0.6**	**0.2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC503**				
Course Name	**: ARTIFICIAL INTELLIGENCE**				
Semester / Year	**: 5th Semester / 3rd Year**				
	L	**T**	**P**	**C**	
	3	**1**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To impart knowledge about Artificial Intelligence.
2. To give understanding of the main abstractions and reasoning for intelligent systems.
3. To enable the students to understand the basic principles of Artificial Intelligence in various

COURSE CONTENT

Unit I **[No. of Hours: 8]**

Introduction:- Definition and meaning of artificial intelligence, A.I. techniques, pattern recognition, Level of, speech recognition representation in A.I. properties of internal representation.

Unit II **[No. of Hours: 8]**

Production System:- Different types of tracing, strategies, graph search strategies, Heuristic graph, search procedure, AND/OR graph, relationship between decomposional and compatible systems, searching Gate Tree, min-max search game playing, actual game playing.

Unit III **[No. of Hours: 8]**

Introduction to Predicate Calculus:- Predicates and Arguments, connectives, Simplifications of strategies, extracting answers from Resolution Refutation. Control strategies.

Unit IV **[No. of Hours: 8]**

Rule Based Deduction Systems: Forward and backward deduction system, resoling with AND/OR graph, computation, deduction and program synthesis, central knowledge for rules based deduct systems.

Unit V **[No. of Hours: 8]**

Structural Object Representation: Semantic networks semantic market matching deductive operations on structured objects. Architectural for A.I. Systems: Knowledge, acquisitions representation, Natural language processing.

Text Books:

TB1. Introduction to artificial Intelligence Eugene Charnik Drew MC mott
TB2. Artificial Intelligence Elaine Rice.

Reference Books:

RB1. Principal of Artificial Intelligence, Nelson, Springer-Verlag.
RB2. Artificial Intelligence Application Programming: Tim Jones, Wiley dreamtech

Course Outcomes (COs):
Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Demonstrate fundamental understanding of the history of AI
CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception
CO3	Demonstrate awareness and a fundamental understanding of various applications of AI
CO4	Apply different search algorithms
CO5	Understand Natural Language Processing
CO6	Plan heuristic algorithm

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1			2						
CO2	2	3	2		2							
CO3	2			2		2	1					
CO4			2		2							
CO5	2	2		2		2						
CO6	1	1	1	2			2	2				
AVG	**1.66**	**1.33**	**1**	**1.0**	**0.8**	**1.2**	**0.5**	**0.33**				

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC601**				
Course Name	**: ADVANCE JAVA PROGRAMMING**				
Semester / Year	**: 6th Semester / 3rd Year**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Using Graphics, Animations and Multithreading for designing Simulation and Game based applications.
2. Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.
3. Design and develop Web applications
4. Designing Enterprise based applications by encapsulating an application's business logic.
5. Designing JDBC connectivity.

COURSE CONTENTS

UNIT I **[No. of Hours: 8]**

Applets and Layout managers- Applets in java, AWT controls- Labels, Buttons, Check Box, Choice, Text Field, Text Area, Lists, Scroll Bar, Progress Bar, Window, Frame, Menu, Menu Bar etc. Layout Managers- Flow Layout, Border Layout, grid layout, Card Layout, Grid Bag Layout.

UNIT II **[No. of Hours: 8]**

Java Swing and Event Handling-Working with JFrame, JApplet, JPanel, JTextField, JFasswordField, JButton,JCheckBox, JRadioButton, JList, JScrollPane, JComboBox,JMenu, JMenuBar,JMenuItem. Event Handling- Event delegation model or event class hierarchy, all classes and interfaces of event delegation model, programs related to event.

UNIT III **[No. of Hours: 8]**

Servlets- Servlet Overview and Architecture, Servlet Life Cycle, GET and POST methods, HTTPServletRequest and HTTPServletResponse objects, Developing an interactive servlet using an HTML page, HTTPSession object.

UNIT IV **[No. of Hours: 8]**

Java Beans- Preparing a Class to be a Java Bean, Creating a JavaBean, JavaBean Properties, Types of beans, Stateful Session bean, Stateless Session bean, Entity bean.

UNIT V **[No. of Hours: 8]**

JDBC Connectivity- Database concepts and HTML Forms. JDBC driver types, JDBC-ODBC Bridge, SQL Statements, Prepared Statements. Using JDBC in servlets.

Text Books:

TB1. Herbert Schildt (2006), "The Complete Reference Java 2 (Updated to Cover J2SE 1.4)", Ed. 05, Tata McGraw-Hill publishing company Ltd. New Delhi, India.

TB2. Cay S. Horstmann Gary Cornell, " Core Java 2 Volume-I Fundamentals", Ed-07, PEARSON Education, Singapore Pte.Ltd., Indian Branch, New Delhi, India 2005.

Reference Books:

RB1. Michael Morgan, "Java 2 for Professionals Developers", Ed. 01, SAMS, Techmedia, New Delhi, India,2000.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Learn java AWT and Swing
CO2	Understand Event handling in Java
CO3	Design java servlets
CO4	Understand java bean and its properties.
CO5	Design JDBC connection using MySQL
CO6	Plan JDBC Programs

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1			2						
CO2	2	3	2		2							
CO3	2			2		2	1					
CO4			2		2							
CO5	2	2		2		2						
CO6	1	2	2			2	2					
AVG	**1.66**	**1.5**	**1.16**	**0.8**	**0.8**	**1.13**	**0.5**					

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP61 (Lab based on BCADSC601)**				
Course Name	**: ADVANCE JAVA PROGRAMMING LAB**				
Semester / Year	**: 6th Semester / 3rd Year**				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Using Graphics, Animations and Multithreading for designing Simulation and Game based applications.
2. Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.
3. Design and develop Web applications
4. Designing Enterprise based applications by encapsulating an application's business logic.
5. Designing applications using pre-built frameworks.

Course Outcomes (COs):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Implement GUI program using AWT and Swing
CO2	Implement Action Event and Item Event
CO3	Design java servlets
CO4	Understand java bean and its properties.
CO5	Design JDBC connection using MySQL
CO6	Design java bean

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	2						
CO2	2	3	2	1	1							
CO3	2	2	1	1	1	2	1					
CO4			2	1	1							
CO5	2	2	1	1	1	2						
CO6	2	2	1	2	1	2		1				
AVG	**1.83**	**1.83**	**1.33**	**1.16**	**1**	**1.33**	**0.16**	**0.16**				

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC602**				
Course Name	**: ANDROID PROGRAMMING**				
Semester / Year	**: 6th Semester / 3rd Year**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. This course facilitates classroom and laboratory learning.
2. Letting students develop competence and confidence in android programming.
3. Understand the entire Android Apps Development Cycle.
4. Enable the students to independently create Android Applications.
5. Access and work with databases under the Android operating system.

COURSE CONTENT

Unit I **[No. of Hours:10]**

Introduction: History of Android, Introduction to Android Operating Systems, Android Development Tools, Android Architecture.

Unit II **[No. of Hours:8]**

Overview of object-oriented programming using Java: OOPs Concepts: Inheritance, Polymorphism, Interfaces, Abstract class, Threads, Overloading and Overriding, Java Virtual Machine.

Unit III **[No. of Hours:6]**

Development Tools: Installing and using Eclipse with ADT plug-in, Installing Virtual machine for Android sandwich/Jelly bean (Emulator), configuring the installed tools, creating an android project-Running on emulator, Deploy it on USB-connected Android device.

Unit IV **[No. of Hours:10]**

User Interface Architecture: Application context, intents, Activity life cycle, multiple screen sizes. User Interface Design: Form widgets, Text Fields, Layouts, Button control, toggle buttons, Spinners (Combo boxes), Images, Menu, Dialog.

Unit V **[No. of Hours:6]**

Database: Understanding of SQLite database, connecting with the database.

Text Books:

TB1. Sayed Y Hashimi and Satya Komatineni, "Pro Android", Wiley India Pvt. Ltd.
TB2. Android application development for java programmers. By James C. Sheusi. Publisher: Cengage Learning, 2013.

Reference Books:

RB1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education2nd edition.
RB2. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
RB3. Mark L Murphy, "Beginning Android", Wiley India Pvt. Ltd.

Course Outcome (COs):

Upon successful completion of the course a student will be able to

CO #	Detailed Statement of the CO
CO1	Knowledge and remember the basics of Java and Android
CO2	Describe the life cycles of Activities, Applications etc.
CO3	Apply the major components of Android API set to make apps. Use the development tools in the Android development environment.
CO4	Classifying and finding uses of UI –components and java Constructs.
CO5	Make UI-rich apps using all the major UI components.
CO6	Create Android apps using Java programming language.

Mapping of PO and CO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1	3	2	3	2	1					
CO2	1	2	3	2	2	1	2	1			1	
CO3	2	1		1		2	1					
CO4	1	1	3	2	3	1		1			1	
CO5	1	1	3	2	2		1	2			1	
CO6	1	1	2				1		1	1		
AVG	1	1.16	2.33	1.5	1.66	1	1	0.66	0.16	0.16	0.5	0

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP62 (Lab based on BCADSC602)**				
Course Name	**: ANDROID PROGRAMMING Lab**				
Semester / Year	**: 6th Semester / 3rd Year**				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Install and configure Android application development tools.
2. Design and develop user Interfaces for the Android platform.
3. Apply Java programming concepts to Android application development.
4. Apply essential Android Programming concepts.
5. Develop various Android applications related to layouts & rich uses interactive interfaces

COURSE CONTENTS

1. Program to show method overloading in java.
2. Program to show method overriding in java.
3. Program to use abstract class in java.
4. Program to implement interface in java.
5. Program to use the concept of multithreading in java.
   a)using Thread class
   b)using Runnable interface.
6. Program to multilevel inheritance in java.
7. Write an Android App to create dialog box.
8. Program to use final keyword in java.
9. Program to use super in java.
10. Program to handle exceptions encountered in java.
11. Android program to print hello world
12. Android program to print addition of two numbers.
13. Android program to create a calculator.
14. Android program to create implicit intent.
15. Android program to create explicit intent.
16. Android program to create toggle button.
17. Android program to create spinner.
18. Android program to create EMI calculator.
19. Android program to use image view.
20. Android program to use different type of layouts.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

CO #	Detailed Statement of the CO
CO1	Understand the basics of Java programming, different graphics tools and their use.
CO2	Development of static and dynamic web APPs using standard tools and learn various properties of the tools.
CO3	Develop interactive and user-friendly APPs using front end and back end programming.
CO4	Develop simple applications using tools available in android studio.
CO5	Implement interactive graphics applications that use graphics tools, using android studio.
CO6	Create Android apps using Java programming language.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1			3	1	2				
CO2	3	1	2	3		3	2	3				
CO3	3	2	3	3	1	2	2	3				
CO4	2	1	3	3	2	3	2	3				
CO5	3	1	3	1	2	3	2	3				
CO6	3	2	2	2			1	1	2	1		
AVG	2.83	1.33	2.33	2	0.83	2.33	1.66	2	0.33	0.16		

Course code	**: BCADSC603**				
Course Name	**: ADVANCE SOFTWARE ENGINEERING**				
Semester / Year	**: 6th Semester / 3rd Year**				
	L	**T**	**P**	**C**	
	3	**1**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Develop models using the UML notation.
2. Analyse requirements with use cases.
3. Create domain models.

COURSE CONTENTS:

UNIT I **[No. of Hours: 10]**

Unified Modelling Language, Basic structures and modelling classes, common modelling techniques, relationships, common mechanism, class diagrams.

UNIT II **[No. of Hours: 10]**

Advanced structured modelling, advanced classes and relationships, interfaces, types and roles, instances and object diagram. Basic idea of behavioural modelling.

UNIT II **[No. of Hours: 10]**

Object- oriented concepts and principles. Identifying the elements of an object model. Object oriented projects metrics and estimation. Design for object – oriented systems. The system design process. Object – oriented testing – testing OOA and OOD models. The object – oriented testing strategies. Inter class testing.

UNIT IV **[No. of Hours: 10]**

Technical metrics for O-O systems. Class oriented metrics and metrics for O-O projects. Advanced topics in software engineering. Component based software engineering and development. Classifying and retrieving components

Text Books:

TB1. Object oriented Modelling and Design with UML - James Rumbaugh. Micheal Blaha (second edition)

TB2. Object Oriented Analysis & Design, Satinger. Jackson, Burd Thomson

Reference Books:

RB1. The Unified Modelling Language User Guide - Grady Booch, James Rumbaugh, Ivar Jacobson.

Course Outcomes (COs):
Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Define or name various analysis and design principles at different levels and various views in different domains of software systems.
CO2	Classify, compare, demonstrate or explain of the diagrams in Unified Modelling Language
CO3	Identify, utilize, make use of Static and Dynamic Diagrams
CO4	Analyse, categorize, compare, design Use case diagram, Sequence diagrams, State Chart diagrams.
CO5	Explain or compare component and deployment diagrams.
CO6	Develop various UML diagrams.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1		2								
CO2	2		1									
CO3	2	1		3								
CO4	3		1									
CO5	3	1		2								
CO6	2	2	2				2					
AVG	**2.5**	**0.8**	**0.6**	**1.16**			**0.33**					

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC701**				
Course Name	**: DATA SCIENCE USING PYTHON**				
Semester / Year	**: 7th Semester / 4th Year**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Understating the concept of Data Science
2. Using the data science using Python
3. Understanding the use of NumPy in data science and how it is different from Python List
4. To understand the dataframe, reading csv, tsv file and working on it.
5. Handling the missing value and data cleansing
6. Understanding the concept of visualize the numbers in graphs using the Python libraries Metplotlib and Seaborn

COURSE CONTENTS

Unit I **[No. of Hours: 12]**

NumPy: Introduction, NumPy Array, NumPy Array Size, NumPy Array Shape, NumPy Mathematical Functions, NumPy Trigonometric Functions, NumPy Random, NumPy String Operations

Unit II **[No. of Hours: 12]**

Pandas: Pandas Series, Pandas DataFrame, Pandas Read_csv, Pandas Write csv File, Data Cleansing, Pandas Handling Missing Values, Pandas concat(), Pandas join(), Pandas append(), Pandas GroupBy

Unit III **[No. of Hours: 10]**

Metplotlib: Matplotlib Line Plot, Matplotlib Histogram, Matplotlib Bar Chart, Matplotlib Pie Chart, Matplotlib Scatter Plot, Matplotlib Subplot, Matplotlib Save Figure, Matplotlib Image Show

Unit IV **[No. of Hours: 6]**

Seaborn: Introduction, Seaborn Line Plot, Seaborn Histogram, Seaborn Barplot

Text Books

TB1. Pandas for everyone, Python Data Analysis by Daniel Y. Chen, Pearson publication
TB2. Laura Igual, Santi Seguí, "Introduction to Data Science - A Python Approach to Concepts,

Reference book:

RB1. Techniques and Applications", Springer
RB2. Wes McKinney, "Python for Data Analysis", O'Reilly
RB3. Luca Massaron, John Paul Mueller, "Python for Data Science for Dummies"

Course Outcomes (COs):
Upon successful completion of the course a student will be able to

CO #	Detailed Statement of the CO
CO1	Defining the fundamental of data science and libraries used.
CO2	Understanding the scientific computing in Python, data analysis and plotting.
CO3	Applying data science functions on data
CO4	Analyzing data through plots.
CO5	Evaluate the output produced by the different data science constructs.
CO6	Designing programs based on data science concepts.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1		1						
CO2	2	1	2	2		1		1				
CO3	2	2	2	2		1	2	3		1		
CO4	1	3	2	2			1	3				
CO5	1	3	3	2								
CO6	2	3	3	3		1	2	3	1	1		
AVG	**1.7**	**2.2**	**2.2**	**2**		**0.7**	**0.8**	**1.7**	**0.2**	**0.3**		

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP71 (Lab based on BCADSC701)**				
Course Name	**: DATA SCIENCE LAB**				
Semester / Year	**: 7th Semester / 4th Year**				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Using the data science using Python
2. Understanding the use of NumPy in data science
3. To understand the dataframe, reading csv, tsv file and working on it.
4. Handling the missing value and data cleansing
5. Understanding the concept of visualize the numbers in graphs using the Python libraries Metplotlib and Seaborn

COURSE CONTENTS

- Programs based using NumPy.
- Programs based on using series and dataframe using Pandas.
- Reading CSV files in Panadas
- Handling missing values in Panadas
- Using concat(), join(), append() and groupby in Panadas
- Plotting line plot, histogram, bar chart, pie chart, scatter plot, subplot etc. using Matplotlib and saving the figure.
- Plotting line plot, histogram, bar plot, scatter plot, heatmap, etc. using Seaborn

Course Outcomes (COs):
Upon successful completion of the course a student will be able to

CO #	Detailed Statement of the CO
CO1	Design algorithms involving more complex data structures, and can implement it.
CO2	Understanding the performance of multiple methods and models, recognize the connections between how the data were collected and the scope of conclusions from the resulting analysis
CO3	Apply models and use different measures of model to assess outputs.
CO4	Analyse the data model applied using the data science tools.
CO5	Evaluate the data from disparate sources, cleaning the data and transform data from one format to another
CO6	Developing the program using various tools of data science.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1		1						
CO2	2	1	2	2		1		1				
CO3	2	2	2	2		1	2	3		1		
CO4	1	3	2	2			1	3				
CO5	1	3	3	2								
CO6	2	3	3	3		1	2	3	1	1		
AVG	**1.7**	**2.2**	**2.2**	**2**		**0.7**	**0.8**	**1.7**	**0.2**	**0.3**		

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSC801**				
Course Name	**: C# PROGRAMMING WITH .NET FRAMEWORK**				
Semester / Year	**: 8th Semester / 4th Year**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To study the features of .NET Technologies and to understand the framework and environment.
2. To learn C# programming fundamentals for console application development.
3. To learn use of C# libraries and exception handling techniques.
4. To learn ADO. NET and advance features of C#.
5. To learn .NET assemblies and attributes

Course Content

UNIT 1 **[No. of Hours:07]**

Introduction to .NET Framework- .NET framework, MSIL, CLR, CLS, CTS, Just in time (JIT) Compiler, Base class library, Namespaces, Assemblies, DLL Hell -Problem, Garbage Collection.

UNIT 2 **[No. of Hours:11]**

C# Object oriented programming- OOPs, Classes and objects, loops, Array, Encapsulation, Inheritance, Polymorphism, Interface ,Constructor and Destructors, Method Overloading ,Method overriding, Operator Overloading, Modifiers, Indexers , Collections Namespaces, Delegates, Exception Handling.

UNIT 3 **[No. of Hours:07]**

Microsoft .NET IDE- Creating a Project and solution, Building project, Debugging project, Solution Explorer, Toolbox, Server Explorer, Property Window, Windows Forms and Controls in details-The Windows Forms Model, Creating Windows Forms Windows Forms Properties and Events, Windows Form Controls .

UNIT 4 **[No. of Hours:08]**

ADO.Net, C# windows forms for data control: Grid, Datasource and databinding controls, Connected and disconnected scenarios, Dataset, connections, Adapters, commands, datareaders.

UNIT 5 **[No. of Hours:08]**

ASP.net-Introduction to ASP.NET, Architecture, Working with Web and HTML Controls, Web forms, Using Rich Server Controls, Overview of ASP.NET Validation Controls, Data base connectivity using ASP.net.

Text Books

TB1. A Guide to the Project Management Body of Knowledge (PMBOK), Project Management Institute, PA, (2004).
TB2. Harold Kerzner, Frank P. Saladis, Project Management Workbook and PMP/CAPM Exam Study Guide , Wiley Publishers (2006)
TB3. Addison Wesley –C# Developers Guide to ASP.Net
TB4. Wiley," Beginning Visual C# 2008", Wrox

Reference Books

RB1. Claudia M. Baca, Patti, PMP: Project Management Professional Workbook, Sybex, Workbook (2003).
RB2. C#.Net Developers Guide- Greg Hack, Jason Werry, SaurabhNandu. (SyngRess)
RB3. Wrox Press Professional C# 3rd Edition – Simon Robinson, Jay Glynn

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Knowledge and remember.NET Framework, its runtime environment and application development IDE of Visual Studio.
CO2	Understand the concept of object oriented for making programs.
CO3	Implement C# language constructs in the form of stand-alone console and window form applications.
CO4	Analyze and Understand database concepts in ADO.NET and apply the knowledge to implement distributed data-driven applications.
CO5	Design, document, debug ASP.NET web forms with server and validation controls and implement ASP.NET web services.
CO6	Create the programs based on console, windows and web application.

Mapping of PO and CO:

CO	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	-	3	1	1	-	-	-	-	-
CO2	1	-	3	-	-	-	1	-	-	-	-	-
CO3	-	-	3	-	2	-	-	-	-	-	-	-
CO4	2	-	2	-	2	-	-	-	-	-	-	-
CO5	-	-	3	-	-	-	1	-	-	-	-	-
CO6	2	2	1	4				1	1	1		
AVG	1.16	0.33	2.5	0.66	1.16	0.16	0.5	0.16	0.16	0.16	0	0

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAP81 (Lab based on BCADSC801)**				
Course Name	**: C# PROGRAMMING LAB**				
Semester / Year	**: 8th Semester / 4th Year**				
		L	**T**	**P**	**C**
		0	**0**	**2**	**1**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To learn and understand different types of statements in C#.
2. Use of data base for making dynamic websites using C# programming
3. Programming concepts in .Net Framework.
4. Data base connectivity using ADO.net
5. Understand and use of different graphical tools for the development of web page and website using C# programming.

COURSE CONTENTS

1. Program to generate prime numbers between 1 to200 and also print to the console. (ex. 1,2,3,5.....199).
2. Program to print ARMSTRONG number.
3. Program using loop that examines all the numbers between 2 and 1000, and displays only Perfect numbers.(A perfect number is the one whose sum of their divisors equals the number itself).For example given the number 6, the sum of its divisors is 6(1+2+3).Hence, 6 is a perfect number.
4. Program to accept an array of integers (10) and sort them in ascending order.
5. Program to implement the concept of abstract class.
6. Program to implement the concept of sealed class.
7. Program for jagged array and display its item through foreach loop.
8. Program in C Sharp using a class that gets the information about employee's such as Emp Id, First Name, Last Name, Basic Salary,Grade,Address, Pin Code and Contact Number. Write a method that calculates the Gross Salary (Basic +DA+HRA) and returns to the calling program and another method for the Net salary (Gross - (P.F + Income Tax)).Finally write a method that prints, a pay slip of an employee, containg all the above components in a proper format to the console.(Grade A = 20,000 , B=15,000 and C=10,000) DA=56% and HRA=20%., Pf=780, ITax.
9. Program to demonstrate boxing and unboxing.
10. Program to find number of digit, character, and punctuation in entered string.
11. Program using C# for exception handling.
12. Program to implement multiple inheritances using interface.
13. Program in C# using a delegate to perform basic arithmetic operations like addition, subtraction, division, and multiplication.
14. Program to get the user's name from the console and print it using different namespace.
15. Demonstrate the concept of Multithreading using locks in C Sharp
16. Program to implement Indexer.

17. Program to design two interfaces that are having same name methods how we can access these methods in another class.
18. Program to implement method overloading.
19. Program to implement method overriding
20. Program in C sharp to create a calculator in windows form.
21. Create a front end interface in windows that enables a user to accept the details of an employee like EmpId ,First Name, Last Name, Gender, Contact No, Designation, Address and Pin. Create a database that stores all these details in a table. Also, the front end must have a provision to Add, Update and Delete a record of an employee.
22. Create a database named MyDb (SQL or MS Access).Connect the database with your window application to display the data in List boxes using Data Reader.
23. Program using ADO.net to insert, update, delete data in back end
24. Display the data from the table in a DataGridView control using dataset.
25. Create a registration form in ASP.NET and use different types of validation controls.
26. Display the data from the table in a Repeater control using dataset in ASP.net.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Remember the basics of C# programming, different graphics tools and their use.
CO2	Understand of static and dynamic web pages using standard tools and learn various properties of the tools.
CO3	Develop interactive and user friendly websites using front end and back end programming.
CO4	To develop, implement and creating Applications with ADO.NET and SQL server
CO5	Create user interactive web pages using ASP.Net.
CO6	Create console, windows and wed applications

Mapping of PO and CO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1			3	1	2				
CO2	3	1	2	3		3	2	3				
CO3	3	2	3	3	1	2	2	3				
CO4	2	1	3	3	2	3	2	3				
CO5	3	1	3	1	2	3	2	3				
CO6	2	3	2	2			1	1	2	1		
AVG	**2.66**	**1.5**	**2.33**	**2**	**0.83**	**2.33**	**1.66**	**2**	**0.33**	**0.16**		

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Generic Electives

Generic Electives

Couse Code	Course Name	L	T	P	C
BCAGE101	Office Automation	4	-	-	4
BCAGE201	Cyber Security	4	-	-	4
BCAGE301	Management Information System	4	-	-	4
BCAGE401	Digital Marketing	4	-	-	4
BCAGE501	E-Commerce	4	-	-	4
BCAGE601	Business Intelligence	4	-	-	4
BCAGE701	E- Governance	4	-	-	4
BCAGE801	Enterprise Resource Planning	4	-	-	4

Course code	:	**BCAGE101**			
Course Name	:	**OFFICE AUTOMATION**			
Semester /Year	:	**1st Semester / 1st Year**			
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objective:

1 Office tools course would enable the students in crafting professional word documents, excel spread sheets, power point presentations, Database using the Microsoft suite of office tools.
2 To familiarize the students in preparation of documents and presentations with office automation tools.

COURSE CONTENTS

Unit 1: Introduction to MS Office Suite and Microsoft Word **[No. of Hours: 12]**

Overview of Microsoft Office Suite and its applications, Understanding the importance of MS Office in the professional world

Creating, editing, and formatting documents, working with text, fonts, and paragraphs, Page layout, margins, and page numbering, inserting tables, images, and other objects, working with headers and footers, Creating and formatting tables of contents, Introduction to mail merge and document collaboration

Unit 2: Microsoft Excel **[No. of Hours: 10]**

Understanding spreadsheets and their applications, Entering and formatting data in cells, using formulas and functions for calculations, formatting spreadsheets and applying cell styles, creating charts and graphs, Sorting and filtering data, Using conditional formatting and data validation, Introduction to pivot tables and data analysis tools

Unit 3: Microsoft PowerPoint **[No. of Hours: 10]**

Creating and formatting slides, adding text, images, and multimedia elements, applying slide transitions and animations, using slide masters and templates, presenting slideshows and using speaker notes, creating handouts and exporting presentations

Unit 4: Microsoft Access **[No. of Hours: 8]**

Understanding databases and their components, creating tables, forms, queries, and reports, Entering and editing data in tables, Defining relationships between tables, Creating basic queries to retrieve information, Generating reports based on data

Text Books:

TB1. Office 365 All-in-One For Dummies (For Dummies (Computer/Tech)) by Peter Weverka, Timothy L. Warner
TB2. Mastering MS Office by Bittu Kumar
TB3. Word 2019 For Dummies by Dan Gookin

TB4. Microsoft PowerPoint 2010 - Develop Computer Skills: Be Future Ready, by Bittu Kumar.

Reference Books:

RB1. Microsoft Office Step by Step (Office 2021 and Microsoft 365) by Curtis Frye, Joan Lambert
RB2. Word 2019 Beginner (Word Essentials 2019) by M L Humphrey
RB3. Step-By-Step Optimization With Excel Solver The Excel Statistical, Mark Harmon

Course Outcomes (COs):
Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall and remember key features and functionalities of MS Office applications, including Word, Excel, PowerPoint, and Access.
CO2	Explain the concepts and principles underlying MS Office applications, such as document formatting, data manipulation, slide design, and database management.
CO3	Apply knowledge of MS Office applications to create and format professional documents, perform calculations and data analysis, design effective presentations, and manage databases efficiently.
CO4	Analyze complex document structures, spreadsheet formulas, and data relationships within MS Office applications to identify errors, inconsistencies, or opportunities for improvement.
CO5	Evaluate the effectiveness and appropriateness of different MS Office features, tools, and techniques for specific tasks or scenarios, and make informed judgments about their use and potential impact.
CO6	Create professional-quality documents, spreadsheets, presentations, and databases using MS Office applications, demonstrating originality, creativity, and proficiency in their work.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	1	1	1	1	2	1	1	2
CO2	3	2	3	1	2	2	1	1	2	1	1	2
CO3	1	2	2	1	1	2	1	1	2	1	1	2
CO4	1	1	1	2	1	1	1	1	1	1	1	1
CO5	1	1	1	2	1	1	1	1	1	1	1	1
CO6	2	2	2	2	1	2	2	2	2	2	2	2
AVG	**2**	**1.8**	**2**	**1.6**	**1.2**	**1.6**	**1.2**	**1.2**	**1.8**	**1.2**	**1.2**	**1.8**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAGE201**				
Course Name	**: CYBER SECURITY**				
Semester / Year	**: 2nd Semester / 1st Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Learn the foundations of Cyber Security and threat landscape.
2. To equip students with the technical knowledge and skills needed to protect and
3. defend against cyber threats.
4. To develop skills in students that can help them plan, implement, and monitor
5. cyber security mechanisms to ensure the protection of information technology assets.
6. To expose students to governance, regulatory, legal, economic, environmental,
7. social and ethical contexts of Cyber Security.
8. To expose students to responsible use of online social media network.
9. To systematically educate the necessity to understand the impact of cybercrimes
10. and threats with solutions in a global and societal context.
11. To select suitable ethical principles and commit to professional responsibilities and human values and contribute value and wealth for the benefit of the society

COURSE CONTENTS

UNIT I Introduction to Cyber Security **[No. of Hours: 6]**

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.

UNIT II Cybercrime and Cyber law **[No. of Hours: 8]**

Classification of cybercrimes, Common cybercrimes - cybercrime targeting computers, cybercrime against woman and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks., Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act,2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber Security in India, Case studies

UNIT III Social Media Overview and Security **[No. of Hours: 10]**

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

UNIT IV E-Commerce and Digital Payments **[No. of Hours: 8]**

Electronic Commerce definition, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payment related common frauds and preventive measures. RBI guidelines on digital payment and customer protection in unauthorized banking transactions. Relevant provisions of Payment settlement Act,2007.

UNIT V Digital Devices Security, Tools and Technologies for Cyber Security

[No. of Hours: 8]

End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.

Text Books:

TB1. Cyber Crime Impact in the New Millennium, by Marine R. C, Auther Press.
TB2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.

Reference Books:

RB1. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.
RB2. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
RB3. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
RB4. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
RB5. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

Course outcomes (COs):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Define a deeper understanding and familiarity with various types of cyberattacks, cybercrimes, vulnerabilities and remedies thereto.
CO2	Understand and evaluate existing legal framework and laws on Cyber Security.
CO3	Use the security aspects of social media platform and ethical aspects associated with use of social media.
CO4	Analyse and evaluate the digital payment system security and remedial measures against digital payment frauds.

CO5	Analyse and evaluate the Digital devices security and cyber security risks.
CO6	Create Cyber Security Practices and Configuration of basic security policies and permissions.

CO-PO Mapping:

	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		1	1	1	1				2	1	
CO2	2									2	1	
CO3	2	1			3	2				2	1	
CO4	2	1			1	2				2		
CO5	2									2	1	
CO6	2	1			1	1	1		1	1		
AVG	**2.2**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**	**1.0**		**1.0**	**1.8**	**1.0**	

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAGE301**				
Course Name	**: MANAGEMENT INFORMATION SYSTEM**				
Semester / Year	**: 3rd Semester / 2nd Year**				
	L	**T**	**P**	**C**	
	4	**0**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making.
2. Analyse and synthesize business information systems to facilitate evaluation of strategic alternatives.
3. Effectively communicate strategic alternatives to facilitate decision making.
4. Understand entire spectrum of issues related to managing information systems in an ethical manner

COURSE CONTENTS

UNIT 1 **[No. of Hours: 8]**

Organization & Types, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, various channels of information & MIS.

UNIT 2 **[No. of Hours: 8]**

Foundation of Information System: Introduction to Information System in Business Fundamentals of Information System, Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS- dataflow diagram, flow chart etc.

UNIT 3 **[No. of Hours: 8]**

Business application of information technology: electronic commerce Internet, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information system for managerial Decision Support, Information System for Strategic Advantage.

UNIT 4 **[No. of Hours: 8]**

Managing Information Technology, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools.

UNIT 5 **[No. of Hours: 8]**

Advanced concepts in information system: Enterprise Resource Planning: introduction, various modules like Human Resources, Finance, Accounting, Production& Logistics. Supply Chain Management, CRM, Procurement, Management System Object Oriented modeling case studies.

Text Books:

TB1. O.Brian, "Management Information System", TMH.
TB2. O.Brian, "Introduction to Information System", McGraw Hill.

Reference Books:

RB1. Alter, "Information Systems: A Management Perspective", Addison Wesley.
RB2. Arora& Bhatia, "Information Systems for Managers", Excel
RB3. Bansal, "Information System Analysis & Design", TMH.
RB4. Jawadegar, "Management Information System", TMH.
RB5. Murdick, "Information System for Modern Management", PHI.
RB6. Alexis Leon, "Enterprise Resource Planning", TMH.

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Define information, types of Information value and importance of information.
CO2	Explain the usage, of Information system and their tools.
CO3	Apply the techniques of strategic design of information system
CO4	Classify the different types of Information System
CO5	Appraise the Business Applications of Information System
CO6	Construct the required Information Systems in an ethical way

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3		3			2	3	1		2	
CO2	2	3		3	3						2	
CO3	2	3	3	3								
CO4	2	2	3	2	3	3						
CO5	2	2	3	2	3		3			2	2	
CO6	2	2	3	2	1		3			2	2	
AVG	2	2.5	2	2.5	1.6	0.5	1.3	0.5	0.1	0.6	1.3	0

Course code	**: BCAGE401**				
Course Name	**: DIGITAL MARKETING**				
Semester / Year	**: 4th Semester / 2nd Year**				
	L	**T**	**P**	**C**	
	4	**0**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1 Provide students with a comprehensive understanding of digital marketing concepts, strategies, and channels.
2 Equip students with the knowledge and skills to design and optimize websites, social media campaigns, and search engine marketing initiatives.
3 Develop students' ability to analyze data from digital marketing campaigns and make data-driven decisions for campaign optimization.
4 Enable students to evaluate the performance of digital marketing campaigns and identify areas for improvement.
5 Foster the ability to create and implement integrated digital marketing campaigns to achieve specific objectives and target audiences.
6 Cultivate ethical and responsible digital marketing practices in students' professional endeavors.

COURSE CONTENTS

Unit 1: Introduction to Digital Marketing **[No. of Hours: 3]**

Definition, scope, and importance of digital marketing, Evolution of digital marketing and its impact on businesses, Digital marketing strategies and their objectives, Digital marketing channels and tools, Ethical and legal considerations in digital marketing

Unit 2: Website Design and Optimization **[No. of Hours: 7]**

Basics of website development and design principles, User experience (UX) and user interface (UI) design for websites, Search engine optimization (SEO) techniques for website visibility, Conversion rate optimization (CRO) strategies for website performance, Mobile optimization and responsive web design

Unit 3: Social Media Marketing **[No. of Hours: 7]**

Overview of social media platforms and their role in marketing, Creating effective social media marketing strategies, Content creation and curation for social media, Social media advertising and targeting options, Social media analytics and measuring campaign performance

Unit 4: Search Engine Marketing (SEM) and Pay-per-Click (PPC) **[No. of Hours: 5]**

Introduction to search engine marketing and its benefits, Keyword research and selection for SEM campaigns, Creating and optimizing search ads using Google Ads, Bid management and budgeting for PPC campaigns, Tracking and analyzing SEM campaign performance

Unit 5: Email Marketing and Marketing Automation **[No. of Hours: 3]**
Fundamentals of email marketing and its role in digital marketing, Creating compelling email campaigns and newsletters, Email list building and segmentation, Marketing automation tools and workflows, Analyzing email campaign metrics and optimizing performance

Unit 6: Content Marketing and Branding **[No. of Hours: 5]**
Introduction to content marketing and its importance, Developing a content marketing strategy, Content creation, distribution, and promotion, Influencer marketing and collaborations, Building and managing a brand's online presence

Unit 7: Analytics and Data-driven Decision Making **[No. of Hours: 5]**
Basics of digital marketing analytics, Key performance indicators (KPIs) and metrics, Data analysis tools and techniques, Conversion tracking and reporting, Using data to make data-driven marketing decisions

Unit 8: Digital Marketing Campaign Planning and Management **[No. of Hours: 5]**
Developing a comprehensive digital marketing campaign, Setting campaign objectives and target audience identification, Campaign budgeting and resource allocation, Monitoring, measuring, and optimizing campaign performance, Campaign reporting and evaluation

Text Books:

TB1. "Digital Marketing: Strategy, Implementation, and Practice" by Dave Chaffey and Fiona Ellis-Chadwick
TB2. "Digital Marketing for Dummies" by Ryan Deiss and Russ Henneberry
TB3. "Social Media Marketing Workbook: How to Use Social Media for Business" by Jason McDonald
TB4. "Epic Content Marketing: How to Tell a Different Story, Break through the Clutter, and Win More Customers by Marketing Less" by Joe Pulizzi
TB5. "Google Analytics Breakthrough: From Zero to Business Impact" by Feras Alhlou, Shiraz Asif, and Eric Fettman
TB6. "The Conversion Code: Capture Internet Leads, Create Quality Appointments, Close More Sales" by Chris Smith

Reference Books:

RB1. "The Art of SEO: Mastering Search Engine Optimization" by Eric Enge, Stephen Spencer, Jessie Stricchiola, and Rand Fishkin
RB2. "Inbound Marketing: Attract, Engage, and Delight Customers Online" by Brian Halligan and Dharmesh Shah
RB3. "Email Marketing Rules: How to Wear a White Hat, Shoot Straight, and Win Hearts" by Chad S. White
RB4. "Contagious: How to Build Word of Mouth in the Digital Age" by Jonah Berger

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall and explain fundamental concepts and terminology related to digital marketing.
CO2	Demonstrate comprehension of different digital marketing strategies, channels, and their impact on business growth.
CO3	Apply digital marketing principles and techniques to design and optimize websites, social media campaigns, and search engine marketing initiatives.
CO4	Analyze data from digital marketing campaigns and tools to evaluate their effectiveness and make data-driven decisions for campaign optimization.
CO5	Evaluate the performance of digital marketing campaigns, including website analytics, social media metrics, and conversion rates, to assess their success and identify areas for improvement.
CO6	Develop comprehensive digital marketing campaigns by integrating various strategies, channels, and tools to achieve specific objectives and target audiences.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	1	1	1	1	2	1	1	1
CO2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	2	2	3	2	2	2	2	2	2	2	2	2
CO4	1	2	2	2	1	1	2	1	2	1	1	2
CO5	1	1	2	1	1	1	1	1	2	1	1	1
CO6	1	2	2	2	1	1	2	1	2	1	1	2
AVG	**1.67**	**1.83**	**2.25**	**1.83**	**1.67**	**1.67**	**1.83**	**1.67**	**2.25**	**1.67**	**1.67**	**1.83**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAGE501**				
Course Name	**: E-COMMERCE**				
Semester / Year	**: 5th Semester / 3rd Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

7 Provide students with a comprehensive understanding of digital marketing concepts, strategies, and channels.
8 Equip students with the knowledge and skills to design and optimize websites, social media campaigns, and search engine marketing initiatives.
9 Develop students' ability to analyze data from digital marketing campaigns and make data-driven decisions for campaign optimization.
10 Enable students to evaluate the performance of digital marketing campaigns and identify areas for improvement.
11 Foster the ability to create and implement integrated digital marketing campaigns to achieve specific objectives and target audiences.
12 Cultivate ethical and responsible digital marketing practices in students' professional endeavors.

COURSE CONTENTS

Unit 1: Introduction to E-commerce **[No. of Hours: 5]**

Definition and evolution of e-commerce, Advantages and disadvantages of e-commerce, E-commerce business models (B2C, B2B, C2C, etc.), Emerging trends and future prospects in e-commerce

Unit 2: E-commerce Infrastructure **[No. of Hours: 6]**

Internet and its role in e-commerce, Web hosting and domain registration, Payment gateways and online payment systems, E-commerce security and SSL certificates

Unit 3: Online Marketing and Advertising **[No. of Hours: 7]**

Digital marketing strategies for e-commerce, Search engine optimization (SEO) for e-commerce websites, Social media marketing and influencer marketing, Email marketing campaigns and customer retention strategies

Unit 4: E-commerce Analytics **[No. of Hours: 7]**

Data analytics for e-commerce decision making, Key performance indicators (KPIs) in e-commerce, Google Analytics and other e-commerce tracking tools, Using data to optimize website performance and customer experience

Unit 5: Mobile Commerce (M-commerce) **[No. of Hours: 5]**

Introduction to m-commerce and its significance, Responsive web design and mobile app development for e-commerce, Mobile payment systems and mobile marketing strategies

Module 6: E-commerce Legal and Ethical Considerations **[No. of Hours: 5]**

Legal aspects of e-commerce (contracts, intellectual property, etc.), Privacy and data protection in e-commerce, Cybersecurity and preventing online fraud, Ethical issues related to online business practices

Module 7: E-commerce Case Studies **[No. of Hours: 5]**

Analysis of successful e-commerce businesses, Case studies on e-commerce failures and lessons learned, Identifying best practices and strategies from real-world examples

Text Books:

TB1. E-Commerce Concepts. Models, Strategies C.S.V Murthy, Himalaya Publishing House

TB2. The Complete E-Commerce Book: Design, Build & Maintain a Successful Web-based Business by Janice Reynolds

Reference Books:

RB1. E-Commerce: Fundamentals and Applications by Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang November 2001"Inbound Marketing: Attract, Engage, and Delight

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Able to recall and describe the fundamental concepts and business models of e-commerce.
CO2	Comprehend the infrastructure and technologies required for establishing and running an e-commerce business.
CO3	Apply digital marketing strategies to promote e-commerce websites effectively.
CO4	Analyze e-commerce analytics data to make informed business decisions.
CO5	Evaluate legal and ethical considerations in e-commerce and propose ethical solutions to business challenges.
CO6	Design and develop a mobile commerce (m-commerce) platform, considering user experience and security.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	2	1	2	2	2	1	2	2
CO2	2	3	3	2	2	1	3	3	2	1	2	3
CO3	2	2	3	2	2	1	3	3	2	1	2	3
CO4	1	2	2	1	2	1	2	2	2	1	2	2
CO5	1	2	2	1	2	1	2	2	2	1	2	2
CO6	2	2	3	1	2	1	2	2	2	1	2	2
AVG	1.7	2.3	2.6	1.5	2.1	1.1	2.5	2.5	2.2	1.2	2.2	2.5

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAGE601**				
Course Name	**: BUSINESS INTELLIGENCE**				
Semester / Year	**: 6th Semester / 3rd Year**				
	L	**T**	**P**	**C**	
	4	**0**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Introduce students to fundamental Business Intelligence (BI) concepts, methodologies, and tools.
2. Enable students to collect, analyze, and visualize data for informed decision-making in business organizations.

COURSE CONTENTS

Unit 1: Introduction to Business Intelligence **[No. of Hours: 4]**

Definition and importance of Business Intelligence, BI architecture and components, BI vs. traditional reporting

Unit 2: Data Warehousing **[No. of Hours: 7]**

Data Warehousing concepts and architecture, Data marts and data integration, ETL (Extract, Transform, Load) process

Unit 3: Data Modeling and Visualization **[No. of Hours: 11]**

Dimensional modeling (star schema and snowflake schema), Fact and dimension tables, Data modeling tools and techniques, Principles of data visualization, Popular BI visualization tools (e.g., Tableau, Power BI), Creating interactive dashboards and reports

Unit 4: Data Mining and Predictive Analytics **[No. of Hours: 5]**

Introduction to data mining, Data mining techniques (classification, clustering, association), Predictive analytics and its applications

Unit 5: OLAP (Online Analytical Processing) **[No. of Hours: 5]**

OLAP concepts and multidimensional data analysis, OLAP operations (slice, dice, pivot, drill-down, roll-up), Implementing OLAP using tools like Mondrian, Microsoft Analysis Services

Unit 6: Business Performance Management and Data Governance **[No. of Hours: 6]**

Key Performance Indicators (KPIs) and metrics, Performance scorecards and balanced scorecards, Business performance management tools and methodologies, Data quality issues and challenges, Data cleansing and data enrichment techniques, Data governance and compliance

Unit 7: Business Intelligence Implementation **[No. of Hours: 2]**

BI project planning and management, BI best practices and success factors, Case studies of successful BI implementations

Text Books:

TB3. "Successful Business Intelligence: Secrets to Making BI a Killer App" by Cindi Howson

TB4. "Business Intelligence and Analytics: Systems for Decision Support" by Ramesh Sharda, Dursun Delen, Efraim Turban, and Jay E. Aronson

TB5. Business Intelligence: Applications to Consumer Marketing by Sandhya Kuruganti and Hindol Basu

Reference Books:

RB2. "Business Intelligence Guidebook: From Data Integration to Analytics" by Rick Sherman

RB3. "Business Intelligence for Dummies" by Swain Scheps

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall and recognize fundamental concepts, terminologies, and components related to Business Intelligence.
CO2	Understanding of various BI methodologies, tools, and techniques used in data analysis and decision-making processes.
CO3	Analyze and visualize data, and effectively communicate insights using appropriate BI visualization tools.
CO4	Analyze and interpret data mining results and apply predictive analytics techniques to make data-driven business decisions.
CO5	Evaluate the effectiveness of OLAP in providing multidimensional data analysis and assess the impact of BI solutions on business performance management.
CO6	Create innovative solutions and implement Business Intelligence strategies in real-world scenarios, considering data governance and quality.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	1	1	2	1	1	1	2
CO2	2	2	3	2	2	1	1	2	1	1	1	2
CO3	2	2	3	2	2	1	1	2	1	1	1	2
CO4	1	1	2	1	1	1	1	1	1	1	1	1
CO5	1	1	2	1	1	1	1	1	1	1	1	1
CO6	2	2	3	2	2	1	1	2	1	1	1	2
AVG	**1.8**	**1.8**	**2.6**	**1.8**	**1.8**	**1.2**	**1.2**	**1.8**	**1.2**	**1.2**	**1.2**	**1.8**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAGE701**				
Course Name	**: E- GOVERNANCE**				
Semester / Year	**: 7th Semester / 4th Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Understand the fundamental concepts and principles of E-Governance.
2. Explore the role of information and communication technologies in modern governance.
3. Analyze the challenges and opportunities in implementing E-Governance projects.
4. Evaluate the impact of E-Governance on public service delivery and citizen engagement.
5. Apply E-Governance frameworks and technologies in practical scenarios.
6. Create innovative solutions and proposals for future E-Governance initiatives.

COURSE CONTENTS

Unit 1: Introduction to E-Governance **[No. of Hours: 4]**

Definition and scope of E-Governance, Evolution and importance of E-Governance, Benefits and challenges of E-Governance

Unit 2: ICT in Governance **[No. of Hours: 4]**

Role of information and communication technologies in governance, E-Government models: G2C, G2B, G2G, G2E, Digital divide and its implications for E-Governance

Unit 3: E-Governance Framework and Architecture **[No. of Hours: 6]**

Components of an E-Governance framework, Building blocks of E-Governance architecture, Interoperability and data standards in E-Governance

Unit 4: E-Governance Initiatives in India **[No. of Hours: 6]**

Overview of major E-Governance projects in India, National E-Governance Plan (NeGP) and its components, Case studies of successful E-Governance implementations

Unit 5: E-Governance Infrastructure **[No. of Hours: 4]**

Cloud computing and its role in E-Governance, Data centers and data security in E-Governance Mobile Governance (M-Governance) applications

Unit 6: Legal and Ethical Issues in E-Governance **[No. of Hours: 5]**

Cybersecurity and data privacy concerns, E-Governance policies and regulations in India, Ethical considerations in handling citizen data

Unit 7: Citizen Engagement and Service Delivery **[No. of Hours: 5]**

E-Governance portals and citizen-centric services, Role of social media in E-Governance, Evaluating the effectiveness of E-Governance initiatives

Unit 8: Emerging Trends in E-Governance **[No. of Hours: 6]**

Blockchain technology in governance, Artificial Intelligence (AI) and Machine Learning (ML) applications, Internet of Things (IoT) for Smart Cities

Text Books:

TB1. E-Governance: Concepts And Case Studies, C.S.R. Prabhu ,PHI ,2011
TB2. E- Governance in India: initiatives and issues, R.P. Sinha, Concept Publishing Company, 2006
TB3. E-governance for Development: A Focus on India, Shirin Madon , Palgrave Macmillan , 2002.
TB4. E-Governance: case studies, Ashok Agarwal, University Press India, 2007.

Reference Books:

RB1. IT and E-Governance in India , Kamalesh N. Agarwala, Murli D. Tiwari , Macmillan , 2002.
RB2. E-Government: from vision to implementation: a practical guide with case studies, Subhash C. Bhatnagar, SAGE , 2004
RB3. Good Governance and development An Indian Perspective, Kanak kanthi, Abhijeet publication New Delhi 2009.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the fundamental concepts and principles of E-Governance. List and explain the different E-Government models and their key characteristics. Memorize the major E-Governance initiatives and projects implemented in India.
CO2	Comprehend the significance of information and communication technologies in governance. Explain the role of E-Governance in enhancing government processes and citizen services. Discuss the impact of E-Governance on bridging the digital divide and promoting inclusivity.
CO3	Apply E-Governance frameworks and architecture concepts to design efficient governance systems. Utilize E-Governance infrastructure and technologies for real-world governance scenarios. Implement strategies to enhance citizen engagement through E-Governance platforms.
CO4	Analyze the challenges and barriers faced during the implementation of E-Governance projects. Compare and contrast different E-Governance models and their suitability for specific contexts. Evaluate the impact of E-Governance initiatives on improving government efficiency and citizen satisfaction.
CO5	Assess the legal and ethical considerations related to data privacy and security in E-Governance. Critically evaluate the success factors and limitations of various E-Governance projects in India. Judge the effectiveness of E-Governance solutions in achieving transparency and accountability in governance.

CO6	Design innovative E-Governance solutions for addressing specific governance challenges. Develop proposals for new E-Governance projects that cater to the needs of citizens and businesses. Generate novel ideas to leverage emerging technologies for advancing E-Governance in the future.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	2	1	1	2	2	2	2	2
CO2	2	3	3	2	3	2	2	3	3	3	3	3
CO3	2	3	3	2	3	2	2	3	3	3	3	3
CO4	1	2	2	1	2	1	1	2	2	2	2	2
CO5	1	2	2	1	2	1	1	2	2	2	2	2
CO6	2	3	3	2	3	2	2	3	3	3	3	3
AVG	**1.6**	**2.6**	**2.6**	**1.6**	**2.6**	**1.6**	**1.6**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAGE801**				
Course Name	**: ENTERPRISE RESOURCE PLANNING**				
Semester /Year	**: 8th Semester/ 4th Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To learn the need and evolution of ERP Systems and related technologies.
2. To learn ERP benefits and classification and implementation of ERP Life Cycle
3. To learn Analytical Hierarchy Process & its applications and ERP implementation approaches and its strategies.
4. To learn factors affecting ERP success and effectiveness.
5. To learn extend ERP and its learning and emerging issues.

COURSE CONTENTS

Unit-I **[No. of Hours: 10]**

Enterprise wide information system, Custom built and packaged approaches, Needs and Evolution of ERP Systems, Common myths and evolving realities, ERP and Related Technologies, Business Process Reengineering and Information Technology, Supply Chain Management, Relevance to Data Warehousing, Data Mining and OLAP, ERP Drivers, Decision support system

Unit-II **[No. of Hours: 6]**

ERP Domain, ERP Benefits classification, Present global and Indian market scenario, milestones and pitfalls, Forecast, Market players and profiles, Evaluation criterion for ERP product.

Unit-III **[No. of Hours: 6]**

ERP Life Cycle: Adoption Decision, Acquisition, Implementation, Use & Maintenance, Evolution and Retirement phases, ERP Modules

Unit- IV **[No. of Hours: 10]**

Framework for evaluating ERP acquisition, Analytical Hierarchy Processes (AHP), Applications of AHP in Evaluating ERP, Selection of Weights, Role of consultants, vendors and users in ERP implementation; Implementation vendor's evaluation criterion, ERP Implementation approaches and methodology, ERP Implementation strategies, ERP Customization,

Unit- V **[No. of Hours: 8]**

Critical success and failure factors for implementation, Model for improving ERP effectiveness, ROI of ERP Implementation, Hidden costs, ERP success inhibitors and accelerators, Management concern for ERP success, Strategic Grid: Useful guidelines for ERP Implementations.

Text Books:

TB1. Enterprise Resource Planning, Alexis Leon

TB2. ERP Concepts & Planning, V.K. Garg & N.K. Venkita Krishnan

Reference Books:

RB3. ERP Ware: ERP Implementation Framework, V.K. Garg &N.K. Venkita Krishnan

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO #	Detailed Statement of the CO
CO1	Defining basic use of enterprise software and its role in integrating business functions, reengineered business processes, phases of ERP implementation life cycle, domains of ERPs, implementation cost etc.
CO2	Understanding the work done during the ERP implementation life cycle.
CO3	Illustrate the Analytical Hierarchy Processes (AHP) for the selection of ERP system. Apply the customization to ERP system as per user's requirement.
CO4	Analyse the role of consultant, vendors and users in ERP implementation.
CO5	Evaluate critical success and failure factors for implementation, Hidden cost during ERP implementation.
CO6	Formulate methodology for the implementation of ERP system.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	2	2	2	2	1	2	2	2
CO2	3	2	3	2	2	2	2	2	2	2	2	2
CO3	3	2	3	2	2	2	2	2	2	2	2	2
CO4	2	3	3	3	2	2	2	2	2	2	2	2
CO5	2	3	2	3	2	2	2	2	2	2	2	2
CO6	2	2	2	2	2	2	2	2	2	2	2	2
AVG	**2.33**	**2.5**	**2.67**	**2.5**	**2**	**2**	**2**	**2**	**1.83**	**2**	**2**	**2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Skill Enhancements Courses

Skill Enhancement courses

Couse Code	Course Name	L	T	P	C
BCASC101	Personality Development and Soft Skills	2	-	-	2
BCASC201	Leadership Skills	2	-		2
BCASC301	Quantitative Aptitude	2	-	-	2
BCASC401	Analytical Reasoning	2	-	-	2
BCAPR5	Project	-	-	4	2
BCAPR6	Project	-	-	4	2
BCAPR7	Research/Academic/Entrepreneurship Project – I	-	-	12	6
BCAPR8	Research/Academic/Entrepreneurship Project – II	-	-	12	6
	Total	**8**	**-**	**32**	**24**

Course code	**: BCASC101**				
Course Name	**: PERSONALITY DEVELOPMENT AND SOFT SKILLS**				
Semester / Year	**: 1st Semester / 1st Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1 Develop effective communication skills, both verbal and non-verbal.
2 Enhance interpersonal skills for building and maintaining positive relationships.
3 Cultivate self-awareness and personal development to enhance professional growth.
4 Acquire problem-solving and decision-making abilities in various contexts.
5 Develop ethical and professional behavior in personal and team settings.
6 Adapt to new technologies and embrace lifelong learning for continuous growth.

COURSE CONTENTS

Unit 1: Introduction to Personality Development **[No. of Hours: 4]**
Understanding the concept of personality, Factors influencing personality development, Self-awareness and self-assessment, Personality traits and characteristics,

Unit 2: Communication Skills **[No. of Hours: 9]**
Verbal and non-verbal communication, Effective listening skills, Public speaking and presentation skills, Interpersonal communication and conflict resolution

Unit 3: Interpersonal Skills **[No. of Hours: 7]**
Building and maintaining relationships, Teamwork and collaboration, Emotional intelligence and empathy, Assertiveness and negotiation skills

Unit 4: Time Management and Organization **[No. of Hours: 5]**
Setting goals and priorities, Managing time effectively, Prioritizing tasks and resources, Organizational skills and productivity enhancement

Unit 5: Professionalism and Etiquette **[No. of Hours: 5]**
Business etiquette and professional behavior, Dressing and grooming standards, Workplace ethics and professionalism, Networking and building professional relationships

Unit 6: Leadership and Management Skills **[No. of Hours: 5]**
Leadership styles and qualities, Decision-making and problem-solving skills, Team management and delegation, Conflict management and resolution

Unit 7: Stress Management and Emotional Well-being **[No. of Hours: 5]**
Understanding stress and its impact, Coping mechanisms and stress reduction techniques, Work-life balance, Building resilience and managing emotions

Text Books:

TB1. "The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change" by Stephen R. Covey
TB2. "Emotional Intelligence: Why It Can Matter More Than IQ" by Daniel Goleman
TB3. "Crucial Conversations: Tools for Talking When Stakes Are High" by Kerry Patterson, Joseph Grenny, Ron McMillan, and Al Switzler
TB4. "The Power of Now: A Guide to Spiritual Enlightenment" by Eckhart Tolle
TB5. "How to Stop Worrying and Start Living" by Dale Carnegie
TB6. "Influence: The Psychology of Persuasion" by Robert Cialdini

Reference Books:

RB1. "How to Win Friends and Influence People" by Dale Carnegie
RB2. "The Art of Public Speaking" by Stephen E. Lucas
RB3. "Soft Skills: The Software Developer's Life Manual" by John Sonmez
RB4. "Mindset: The New Psychology of Success" by Carol S. Dweck

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall and describe the key concepts and theories related to personality development and soft skills and identify the components of effective communication and interpersonal skills.
CO2	Explain the importance of personality development and soft skills in personal and professional contexts and summarize the principles and strategies behind effective communication and interpersonal relationships.
CO3	Apply effective communication techniques to convey ideas clearly and assertively in different settings and utilize active listening skills to understand and respond effectively to others.
CO4	Analyze the impact of different communication styles on interpersonal relationships and conflict resolution and evaluate the effectiveness of various techniques for building and maintaining positive relationships.
CO5	Critically evaluate personal strengths and weaknesses in areas such as time management, leadership, and emotional intelligence and assess the ethical implications of different professional behaviors and decision-making processes.
CO6	Develop a personal development plan integrating various strategies for enhancing communication, leadership, and self-awareness and design and implement a comprehensive presentation or project demonstrating effective communication and soft skills.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		1								2	
CO2	2	1								3		
CO3			1			2					3	
CO4						3				2		
CO5				2			1				3	
CO6							3		1	2		
AVG	**0.83**	**0.17**	**0.33**	**0.33**	**0**	**0.83**	**0.67**	**0**	**0.17**	**1.17**	**1.33**	**0**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCASC201**				
Course Name	**: LEADERSHIP SKILLS**				
Semester / Year	**: 2nd Semester / 1st Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1 Understand the principles and theories of effective leadership.
2 Develop essential communication and interpersonal skills for leading teams.
3 Apply decision-making and problem-solving techniques in leadership scenarios.
4 Analyze different leadership styles and their suitability in various contexts.
5 Evaluate personal leadership strengths and areas for improvement.
6 Create a comprehensive leadership plan for project management and team leadership.

COURSE CONTENTS

Unit 1: Introduction to Leadership (3 hours)
Definition of leadership, Importance of leadership in the technology industry, Key qualities and characteristics of effective leaders

Unit 2: Leadership Theories and Styles (4 hours)
Trait theory of leadership, Behavioral theories of leadership (e.g., autocratic, democratic, laissez-faire), Situational and contingency theories, Transformational and transactional leadership

Unit 3: Communication Skills for Leaders (4 hours)
Effective verbal and non-verbal communication, Active listening and feedback, Emotional intelligence in leadership, Presentation skills for leaders

Unit 4: Decision-Making and Problem-Solving (4 hours)
Decision-making models and techniques, Problem-solving processes, Critical thinking and creativity in decision-making, Handling conflicts and making tough decisions

Unit 5: Team Building and Team Management (6 hours)
Forming, storming, norming, and performing stages of team development, Building and motivating high-performing teams, Delegation and empowerment, Conflict resolution and team dynamics

Unit 6: Leadership in Project Management (4 hours)
Leadership roles and responsibilities in project management, Setting project goals and objectives Time and resource management, Managing risks and overcoming challenges

Unit 7: Ethical Leadership and Personal Growth (5 hours)
Ethical considerations in leadership, Values-based leadership, Personal growth and self-awareness as a leader, Continuous learning and professional development

Text Books:

TB1. "Leadership: Theory and Practice" by Peter G. Northouse
TB2. "The Leadership Challenge" by James M. Kouzes and Barry Z. Posner
TB3. "Leading Teams: Setting the Stage for Great Performances" by Richard Hackman
TB4. "The 21 Irrefutable Laws of Leadership: Follow Them and People Will Follow You" by John C. Maxwell

Reference Books:

RB1. "Good to Great: Why Some Companies Make the Leap... and Others Don't" by Jim Collins

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall and define fundamental leadership theories and styles discussed in the course.
CO2	Understanding of the importance of effective communication in leadership and its impact on team dynamics.
CO3	Apply various decision-making models to real-world leadership scenarios and demonstrate their problem-solving skills.
CO4	Analyze the strengths and weaknesses of different leadership styles and their applicability in different organizational contexts.
CO5	Assess and critique their own leadership skills and behaviors, identifying areas for improvement.
CO6	Design and present a comprehensive leadership plan for managing a project team, incorporating the principles learned in the course.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	3	2	1	1	2	3	3	2
CO2	2	3	3	2	3	3	2	2	3	3	3	3
CO3	2	3	3	2	3	3	2	2	3	3	3	3
CO4	1	2	2	1	3	2	1	1	2	3	3	2
CO5	1	2	2	1	3	2	1	1	2	3	3	2
CO6	2	3	3	2	3	3	2	2	3	3	3	3
AVG	1.67	2.67	2.67	1.67	3	2.67	1.67	1.67	2.67	3	3	2.67

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCASC301**				
Course Name	**: QUANTITATIVE APTITUDE**				
Semester / Year	**: 3rd Semester / 2nd Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1 Gain a fundamental understanding of quantitative aptitude concepts.
2 Apply mathematical techniques to solve real-world problems.
3 Analyze complex data and information using quantitative methods.
4 Evaluate the accuracy and validity of mathematical solutions.
5 Foster innovative problem-solving skills and creative thinking.
6 Develop proficiency in interpreting and presenting quantitative data.
7 Enhance logical and analytical reasoning abilities.
8 Cultivate ethical and responsible decision-making in professional settings.

COURSE CONTENTS

Unit 1: Number Systems **[No. of Hours: 2]**
Integers, Fractions and Decimals, Factors and Multiples, Prime Numbers, HCF (Highest Common Factor) and LCM (Lowest Common Multiple)

Unit 2: Arithmetic **[No. of Hours: 4]**
Percentages, Ratios and Proportions, Averages, Profit and Loss, Simple and Compound Interest Time, Speed, and Distance, Time and Work

Unit 3: Algebra **[No. of Hours: 4]**
Equations (Linear and Quadratic), Inequalities, Exponents and Surds

Unit 4: Geometry **[No. of Hours: 6]**
Basic Geometric Concepts (Points, Lines, and Angles), Triangles (Types, Properties, and Congruence), Quadrilaterals (Types and Properties), Circles (Properties and Arcs), Mensuration (Perimeter, Area, and Volume), Trigonometry (Trigonometric Ratios and Identities)

Unit 5: Data Interpretation **[No. of Hours: 4]**
Tabular Data Interpretation, Bar Graphs, Line Graphs, Pie Charts, Data Analysis and Interpretation

Unit 6: Probability and Statistics **[No. of Hours: 4]**
Probability Basics, Measures of Central Tendency (Mean, Median, Mode), Measures of Dispersion (Range, Variance, Standard Deviation), Probability Distributions

Unit 7: Permutations and Combinations **[No. of Hours: 3]**
Factorial Notation, Permutations (with and without repetition), Combinations (with and without repetition)

Unit 8: Logical Reasoning **[No. of Hours: 3]**

Number Series, Coding and Decoding, Blood Relations, Direction Sense, Logical Puzzles Syllogism, Data Sufficiency

Text Books:

TB1. "Quantitative Aptitude for Competitive Examinations" by R.S. Aggarwal
TB2. "Quantitative Aptitude Quantum CAT" by Sarvesh K. Verma
TB3. "Fast Track Objective Arithmetic" by Rajesh Verma
TB4. "How to Prepare for Quantitative Aptitude for the CAT" by Arun Sharma
TB5. "A Modern Approach to Verbal & Non-Verbal Reasoning" by R.S. Aggarwal
TB6. "Analytical Reasoning" by M.K. Pandey
TB7. "Logical and Analytical Reasoning" by A.K. Gupta

Reference Books

RB1. "Quantitative Aptitude for All Competitive Examinations" by Abhijit Guha
RB2. "Logical Reasoning and Data Interpretation for the CAT" by Nishit K. Sinha
RB3. "How to Prepare for Logical Reasoning for the CAT" by Arun Sharma

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall and identify the key concepts and principles related to arithmetic, algebra, geometry, data interpretation, and logical reasoning.
CO2	Demonstrate a clear understanding of the fundamental principles, formulas, and methods used in various quantitative aptitude topics. Explain and interpret the reasoning behind different mathematical concepts.
CO3	Apply the learned mathematical techniques and problem-solving methods to solve a wide range of real-world problems related to percentages, ratios, time, distance, work, profit and loss, interest, probability, and statistical data.
CO4	Analyze complex quantitative data, charts, graphs, and word problems to extract relevant information and make informed decisions. They should be capable of breaking down intricate problems into manageable parts for effective problem-solving.
CO5	Evaluate the validity and accuracy of mathematical results obtained through different problem-solving approaches. They should also be able to assess the reasonableness of their answers and identify potential errors in calculations.
CO6	Develop innovative problem-solving strategies and apply creative thinking to tackle novel quantitative aptitude challenges. They should be capable of formulating and designing their problem-solving methods for non-standard scenarios.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	1	1	1	0	0	0	0	0
CO2	3	2	2	1	2	2	1	0	0	0	3	0
CO3	2	2	3	2	1	1	2	1	0	0	1	1
CO4	3	3	3	3	1	1	1	2	2	0	0	0
CO5	1	1	2	2	3	2	1	0	0	3	1	1
CO6	1	1	2	2	2	3	2	1	1	0	0	2
AVG	**2**	**1.67**	**2.5**	**2**	**1.67**	**1.67**	**1.33**	**0.67**	**0.5**	**0.5**	**0.83**	**0.67**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCASC401**				
Course Name	**: ANALYTICAL REASONING**				
Semester / Year	**: 4th Semester / 2nd Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Enhance the ability to critically evaluate arguments, identify logical fallacies, and assess validity and reliability in various contexts.
2. Gain proficiency in different types of reasoning including deductive, inductive, and abductive reasoning.
3. Apply analytical reasoning techniques to effectively solve complex problems and puzzles.
4. Acquire skills in interpreting and analyzing data using statistical methods and logical reasoning.
5. Learn to construct and deconstruct arguments, recognizing underlying assumptions and biases.
6. Encourage the creation of original logical puzzles and the development of unique problem-solving strategies.

COURSE CONTENTS

Unit 1: Introduction to Analytical Reasoning **[No. of Hours: 3]**

Introduction to analytical reasoning, Definition and importance, Overview of types of reasoning: deductive, inductive, abductive, Basics of argument structure, Premises, conclusions, inferences, Recognizing assumptions

Unit 2: Deductive Reasoning **[No. of Hours: 7]**

Categorical logic: Syllogisms, Venn diagram techniques
Conditional statements: If-then constructs, Identifying sufficient and necessary conditions
Formal logic: Symbolization, Logical equivalencies and contrapositives

Unit 3: Inductive Reasoning **[No. of Hours: 7]**

Analogies and comparisons: Identifying relationships, Avoiding false analogies
Pattern recognition: Sequences and series, Spatial reasoning
Statistical reasoning: Interpreting data, Making predictions

Unit 4: Problem Solving and Data Analysis **[No. of Hours: 7]**

Numeric and quantitative problem solving: Basic numerical calculations, Rates, ratios, and percentages
Data interpretation: Graphs and charts, Critical interpretation of data
Problem-solving strategies: Heuristics, Decision-making models

Unit 5: Advanced Reasoning Skills **[No. of Hours: 6]**

Complex logical puzzles: Logic games, Multi-step problems

Critical thinking: Identifying biases and fallacies, Evaluating arguments
Abstract reasoning: Non-verbal and spatial reasoning tests, Advanced pattern recognition

Text Books:

TB1. "A Modern Approach to Verbal & Non-Verbal Reasoning" by R.S. Aggarwal
TB2. "Analytical Reasoning" by M.K. Pandey
TB3. "Logical and Analytical Reasoning" by A.K. Gupta

Reference Books

RB1. "Logical Reasoning and Data Interpretation for the CAT" by Nishit K. Sinha
RB2. "How to Prepare for Logical Reasoning for the CAT" by Arun Sharma

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Able to recall and list key concepts in analytical reasoning, including the types of reasoning (deductive, inductive, abductive), basic structures of arguments, and fundamental principles of logic and pattern recognition.
CO2	Demonstrate understanding of analytical reasoning concepts by explaining in their own words the differences between deductive and inductive reasoning, the role of premises and conclusions in argumentation, and the significance of recognizing assumptions and biases in arguments.
CO3	Apply analytical reasoning techniques to solve a variety of problems, including using categorical logic in syllogisms, applying conditional reasoning in real-world scenarios, and employing statistical methods to interpret data.
CO4	Analyze complex arguments and data sets, identifying logical fallacies, underlying assumptions, and biases. They will also dissect and evaluate patterns in data and logical puzzles, breaking them down into their constituent elements.
CO5	Critically evaluate different arguments and data interpretations, assessing their validity and reliability. They will also be able to compare and contrast various problem-solving strategies, determining the most effective approach in different contexts.
CO6	Create their own logical puzzles and arguments, demonstrating originality and complexity. They will also design unique problem-solving strategies and methods for data analysis, showcasing their ability to synthesize knowledge and skills learned throughout the course.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1	1	1	1	1	1
CO2	3	3	2	2	1	1	1	1	1	1	1	1
CO3	3	3	2	3	1	1	2	1	1	1	1	1
CO4	2	3	3	3	2	1	2	1	1	1	1	1
CO5	3	3	2	3	2	1	2	1	1	1	2	1
CO6	2	2	3	3	3	2	3	2	1	2	3	3
AVG	2.7	2.9	2.3	2.7	1.7	1.2	1.8	1.2	1	1.2	1.5	1.2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCASM5**				
Course Name	**: SEMINAR**				
Semester / Year	**: 5th Semester / 3rd Year**				
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Identify and compare technical and practical issues related to the area of course specialization.
2. Outline annotated bibliography of research demonstrating scholarly skills.
3. Prepare a well-organized report employing elements of technical writing and critical thinking.
4. Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recite and speak cogently with or without notes on the topic using audio-visual aids.
CO2	Utilize technical resources.
CO3	Acquire the confidence in presenting the topic.
CO4	Analyze technically relevant current topics on computer science/information technology/research.
CO5	Create audience-centered presentations.
CO6	Create technical documents and give oral presentations related to the work completed.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	0	0	0	0	0	0	0	0	0	0
CO2	0	2	1	0	0	0	0	0	0	0	0	0
CO3	0	2	3	2	0	0	1	0	0	0	0	0
CO4	0	1	2	3	0	0	0	0	0	0	0	0
CO5	0	0	0	0	2	0	0	0	0	0	3	1
CO6	0	0	0	0	0	3	2	0	3	1	0	2
AVG	0.33	0.83	1	0.83	0.33	0.5	0.5	0	0.5	0.17	0.5	0.5

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAPR6**			
Course Name	**: PROJECT**			
Semester / Year	**: 6th Semester / 3rd Year**			
L	**T**	**P**	**C**	
0	**0**	**4**	**2**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

In this course, the learners will be able to develop working expertise of solving complex computing problems through project-based learning approach using real world case studies by implementing the concepts studied in the theory courses of this semester.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Identify the problem and describing it.
CO2	Understand the requirements of the chosen project.
CO3	Apply the collected requirements to define the describe the project in a systematic and comprehensive approach.
CO4	Analyze the technical aspects of the chosen project to find the possible solutions for development of the project.
CO5	Evaluate the effective reports and documentation for all project related activities and solutions.
CO6	Create plan for the project development.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	0	0	0	0	0	0	0	0	0
CO2	1	2	2	1	0	0	0	0	2	0	0	0
CO3	2	2	3	2	0	0	2	0	3	0	0	0
CO4	2	1	3	3	0	0	1	0	0	0	0	0
CO5	0	0	0	0	2	0	0	0	0	0	2	1
CO6	0	0	0	0	0	2	1	0	0	1	0	1
AVG	**1**	**1.17**	**1.5**	**1**	**0.33**	**0.33**	**0.67**	**0**	**0.83**	**0.17**	**0.33**	**0.33**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAPR7**			
Course Name	**: RESEARCH/ACADEMIC/ENTREPRENEURSHIP PROJECT – I**			
Semester / Year	**: 7th Semester / 4th Year**			
L	**T**	**P**	**C**	
0	**0**	**12**	**6**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

In this course, the learners will be able to develop working expertise of solving complex computing problems through project-based learning approach using real world case studies by implementing the concepts studied in the theory courses of this semester.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Identify the problem and describing it.
CO2	Understand the requirements of the chosen project.
CO3	Apply the collected requirements to define the describe the project in a systematic and comprehensive approach.
CO4	Analyze the technical aspects of the chosen project to find the possible solutions for development of the project.
CO5	Evaluate the effective reports and documentation for all project related activities and solutions.
CO6	Create plan for the project development.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	0	0	0	0	0	0	0	0	0
CO2	1	2	2	1	0	0	0	0	2	0	0	0
CO3	2	2	3	2	0	0	2	0	3	0	0	0
CO4	2	1	3	3	0	0	1	0	0	0	0	0
CO5	0	0	0	0	2	0	0	0	0	0	2	1
CO6	0	0	0	0	0	2	1	0	0	1	0	1
AVG	**1**	**1.17**	**1.5**	**1**	**0.33**	**0.33**	**0.67**	**0**	**0.83**	**0.17**	**0.33**	**0.33**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCAPR8**			
Course Name	**: RESEARCH/ACADEMIC/ENTREPRENEURSHIP PROJECT – II**			
Semester / Year	**: 8th Semester / 4th Year**			
L	**T**	**P**	**C**	
0	**0**	**12**	**6**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

In this course, the learners will be able to develop working expertise of solving complex computing problems through project-based learning approach using real world case studies by implementing the concepts studied in the theory courses of this semester.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Identify the problem and describing it.
CO2	Understand the requirements of the chosen project.
CO3	Apply the collected requirements to define the describe the project in a systematic and comprehensive approach.
CO4	Analyze the technical aspects of the chosen project to find the possible solutions for development of the project.
CO5	Evaluate the effective reports and documentation for all project related activities and solutions.
CO6	Create plan for the project development.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	0	0	0	0	0	0	0	0	0
CO2	1	2	2	1	0	0	0	0	2	0	0	0
CO3	2	2	3	2	0	0	2	0	3	0	0	0
CO4	2	1	3	3	0	0	1	0	0	0	0	0
CO5	0	0	0	0	2	0	0	0	0	0	2	1
CO6	0	0	0	0	0	2	1	0	0	1	0	1
AVG	**1**	**1.17**	**1.5**	**1**	**0.33**	**0.33**	**0.67**	**0**	**0.83**	**0.17**	**0.33**	**0.33**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Ability Enhancement Courses

Ability Enhancement Courses

Couse Code	Course Name	L	T	P	C
AEC1	Environmental Studies – I	2	-	-	2
AEC2	Communication Skills: Listening and Speaking Skills	2	-	-	2
AEC3	Environmental Studies – II	2	-	-	2
AEC4	Communication Skills: Reading and Writing Skills	2	-	-	2

Course code	**: AEC1**				
Course Name	**: ENVIRONMENTAL STUDIES-I**				
Semester / Year	**: 1st Sem / 1st Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Unit I. Humans and the Environment

Course Learning Outcomes

After completing this unit, students will be able to:

- Appreciate the historical context of human interactions with the environment.
- Gain insights into the international efforts to safeguard the Earth's environment and resources.

Unit Outline

- Human population growth: Impacts on environment, human health and welfare
- Dams: Resettlement and rehabilitation of project-affected persons (case studies)
- Disaster management: Floods, earthquake, cyclones and landslides
- Environmental movements: *Chipko*, Silent valley, *Bishnois* of Rajasthan
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Suggested readings

1 Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2 Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press.
3 Hughes, J. Donald (2009) An Environmental History of the World- Humankind's Changing Role in the Community of Life, 2nd Edition. Routledge.
4 Perman, R., Ma, Y., McGilvray, J., and Common, M. (2003) Natural Resource and Environmental Economics. Pearson Education.
5 Simmons, I. G. (2008). Global Environmental History: 10,000 BC to AD 2000. Edinburgh University Press

Unit II. Natural Resources and Sustainable Development

Course Learning Outcomes

After completion of this unit, students would be able to:

- Understand the concept of natural resources; identify types of natural resources, their distribution and use with special reference to India.
- Discuss the factors affecting the availability of natural resources, their conservation and management.
- Explain sustainable development, its goals, targets, challenges and global strategies for sustainable development.

Unit Outline

- Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable.
- Forest resources: Types, threats and conservation strategies.
- Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges;
- Water scarcity and stress; Conflicts over water.
- Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation.
- Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy
- Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

Suggested readings

1 Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/ Cummins/ Pearson.
2 John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd Edition, Weir Publisher (ELBS).
3 William P. Cunningham and Mary A. (2015) Cunningham Environmental Science: A Global Concern, Publisher (Mc-Graw Hill, USA).
4 Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson).
5 Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications https://sdgs.un.org/goals.

Unit III. Environmental Issues: Local, Regional and Global

Course Learning Outcomes

After completion of this unit, students would be able to:

- Develop a critical understanding of the environmental issues of concern
- Understand the concepts of spatial and temporal scales and their importance
- Understand the sectoral effects on the local, regional, and global environmental issues

Unit Outline

- Pollution: Types of Pollution- air, noise, water, soil, thermal, radioactive; municipal solid waste, hazardous waste; transboundary air pollution; acid rain; smog.
- Land use and Land cover change: land degradation, deforestation, desertification, urbanization.
- Global change: Ozone layer depletion; Climate change. Disasters – Natural and Man-made (Anthropogenic).

Suggested Readings

1 Harper, Charles L. (2017) Environment and Society, Human Perspectives on Environmental Issues 6th Edition. Routledge.
2 Harris, Frances (2012) Global Environmental Issues, 2nd Edition. Wiley- Blackwell.
3 William P. Cunningham and Mary A. (2015). Cunningham Environmental Science: A global concern, Publisher (Mc-Graw Hill, USA)
4 Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238
5 Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.

Unit IV. Conservation of Biodiversity and Ecosystems

Course Learning Outcomes

After completion of this unit, students would be able to:

- Understand the concepts of ecosystems, biodiversity and conservation.
- Describe the main types of ecosystems and their distribution.
- Discuss the factors impacting biodiversity loss and ecosystem degradation.
- Explain major conservation strategies taken in India.

Unit Outline

- Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity hotspots; Species and ecosystem threat categories.
- Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics-forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance.
- Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change.
- Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge.

Suggested Readings

1 Bawa, K.S., Oomen, M.A. and Primack, R. (2011) Conservation Biology: A Primer for South Asia. Universities Press.
2 Sinha, N. (2020) Wild and Wilful. Harper Collins, India.
3 Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) Conservation through Sustainable Use: Lessons from India. Routledge.
4 Bhagwat, Shonil (Editor) (2018) Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge.
5 Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK

Unit V. Case Studies & Fieldwork

- Discussion on one national case study related to the environment and sustainable development.
- Documentation of campus biodiversity.
- Documentation of the biodiversity of any nearby terrestrial/aquatic ecosystem.

- Participation in plantation drives and nature camps.
- Case Studies on any one Natural Disaster: Kedarnath Disaster, Tsunami 2004, Bhuj Earthquake).
- Prepare a report on Environmental Impacts of the Tehri Dam.
- Prepare a report on any one environmental movement of India: (*Chipko*, Silent valley, *Bishnois* of Rajasthan).
- Prepare a map highlighting the protected areas of India.

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall and list the major environmental challenges faced by humanity, including population growth, resource depletion, pollution types, and the impact of human-made structures such as dams.
CO2	Comprehend the concepts of sustainable development, the classification of natural resources, and the significance of biodiversity and ecosystem services.
CO3	Demonstrate the ability to document biodiversity in various ecosystems, participate in environmental conservation activities like plantation drives, and use knowledge of environmental issues in real-world contexts.
CO4	Examine and interpret the causes and effects of major environmental problems, including land degradation, deforestation, and climate change, and analyze the environmental impact of over-exploitation of resources.
CO5	Assess the effectiveness of various conservation policies, both national and international, in preserving biodiversity and ecosystems, and critique the role of different environmental movements in India.
CO6	Design and construct detailed reports on specific environmental case studies, such as the Tehri Dam's impact, and produce maps highlighting the protected areas of India.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	1	1	1	1	1	2	2	2
CO2	3	2	2	3	1	2	1	1	1	3	2	2
CO3	2	3	3	2	2	2	2	2	1	3	3	3
CO4	2	3	3	3	2	2	2	2	2	3	3	3
CO5	1	2	2	3	3	2	2	2	1	2	2	2
CO6	2	3	3	2	2	2	3	2	2	3	3	3
AVG	**2**	**2.5**	**2.5**	**2.67**	**1.83**	**1.83**	**1.83**	**1.67**	**1.33**	**2.67**	**2.5**	**2.5**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: AEC2**				
Course Name	**: COMMUNICATION SKILLS: LISTENING AND SPEAKING SKILLS**				
Semester /Year	**: 2nd Semester / 1st Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are-

1. To communicate appropriately in real-life situation.
2. To use English effectively for study and communicative purpose for successful career.
3. To develop and integrate the use of two language skills- Listening and Speaking.
4. To understand different types of theories and needs of communication.

Course Contents

Unit 1: Introduction: Theory of Communication

Definition and function of Communication, Needs For effective Communication, Process of communication

Unit 2: Listening Skills

Types of Listening, Developing effective listening skills,
Listening to Talks and Presentation, Monologue, dialogue, miscommunication

Unit 3: Speaking Skills

Interview, Public speech, Mock interviews and Group discussions

Reference Books:

1. Dangwal, Surekha. *The Art Effective Communication.* Delhi: Macmillan,2017.
2. Prasad, P. *The Functional Aspects of Communication skills*, Delhi
3. Sen, Leena. *Communication Skills*, Prentice hall of India, New Delhi.
4. McCarty, Michel. *English Vocabulary in Use*, Cambridge University Press.
5. Communication Skill by Sanjay Kumar & Pushp Lata, Oxford University Press
6. An Introduction to Professional English and Soft Skills by B.K. Das, Cambridge University.

Course outcomes (COs):

Upon successful completion of the course a student will be able -

CO1	To memorize the functions of communication and related topics.
CO2	To explain listening and speaking skills.
CO3	To acquire necessary listening and speaking skills in order to follow and comprehend discourse.
CO4	To organize vocabulary and improve accuracy in grammar.
CO5	To select positive attitudes for English Communication.
CO6	To implement communicative skills at interviews, presentations and Group discussions for successful career skills.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	1	1	2	1	1	1	1	2	3	2
CO2	1	3	1	1	2	1	1	1	1	1	3	2
CO3	1	3	2	1	2	2	2	1	1	2	3	2
CO4	1	2	1	1	2	2	1	1	1	1	3	2
CO5	1	2	1	1	3	1	1	1	1	2	3	2
CO6	1	3	2	2	3	2	2	2	1	2	3	3
AVG	**1.17**	**2.67**	**1.33**	**1.17**	**2.33**	**1.5**	**1.33**	**1.17**	**1**	**1.67**	**3**	**2.17**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: AEC3**				
Course Name	**: ENVIRONMENTAL STUDIES-II**				
Semester / Year	**: 3rd Sem / 2nd Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Unit I. Environmental Pollution and Health

Course Learning Outcomes

After completing this unit, students would be able to:

- Develop an understanding of pollution and its types.
- Learn about sources of different kinds of pollution.
- Sensitize themselves to adverse health impacts of pollution.

Unit Outline

- Definition of pollution; Point sources and non-point sources of pollution.
- Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants; Other important air pollutants- (VOCs), (PAN), (PAHs) and (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards.
- Water pollution: Sources of water pollution; river, lake and marine pollution, groundwater pollution; water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life.
- Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health.
- Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health.
- Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.

Suggested Readings

1. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
2. Masters, G. M., & Ela, W. P. (2008). Introduction to environmental engineering and science (No. 60457). Englewood Cliffs, NJ: Prentice Hall.
3. Miller, G. T., & Spoolman, S. (2015) Environmental Science. Cengage Learning.
4. Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/
5. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).

Unit II. Climate Change: Impacts, Adaptation and Mitigation

Course Learning Outcomes

After completing this unit, students would be able to:

- Gain a comprehensive knowledge of climate change, its science and response measures
- Have an overview of national and global efforts to address climate change adaptation and mitigation.

Unit Outline

- Structure of atmosphere; Climate Change, GHGs (greenhouse gas emissions).
- Paris Agreement; Climate change projections for the Indian sub-continent. Impacts, vulnerability and adaptation to climate change: Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment.
- Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change.
- Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality.
- National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; National climate action plan and Intended Nationally Determined Contributions (INDCs); Climate justice.

Suggested Readings

1. Pittock, Barrie (2009) Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
2. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/.
3. Adenle A., Azadi H., Arbiol J. (2015). Global assessment of technological innovation for climate change adaptation and mitigation in developing world, Journal of Environmental Management, 161 (15): 261-275.
4. Barnett, J. & S. O'Neill (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions 20: 211–213.
5. Berrang-Ford, L., J.D. Ford & J. Paterson (2011). Are we adapting to climate change? Global Environmental Change—Human and Policy Dimensions 21: 25-33.

UNIT III. Environmental Management

Course Learning Outcomes

After completion of this unit, students would be able to:

- Develop a critical understanding of the complexity of environmental management.
- Understand broad aspects of environmental management systems.
- Understand different methods of assessing environmental quality and associated risks.

Unit Outline

- Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.
- Environmental management system: ISO 14001. Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis.
- Environmental audit and impact assessment; Environmental risk assessment Pollution control and management.
- Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Eco mark scheme.

Suggested Readings

1. Jørgensen, Sven Marques, Erik João Carlos and Nielsen, Søren Nors (2016) Integrated Environmental Management, A transdisciplinary Approach. CRC Press.
2. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
3. Barrow, C. J. (1999). Environmental management: Principles and practice. Routledge.
4. Tiefenbacher, J (ed.) (2022), Environmental Management - Pollution, Habitat, Ecology, and Sustainability, Intech Open, London. 10.5772/
5. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

Unit IV. Environmental Treaties and Legislation

Course Learning outcomes

After completion of this unit, students would be able to:

- Learn about how the nations of the world work together for the environment.
- Learn about the major international treaties and our country's stand on and responses to the major international agreements.
- Learn about major international institutions and programmes and the role played by them in the
- protection and preservation of the environment.

Unit Outline

- Major International Environmental Agreements: Convention on Biological Diversity (CBD); Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Minamata Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions.
- Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; Noise Pollution (Regulation and Control) Rules, 2000; Waste management rules.
- National Green Tribunal; United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN), World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization
- (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.

Suggested Readings

1. UNEP (2007) Multilateral Environmental Agreement Negotiator's Handbook, University of Joensuu, ISBN 978-952-458-992-5

2. Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions & Programmes. https://moef.gov.in/wp-content/uploads/2020/02/convention-V-16-CURVE-web.pdf
3. Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press.
4. India Code – Digital repository of all Central and State Acts: https://www.indiacode.nic.in/
5. Bohra, Saroj, Judicial Intervention and Evolution of Environmental Principles and Doctrines (January 7, 2019). Available at SSRN: https://ssrn.com/abstract=3311406 or http://dx.doi.org/10.2139/ssrn.3311406

Unit V. Case Studies & Fieldwork

- Discussion on one international case study related to the environment and sustainable development.
- Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.
- Participation in cleanliness drives and nature camps.
- Campus environmental management activities such as solid waste disposal and management.
- Campus environmental management activities such as water management and sanitation, and sewage treatment.
- Case Studies on any one Pollution related Disaster: (Bhopal Gas Tragedy, Chernobyl Disaster, London smog, Delhi Smog, Minamata Disaster).
- Prepare a brief report on any one Environment related Treaty/Protocol: (Kyoto Protocol, Montreal Protocol, CITES, Paris Agreement, CBD).
- Prepare a map highlighting the Ramsar Sites of India.

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall key concepts, definitions, and types of environmental pollution, major international environmental agreements, and fundamental principles of environmental management.
CO2	Understand the sources and impacts of different types of pollution on human health and ecosystems, the intricacies of climate change, and the significance of international environmental treaties and domestic legislations.
CO3	Apply knowledge to identify local and regional environmental issues during field visits, participate in environmental management activities, and document observations on various environmental topics.
CO4	Analyze the causes and effects of environmental disasters, the implications of environmental treaties and protocols, and evaluate the effectiveness of different environmental management systems.
CO5	Assess the global and national efforts in addressing climate change, the effectiveness of environmental laws and regulations, and the role of major international institutions and programmes in environmental conservation.

CO6	Design and formulate reports on specific environmental case studies, such as pollution-related disasters and international treaties, and create informative maps highlighting significant environmental sites, like the Ramsar Sites of India.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	1	1	1	1	1	2	1
CO2	1	2	2	2	3	1	1	1	1	2	2	2
CO3	1	3	2	2	2	2	2	1	1	2	3	2
CO4	1	3	2	3	2	2	2	1	1	2	3	3
CO5	1	2	2	2	3	2	2	1	1	2	2	2
CO6	1	2	2	2	3	2	3	1	1	2	2	2
AVG	**1**	**2.33**	**1.83**	**2**	**2.5**	**1.67**	**1.83**	**1**	**1**	**1.83**	**2.33**	**2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: AEC4**				
Course Name	**: COMMUNICATION SKILLS: READING AND WRITING SKILLS**				
Semester /Year	**: 4th Semester / 2nd Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are-

1. To communicate appropriately in real-life situation.
2. To use English effectively for study and communicative purpose for successful career.
3. To develop and integrate the use of four language skills- Reading and Writing in his/her whole life.
4. To understand different types of barriers and kinds of communication.
5. Learn the skills to face interview, making a speech, presentation etc.

Course Contents

Unit 1: Introduction: Types and modes of Communication

Barrier to Communication, Kinds of communication: intrapersonal, personal, group and mass, Verbal and non-Verbal communication

Unit 2: Reading Skills

Skimming, Scanning, Summary, Paraphrasing, Comprehension

Unit 3: Writing Skills: Social and Official Correspondence

Complaints and replies, Letter to the editors, Standard business letter, Email drafting and etiquettes, Preparing agenda and minutes for meetings, Job application, Cover letters, Bio-data, CV and Resume

Reference Books:

1. Dangwal, Surekha. *The Art Effective Communication.* Delhi: Macmillan,2017.
2. Prasad, P. *The Functional Aspects of Communication skills*, Delhi
3. Sen, Leena. *Communication Skills*, Prentice hall of India, New Delhi.
4. McCarty, Michel. *English Vocabulary in Use*, Cambridge University Press.
5. Communication Skill by Sanjay Kumar & Pushp Lata, Oxford University Press
6. An Introduction to Professional English and Soft Skills by B.K. Das, Cambridge University.

Course outcomes (COs):

Upon successful completion of the course a student will be able -

CO1	To memorize the functions of communication and related topics.
CO2	To improve communication skills to communicate within the society.
CO3	To implement writing and reading as skills.
CO4	To organize vocabulary and improve accuracy in grammar.
CO5	To select positive attitudes for English Communication.
CO6	To design formal letters, CV, interview, resume and cover letters etc. for successful career skills.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	2	1	1	1	1	1	3	2
CO2	1	3	1	1	2	1	1	1	1	1	3	2
CO3	1	2	1	1	1	2	1	1	1	2	3	2
CO4	1	2	1	1	1	2	1	1	1	2	3	2
CO5	1	2	1	1	3	1	1	1	1	2	3	2
CO6	1	3	2	2	2	1	2	2	1	2	3	3
AVG	**1**	**2.5**	**1.17**	**1.17**	**1.83**	**1.33**	**1.17**	**1.17**	**1**	**1.67**	**3**	**2.17**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Value Addition Course

Value Addition Courses

Couse Code	Course Name	L	T	P	C
CITVC101	Computers and Ethics	2	-	-	2
CITVC201	The Art of Clean Code	2	-	-	2
CITVC301	Digital Empowerment	2	-	-	2
CITVC401	Challenges in Programming	2	-	-	2

Course code	: **CITVC101**				
Course Name	: **COMPUTERS AND ETHICS**				
Semester / Year	: **1st Sem / 1st Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

- Understand ethical considerations in computing and information technology.
- Explore the ethical dimensions of privacy, cybersecurity, and social media.
- Analyze the ethical implications of emerging technologies and artificial intelligence.
- Apply ethical decision-making models to resolve ethical dilemmas in computing.
- Evaluate the social and cultural impacts of technology on society.
- Develop ethical guidelines for responsible technology use and development.

COURSE CONTENTS

Unit 1: Introduction to Computers and Ethics **[No. of Hours: 4]**

Introduction to ethical theories and frameworks, Ethical decision-making models and approaches, Ethical considerations in computing and information technology, Historical perspectives on computers and ethics

Unit 2: Privacy and Data Protection **[No. of Hours: 4]**

Concepts of privacy and data protection, Ethical issues related to data collection, storage, and sharing, Legal and regulatory frameworks for privacy, Privacy-enhancing technologies and practices, Privacy implications of emerging technologies (e.g., Internet of Things, biometrics)

Unit 3: Intellectual Property and Copyright **[No. of Hours: 4]**

Introduction to intellectual property rights, Ethical issues surrounding software piracy and copyright infringement, Open source software and its ethical implications, Digital rights management and fair use of copyrighted material, Ethical considerations in software development and intellectual property licensing

Unit 4: Cybersecurity and Ethical Hacking **[No. of Hours: 4]**

Fundamentals of cybersecurity and its importance, Ethical considerations in hacking and penetration testing, Ethical hacking techniques and methodologies, Legal and ethical issues related to vulnerability disclosure, Cybersecurity ethics in the context of organizational security practices

Unit 5: Social Media and Online Ethics **[No. of Hours: 4]**

Social media ethics and responsible online behavior, Privacy risks and ethical dilemmas in social media usage, Cyberbullying, harassment, and online hate speech, Implications of social media algorithms and filter bubbles, Social media and its impact on democracy and political discourse

Unit 6: Ethical Implications of Artificial Intelligence **[No. of Hours: 5]**

Introduction to artificial intelligence (AI) and machine learning, Ethical considerations in AI algorithm development and bias, Privacy and transparency issues in AI systems, Automation, job displacement, and socioeconomic impacts of AI, Ethical guidelines and principles for AI development and deployment

Unit 7: Technology and Society **[No. of Hours: 4]**

Ethical issues arising from the digital divide, Social and cultural impacts of technology, Ethical considerations in emerging technologies (e.g., blockchain, virtual reality), Technology addiction and its ethical implications, Ethical responsibilities of technology professionals

Text Books:

TB1. Computers and Society: Modern Perspectives by by Ronald M. Baecker

TB2. THE HANDBOOK OF INFORMATION AND COMPUTER ETHICS by Kenneth Einar Himma and Herman T. Tavani.

Reference Books/ Online Resources

RB1. "Ethics for the Information Age" by Michael J. Quinn

RB2. "Ethics in Information Technology" by George Reynolds

RB3. "Ethics in Computing: A Concise Module" by Joseph Migga Kizza

RB4. "Information Ethics: Privacy, Property, and Power" by Adam D. Moore

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall and explain key ethical theories and frameworks relevant to computing and information technology. Identify and describe the legal and regulatory frameworks for privacy and intellectual property in the digital domain.
CO2	Demonstrate an understanding of the ethical considerations in computing, including privacy, cybersecurity, and social media. Explain the social and cultural impacts of technology and the ethical responsibilities of technology professionals.
CO3	Apply ethical decision-making models and approaches to analyze and resolve ethical dilemmas in computing and information technology. Apply privacy-enhancing technologies and practices to protect personal data and mitigate privacy risks.
CO4	Analyze the ethical implications of emerging technologies, such as artificial intelligence, blockchain, and virtual reality, on society and individuals. Evaluate the ethical considerations in hacking and penetration testing, considering legal and ethical issues related to vulnerability disclosure.
CO5	Evaluate the ethical implications of social media usage, including privacy risks, cyberbullying, and the impact of algorithms on information access.

	Critically evaluate the ethical dimensions of artificial intelligence, including algorithmic bias, job displacement, and transparency.
CO6	Construct well-reasoned arguments and proposals for addressing ethical challenges in the use of computers and information technology. Design ethical guidelines and principles for the development and deployment of emerging technologies, considering privacy, transparency, and societal impact.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	2	1	1	1	1	2	2	2
CO2	2	3	3	2	3	2	2	2	2	3	3	3
CO3	2	2	2	1	2	2	1	1	1	2	2	2
CO4	1	2	2	2	2	1	1	1	1	2	2	2
CO5	1	2	2	2	2	1	1	1	1	2	2	2
CO6	2	2	2	2	2	2	2	2	2	2	2	2
AVG	1.6	2.4	2.4	1.8	2.4	1.6	1.4	1.4	1.4	2.4	2.4	2.4

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: CITVC201**				
Course Name	**: THE ART OF CLEAN CODE**				
Semester / Year	**: 2nd Sem / 1st Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

- Understand the principles of clean code and its significance in software development.
- Apply coding standards and best practices for writing readable and maintainable code.
- Analyze and refactor existing code to eliminate code smells and improve code quality.
- Implement design patterns to enhance code structure and flexibility.
- Develop effective unit tests using Test-Driven Development (TDD) principles.
- Evaluate and optimize code performance to identify and resolve bottlenecks.
- Create software projects showcasing clean code practices and design patterns.

COURSE CONTENTS

Unit 1: Introduction to Clean Code and Coding Standards **[No. of Hours: 4]**

Definition and significance of clean code, The impact of clean code on software development Code readability and maintainability, Naming conventions and meaningful identifiers, Formatting and indentation, Comments and documentation

Unit 2: Refactoring and Code Smells **[No. of Hours: 4]**

Introduction to code refactoring, identifying code smells, Common refactoring techniques, understanding common code smells and anti-patterns, Refactoring exercises to improve code quality

Unit 3: Design Principles and Design Patterns **[No. of Hours: 6]**

SOLID principles, DRY (Don't Repeat Yourself) principle, KISS (Keep It Simple, Stupid) principle, Introduction to design patterns, Creational, Structural, and Behavioral patterns, Applying design patterns to real-world problems

Unit 4: Unit Testing and Test-Driven Development (TDD) **[No. of Hours: 4]**

Importance of testing in clean code development, Writing effective unit tests, Test-Driven Development (TDD) methodology

Unit 5: Debugging, Error Handling, and Performance Optimization **[No. of Hours: 5]**

Techniques for effective debugging, Proper error handling and exception management, identifying performance bottlenecks, Techniques for optimizing code performance

Unit 6: Version Control, Code Collaboration, Code Reviews, and Code Quality Metrics **[No. of Hours: 7]**

Using version control systems (e.g., Git), Collaborating on code using version control, Conducting code reviews, Code quality metrics and tools, Real-world Case Studies, Presentations and discussions on code quality improvement

Text Books:

TB1. Clean Architecture: A Craftsman's Guide to Software Structure and Design by Robert C. Martin
TB2. Code Complete: A Practical Handbook of Software Construction by Steve McConnell
TB3. Working Effectively with Legacy Code by Michael C. Feathers

Reference Books/ Online Resources

RB1. Refactoring: Improving the Design of Existing Code by Martin Fowler
RB2. Design Patterns: Elements of Reusable Object-Oriented Software by Erich Gamma,
RB3. Test-Driven Development: By Example by Kent Beck

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the importance of clean code in software development and its impact on project maintainability and collaboration. List and explain the basic coding standards and best practices, including naming conventions, formatting, and code documentation. Identify common code smells and anti-patterns and describe their negative impact on code quality.
CO2	Demonstrate an understanding of various design principles, such as SOLID, DRY, and KISS, and apply them to design cleaner and maintainable code. Explain the purpose and characteristics of different design patterns and illustrate their use in solving specific software design challenges.
CO3	Apply code refactoring techniques to improve existing codebases by eliminating code smells and enhancing code readability. Implement unit testing and Test-Driven Development (TDD) methodologies to write effective unit tests for code validation and enhancement.
CO4	Analyze codebases to identify performance bottlenecks and inefficiencies, and propose appropriate optimization strategies. Critically evaluate code quality using code reviews, code quality metrics, and static analysis tools to suggest improvements.
CO5	Evaluate the trade-offs and benefits of using various design patterns and justify their application in specific software development scenarios.
CO6	Design and implement clean code solutions for real-world software development problems, demonstrating creativity and proficiency in coding practices.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2	1	2	1	2	2	2
CO2	2	2	3	2	2	2	2	2	2	2	2	3
CO3	1	2	2	1	1	2	1	1	1	1	1	2
CO4	1	2	2	2	2	2	1	1	1	1	2	2
CO5	1	2	2	2	2	2	1	1	1	1	2	2
CO6	3	3	3	3	3	3	2	2	2	2	3	3
AVG	**1.8**	**2.4**	**2.6**	**2**	**2**	**2.4**	**1.6**	**1.8**	**1.6**	**1.8**	**2.2**	**2.6**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	: **CITVC301**				
Course Name	: **DIGITAL EMPOWERMENT**				
Semester / Year	: **3rd Sem / 2nd Year**				
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

- Understand the concept and scope of digital empowerment.
- Explore the evolution and impact of digital technologies in India.
- Analyze the challenges and future prospects of digital infrastructure in the country.
- Develop digital skills and literacy necessary for the 21st-century workforce.
- Examine the role of digital entrepreneurship, e-commerce, and digital payments in the Indian economy.
- Evaluate the implementation of e-governance models and their impact on public service delivery.
- Investigate the social impact of digital initiatives in healthcare, education, and agriculture.
- Discuss ethical considerations, privacy, and responsible use of digital technologies.
- Understand the policies and legal frameworks governing digital ethics and citizenship.
- Explore strategies for promoting digital inclusion, especially for marginalized communities.

COURSE CONTENTS

Unit 1: Introduction to Digital Empowerment **[No. of Hours: 2]**

Definition and scope of digital empowerment, Evolution of digital technologies in India, Digital divide and its implications, Overview of government initiatives for digital empowerment (e.g., Digital India program)

Unit 2: Digital Infrastructure in India **[No. of Hours: 4]**

Internet and broadband penetration in India, Mobile technology and its impact on digital empowerment, Role of government and private sector in developing digital infrastructure, E-governance initiatives in India (e.g., Aadhaar, GSTN), Challenges and future prospects of digital infrastructure in India

Unit 3: Digital Skills and Education **[No. of Hours: 4]**

Importance of digital skills in the 21st century, Digital literacy initiatives in India, Online education and e-learning platforms, Skill development programs for digital empowerment

Unit 4: Digital Economy in India **[No. of Hours: 4]**

Digital entrepreneurship and start-up ecosystem in India, E-commerce and its impact on Indian businesses, Digital payments and financial inclusion, Opportunities and challenges in the gig economy, Government policies and regulations for promoting the digital economy

Unit 5: Digital Governance and Public Services **[No. of Hours: 5]**

E-governance models and their implementation in India, Digital platforms for service delivery (e.g., e-health, e-education), Role of technology in improving transparency and accountability in governance, Privacy and security concerns in digital governance, Citizen engagement and participatory governance through digital platforms

Unit 6: Digital Inclusion and Social Impact **[No. of Hours: 5]**

Role of digital technologies in social development, Digital initiatives for healthcare, education, and agriculture, Digital inclusion of marginalized communities (e.g., rural areas, differently-abled individuals), Ethical considerations in digital inclusion

Unit 7: Digital Ethics and Responsible Use **[No. of Hours: 6]**

Ethical considerations in digital technologies, Privacy, data protection, and cybersecurity, Responsible use of social media and online platforms, Digital rights and digital citizenship, Policy and legal frameworks for ensuring digital ethics

Text Books:

TB1. Rodney Jones and Christoph Hafner. "Understanding digital literacies: A practical Introduction". Routledge Books, 2nd edition, 2021.

Reference Books/ Online Resources

RB1. https://www.digitalindia.gov.in
RB2. https://www.digilocker.gov.in
RB3. https://www.cybercrime.gov.in
RB4. https://www.cybersafeindia.in
RB5. https://www.meity.gov. in/cyber-surakshit-bharat-programme
RB6. David Sutton. "Cyber security: A practitioner's guide", BCS Learning & Development Limited, UK, 2017.
https://www.mha.gov.in/document/downloads/cyber-safety-handbook

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the definition and scope of digital empowerment. Recall the key government initiatives for digital empowerment in India. Remember the importance of digital skills in the 21st century.
CO2	Explain the evolution of digital technologies in India. Describe the implications of the digital divide and its impact on society. Understand the role of digital infrastructure in facilitating digital empowerment.
CO3	Apply knowledge of e-governance initiatives in India to analyze their impact on service delivery. Apply digital literacy skills to access and utilize online educational

	platforms. Apply principles of responsible use of social media and online platforms to real-world scenarios.
CO4	Analyze the challenges and future prospects of digital infrastructure in India. Examine the impact of e-commerce on Indian businesses and the digital economy. Analyze the ethical considerations and implications of digital inclusion initiatives.
CO5	Evaluate the effectiveness of government policies and regulations in promoting the digital economy. Assess the role of technology in improving transparency and accountability in digital governance. Evaluate the social impact of digital initiatives in healthcare, education, and agriculture.
CO6	Create a proposal for a digital entrepreneurship venture, considering the start-up ecosystem in India. Develop an e-governance model that enhances citizen engagement and participatory governance.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	1	1	1	1	1	1	2
CO2	1	2	2	2	2	2	1	1	1	1	2	2
CO3	1	1	2	1	2	2	1	1	1	1	1	2
CO4	1	2	2	2	2	2	1	1	1	1	2	2
CO5	1	2	2	2	2	2	1	1	1	1	2	2
CO6	1	1	2	1	2	2	1	1	1	1	1	2
AVG	**1.2**	**1.8**	**2**	**1.6**	**2**	**2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.6**	**2.2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**:**	**CITVC401**			
Course Name	**:**	**CHALLENGES IN PROGRAMMING**			
Semester / Year	**:**	**4th Sem / 2nd Year**			
		L	**T**	**P**	**C**
		2	**0**	**0**	**2**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

- Understand the software development life cycle and its coding phase challenges.
- Apply techniques for code optimization and efficiency to improve performance.
- Demonstrate effective debugging and troubleshooting skills.
- Implement secure coding practices and error handling mechanisms.
- Utilize version control and collaborative coding strategies.
- Analyze legacy code and propose refactoring solutions.
- Evaluate code quality, documentation, and external dependencies.
- Create efficient, secure, and well-documented code to meet project requirements.

COURSE CONTENTS

Unit 1: Introduction to Software Development Challenges **[No. of Hours: 4]**

Understanding the software development life cycle., Identifying common challenges faced during the coding phase., Role of code quality and maintainability.

Unit 2: Code Optimization and Efficiency **[No. of Hours: 4]**

Techniques for optimizing code for speed and memory usage., Identifying performance bottlenecks and applying suitable solutions., Importance of algorithmic efficiency.

Unit 3: Debugging and Troubleshooting **[No. of Hours: 4]**

Strategies for debugging code effectively., Use of debugging tools and techniques., Common coding errors and how to avoid them.

Unit 4: Code Security and Error Handling **[No. of Hours: 5]**

Basics of software security., Common vulnerabilities and how to avoid them., Best practices for secure coding., Understanding and implementing error handling mechanisms., Handling exceptions and writing robust code., Graceful degradation and fail-safe strategies.

Unit 5: Version Control, Collaboration, and Documentation **[No. of Hours: 6]**

Introduction to version control systems (e.g., Git)., Collaborative coding using version control. Branching and merging strategies., Integration of third-party APIs and libraries., Handling external dependencies., Risks and precautions while using external code., Importance of code documentation., Writing meaningful comments and documentation, Tools for generating documentation.

Unit 6: Dealing with Legacy Code, Project Management, and Emerging Trends **[No. of Hours: 7]**

Challenges when working with legacy codebases., Techniques for refactoring and modernizing

legacy code., Strategies for maintaining and extending legacy applications., Meeting deadlines and managing time effectively., Agile development methodologies., Handling changing requirements and scope., Introduction to new programming paradigms and languages.

Text Books:

TB1. Clean Architecture: A Craftsman's Guide to Software Structure and Design by Robert C. Martin
TB2. Code Complete: A Practical Handbook of Software Construction by Steve McConnell
TB3. Working Effectively with Legacy Code by Michael C. Feathers

Reference Books/ Online Resources

RB1. Refactoring: Improving the Design of Existing Code by Martin Fowler
RB2. Design Patterns: Elements of Reusable Object-Oriented Software by Erich Gamma,
RB3. Test-Driven Development: By Example by Kent Beck

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the stages of the software development life cycle and the challenges associated with the coding phase. Identify and describe common coding errors and their potential impact on software functionality. Recognize the importance of code quality and maintainability in software development.
CO2	Explain the principles of code optimization and efficiency, and apply techniques to improve code performance. Describe the fundamental concepts of software security and identify potential vulnerabilities in code. Demonstrate an understanding of error handling mechanisms and how to implement them effectively in code.
CO3	Apply debugging strategies and utilize debugging tools to identify and resolve issues in code. Implement secure coding practices to protect software applications from common security threats. Utilize version control systems to manage collaborative coding and track changes in software projects.
CO4	Analyze code to identify performance bottlenecks and propose appropriate optimizations. Evaluate and critique the security measures implemented in software code and suggest improvements. Analyze legacy codebases to identify areas for refactoring and modernization.
CO5	Evaluate the effectiveness of error handling and exception management in code for robustness. Critically assess the documentation of code and identify opportunities for improvement.

	Evaluate the impact of using third-party APIs and libraries on software development.
CO6	Create efficient and optimized code to address specific performance requirements. Develop secure code that incorporates best practices to mitigate potential security risks. Create well-documented and maintainable code that adheres to industry standards.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	1	1	2	1	1	1	1	2
CO2	2	2	2	2	2	2	2	2	1	1	1	2
CO3	1	2	2	2	2	2	2	2	1	1	1	2
CO4	1	2	2	2	2	2	2	2	1	1	1	2
CO5	1	2	2	2	2	2	2	2	1	1	1	2
CO6	2	3	3	3	3	3	3	3	1	1	1	3
AVG	**1.8**	**2.2**	**2.2**	**2**	**2**	**2**	**2.2**	**2**	**1**	**1**	**1**	**2.2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Discipline Specific Elective Courses

Discipline Specific Electives

Couse Code	Course Name	L	T	P	C
BCADSE504A	Statistics/MOOC	4	-	-	4
BCADSE504B	Operations Research/MOOC	4	-	-	4
BCADSE604A	Introduction to IOT/MOOC	4	-	-	4
BCADSE604B	Introduction to Blockchain/MOOC	4	-	-	4
BCADSE702A	Research Methodology	3	1	-	4
BCADSE702B	Software Project Management – I	3	1	-	4
BCADSE702C	Entrepreneurship – I	3	1	-	4
BCADSE703A	Data Ware Housing & Data Mining/MOOC	4	-	-	4
BCADSE703B	Advance RDBMS/MOOC	4	-	-	4
BCADSE704A	Multimedia System/MOOC	4	-	-	4
BCADSE704B	Network Security & Cryptography/MOOC	4	-	-	4
BCADSE802A	Research Publication & Ethics	3	1	-	4
BCADSE802B	Software Project Management – II	3	1	-	4
BCADSE802C	Entrepreneurship – II	3	1	-	4
BCADSE803A	Machine Learning/MOOC	4	-	-	4
BCADSE803B	Cloud Computing/MOOC	4	-	-	4
BCADSE804A	Algorithm Analysis & Design/MOOC	4	-	-	4
BCADSE804B	Computer Graphics/MOOC	4	-	-	4
	Total	**66**	**06**	**-**	**72**

Course code	**: BCADSE504A**				
Course Name	**: STATISTICS/MOOC ON STATISTICS**				
Semester / Year	**: 5th Semester / 3rd Year**				
	L	**T**	**P**	**C**	
	4	**0**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

1. To study methods of collection, classification, tabulation of data.
2. To apply various statistical methods and analyses the data
3. To find correlation between the data.
4. To study probability and probability distribution to solve various real life problems
5. To test hypothesis using various statistical test.

COURSE CONTENTS

UNIT 1: Data & Its Diagrammatic Representation **[No. of Hours: 8]**

Definition of Statistics, Data, Primary data & secondary data, classification of data, tabulation of data, individual series, Discrete frequency Distribution, continuous frequency distribution, Exclusive and inclusive continuous series, Diagrammatic representation of data, Tabular form, 1D (All Bar Diagrams), Histogram, Frequency polygon, frequency curve, Ogive.

UNIT 2: Measure of Central Tendency & Dispersion **[No. of Hours: 8]**

Mean (Arithmetic Mean, Weighted Mean, Harmonic Mean, Geometric Mean), Median, Mode, Histogram & Mode, Relationship between mean, median, mode. Definition of dispersion, Range, Quartile deviation & its coefficient, Inter Quartile deviation, Mean deviation & its coefficient, Standard deviation.

UNIT 3: Correlation & Regression Analysis **[No. of Hours: 8]**

Correlation definition, types of correlation, Karl Pearson coefficient of correlation, Spearman coefficient of correlation, repeated rank. **Regression Analysis** Regression lines, Regression line of Yon X & X on Y, Regression coefficient, Relationship between correlation & regression coefficient.

UNIT 4: Probability & Probability Distributions **[No. of Hours: 8]**

probability & probability distribution: probability, Sample space & events, types of events, conditional probability, Bayes theorem, Mathematical expectation

UNIT 5: Sampling, Hypothesis Testing & Statistical Test **[No. of Hours: 8]**

Sampling & its type, Probability & Non probability sampling, Hypothesis, Null hypothesis, Alternative hypothesis, Type I & Type II Errors, Statistical **Test:** Parametric test & non parametric test, F test, T test, ANOVA -1, ANOVA 2, Chi square test as a goodness of fit, Chi square test as test of independence.

Text Books:

TB2. Gerald Keller : Managerial Statistics 9th Edition.

Reference Books:

RB1. Richard Levin & David Rubin : Statistics for management, Prentice Hall.

RB2. Anderson, Sweeny & Williams: Statistics for Business and Economics, South W

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	To gain knowledge of statistical method like Average, Correlation, Regression, dispersion probability and probability distribution
CO2	To understand statistical method like Average, Correlation, Regression, dispersion probability and probability distribution
CO3	To apply statistical method and probability distribution
CO4	To analyze various statistical method and probability distribution
CO5	To apply statistical method probability distribution and statistical test to test the hypothesis
CO6	To create new statistical method probability distribution and statistical test

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	1	1	2	1					
CO2	3	1		2		1	2	1				
CO3	3	2	1	1		2	1		2			
CO4	2	1	2	2	1	2	3	1		2	1	
CO5	1	2	1	3	2	2	2				1	1
CO6	1						2					1
AVG	**2**	**1.4**	**1.4**	**1.8**	**0.8**	**1.8**	**1.83**	**0.4**	**0.4**	**0.4**	**0.4**	**.33**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE504B**				
Course Name	**: OPERATIONS RESEARCH/ MOOC ON OPERATIONS RESEARCH**				
Semester / Year	**: 5th Semester / 3rd Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To impart knowledge in concepts and tools of Operations Research
2. To understand mathematical models used in Operations Research
3. To apply these techniques constructively to make effective business decisions.
4. To be capable of analysing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints.
5. To enable the student to understand and analyse managerial and engineering problems to equip him to use the resources such as capitals, materials, productions, controlling, directing, staffing, and machines more effectively.

COURSE CONTENTS

Unit 1 **[No. of Hours: 6]**

Introduction to OR: Meaning and scope of O.R, Definition of O.R, LPP (Linear Programming Problem). Formulation of LPP, graphical solution of LPP- Problems

Unit 2 **[No. of Hours: 8]**

LPP: IBFS, Basic and Non-basic variable, Slack variable, Surplus variable and Artificial variable, Simplex method, Big M, two phase simplex methods and problems

Unit 3 **[No. of Hours: 10]**

Transportation problem: Definition, feasible solution by North-West corner rule, LCM, VAM, Optimal solution through MODI & stepping stone method for balanced and unbalanced transportation problem.

Assignment problem: Meaning of assignment problem, unbalanced assignment problem, travelling salesman problem, Hungarian method for optimal solution.

Unit 4 **[No. of Hours: 8]**

Game Theory: Concept of game; Two-person zero-sum game; Pure and Mixed Strategy Games; Saddle Point

Unit 5 **[No. of Hours: 8]**

Sequencing problem: Optimal sequencing of N Jobs on 2 and 3 machines.

Project Management: Rules for drawing the network diagram, Applications of CPM and PERT techniques in Project planning and control

Text Books:

TB1. Apte - Operation Research and Quantitative Techniques (Excel Books)
TB2. S Kalawathy - Operation Research (Vikas IV Edition)

Reference Books:

RB1. Natarajan - Operation Research(Pearson)
RB2. Singh & Kumar - Operation Research(UDH Publisher edition 2013)

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recognize LPP as a tool used to construct a mathematical model of a real-world problem which has many alternative solutions.
CO2	Interpret simplex method and duality to solve linear programming problems.
CO3	Solve transportation and assignment problems. Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods.
CO4	Simplify and optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons.
CO5	Employ the principles of game theory in practical situations.
CO6	Formulate Network models for service and manufacturing systems and learn about project scheduling by PERT/CPM.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1								1	1
CO2	3	3	1								1	1
CO3	3	3	1								1	1
CO4	3	3	1								1	1
CO5	3	3	1								1	1
CO6	3	3	1								1	1
AVG	3.0	3.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE604A**				
Course Name	**: INTRODUCTION TO IOT/ MOOC ON IOT**				
Semester / Year	**: 6th Semester / 3rd Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. **To understand the basic concept of Internet of Things (IOT), its standards and components.**
2. Learn the Network and Communication protocols for IoT.
3. Identify the role of controllers and sensors in IoT.

COURSE CONTENTS

Unit I IOT concepts **[No. of Hours: 8]**

Technologies that led to the evolution of IoT, IOT and SCADA, IOT and M2M, IoT and Big data

Unit II IoT Standards and Components **[No. of Hours: 8]**

IOT standards in practice, Operating platforms /systems. **IoT Components:** Design of IoT systems, Development of prototypes.

Unit III Challenges in IoT implementation. **[No. of Hours: 8]**

Big Data Management, Connectivity challenges, Mission-critical applications. Security issues in IOT

Unit IV IoT Applications (Case studies) **[No. of Hours: 8]**

Lighting as a service, Intelligent Traffic systems, Smart Parking, Smart water management etc.

Unit V Relevance of IoT for the future. **[No. of Hours: 8]**

IOT in everyday life, Internet of Everything, IOT and Individual Privacy. **IoT in Indian Scenario:** IOT and Aadhaar, IOT for health services, IOT for financial inclusion, IOT for rural empowerment.

Text Books:

TB1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
TB2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
TB3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.
TB4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key Applications and Protocols", Wiley, 2012.

Reference Books:

RB1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014

RB2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

RB3. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1- 4493-9357-1

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	**Detailed Statement of the CO**
CO1	Recall and list the key technologies that led to the evolution of IoT, including the concepts of SCADA, M2M, IoT, and Big Data.
CO2	Understanding of IoT standards and components, including the ability to explain the functions of various IoT platforms and operating systems.
CO3	Apply knowledge to design and develop prototype IoT systems, utilizing appropriate IoT components and platforms to address specific needs.
CO4	Analyze various challenges in IoT implementation, such as big data management, connectivity issues, mission-critical applications, and security concerns, and identify potential solutions.
CO5	Evaluate real-world IoT applications through case studies (such as Lighting as a Service, Intelligent Traffic Systems, Smart Parking, and Smart Water Management) to assess their effectiveness, efficiency, and societal impact.
CO6	Demonstrate creativity by designing an innovative IoT solution for a real-world problem, considering the relevance of IoT in everyday life, individual privacy, and specific applications in the Indian context, such as health services and rural empowerment.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	1	1	1	1	1	1	1	1	1	1
CO2	3	2	2	1	1	1	1	1	1	1	1	1
CO3	3	3	3	3	2	1	2	2	2	1	2	2
CO4	2	3	2	3	2	1	1	1	1	1	1	1
CO5	2	2	1	2	3	1	1	1	1	1	2	1
CO6	3	2	3	3	3	2	3	2	1	2	2	3
AVG	**2.7**	**2.2**	**2**	**2.2**	**2**	**1.2**	**1.5**	**1.3**	**1.2**	**1.2**	**1.5**	**1.5**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE604B**				
Course Name	**: INTRODUCTION TO BLOCKCHAIN/ MOOC ON BLOCKCHAIN**				
Semester / Year	**: 6th Semester / 3rd Year**				
	L	**T**	**P**	**C**	
	4	**0**	**0**	**4**	

Course Objectives: The objectives of this course are

In this course, the learners will be able to develop expertise related to the following: -

1. To provide Knowledge and concept of cryptography and blockchain.
2. To make familiar with Bitcoin and cryptocurrency with its various impact on blockchain.
3. To know about the Ethereum technology with its multiple aspects.
4. To provide an understanding about and Smart Contracts.
5. To develop an understanding about the various applications of Blockchain.

Course Content

Unit-I **[No. of Hours 10]**

Distributed systems, Blockchain, Generic elements of a blockchain, Benefits and limitations of blockchain, Tiers of blockchain technology, Features of a blockchain, Types of blockchain, Consensus,

Unit-II **[No. of Hours 10]**

Decentralization: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized Organizations,

Unit-III **[No. of Hours 10]**

Cryptography: Symmetric Cryptography, Confidentiality, Integrity, Authentication, Non-repudiation, Public Key Cryptography: Asymmetric cryptography, Public and private keys, Hash functions

Unit-IV **[No. of Hours 10]**

Introduction to Bitcoin and Ethereum

Text Books:

TB1. Imran Bashir, Mastering Blockchain, Packt, 2018

Reference Books

RB1. Daniel Drescher, Block chain basics A non-technical introduction in 25 steps, Apress , 2017.

RB2. Paul Vigna and Michael J.Casey. The Age of Cryptocurrency, 2015.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	To make capable to handle the cryptographic issues and its proper implementation in various fields.
CO2	To understand the Ethereum Virtual Machine and Bitcoin Wallets and related transactional blocks implementation.
CO3	To understand and implement the Consensus Mechanism.
CO4	To make capable to check Structure of Smart Contracts and its performance.
CO5	To understand various applications of Blockchain and its various future aspects.
CO6	Create application for blockchain

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	2	1	1					
CO2	3		2	1		1		1				
CO3	2	1	3	1	2	1	1					
CO4	1	1	2	2		1		1				
CO5	3	2		2	1		1	1				
CO6	2	2	1	1					1	1		
AVG	2.16	1.16	1.83	1.5	0.83	0.66	0.5	0.5	0.16	0.16	0	

Course code	**: BCADSE702A**				
Course Name	**: RESEARCH METHODOLOGY**				
Semester / Year	**: 7th Semester / 4th Year**				
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Understand the research process and its significance in computer applications.
2. Familiarize students with various research methods and designs.
3. Develop skills to design research studies and formulate research questions.
4. Gain proficiency in data collection, analysis, and interpretation.
5. Enhance critical evaluation and interpretation of research literature.
6. Develop effective research reporting and presentation skills.
7. Foster ethical conduct and responsible research practices.
8. Stimulate creativity in proposing innovative research directions.

Course Contents

Unit 1: Introduction to Research Methodology **[No. of Hours: 5]**
Definition and scope of research, Importance of research in computer applications, Research ethics and responsible conduct of research, Types of research (basic, applied, experimental, etc.), Components of a research study

Unit 2: Research Design and Planning **[No. of Hours: 8]**
Research problem identification and formulation, Research objectives and research questions/hypotheses, Variables and operationalization, Types of research design (exploratory, descriptive, experimental, etc.), Sampling techniques and sample size determination

Unit 3: Data Collection Methods **[No. of Hours: 8]**
Primary and secondary data, Quantitative data collection methods (surveys, experiments, observation), Qualitative data collection methods (interviews, focus groups, case studies), Questionnaire design and survey construction, Data sources and data validity and reliability

Unit 4: Data Analysis and Interpretation **[No. of Hours: 8]**
Quantitative data analysis techniques (descriptive statistics, inferential statistics), Qualitative data analysis techniques (content analysis, thematic analysis), Statistical software tools (SPSS, R, Excel), Interpreting research findings and drawing conclusions

Unit 5: Research Reporting and Presentation **[No. of Hours: 6]**
Structure and components of a research report, Writing research proposals and abstracts, Formatting guidelines (APA, IEEE, etc.), Presenting research findings effectively (oral presentations, posters)

Unit 6: Critical Evaluation of Research Literature **[No. of Hours: 5]**

Reviewing and synthesizing research articles, Evaluating research quality and validity, Identifying research gaps and proposing future research directions, Academic integrity and avoiding plagiarism

Text Books:

TB1. Bagchi, Kanak Kanti (2007) Research Methodology in Social Sciences: A Practical Guide, Delhi, Abijeet Publications.
TB2. Kothari, C.R (2004) Research Methodology: An Introduction, Delhi, New Age.

Reference Books:

RB1. Cooper, R. Donald and Pamela S. Schindler (2003) Business Research Methods, Delhi, Tata McGraw-Hill.
RB2. Flyvbjerg, Bent (2001) Making Social Science Matter: Why Social Inquiry Fails and How it can Succeed Again, United Kingdom, Cambridge University Press.
RB3. Goodde and Hatte (1952) Methods in Social Research, New York, McGraw – Hill.

Course Outcome (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the key concepts and terminology related to research methodology. Identify and describe the steps involved in the research process. Memorize ethical guidelines and principles for conducting research.
CO2	Explain the importance of research in the field of computer applications. Demonstrate an understanding of different research designs and their suitability for specific research objectives. Interpret research literature and identify the main findings and implications.
CO3	Apply appropriate research methods and techniques to collect and analyze data in the context of computer science. Design research studies and formulate research questions or hypotheses. Utilize statistical software tools to analyze quantitative research data.
CO4	Analyze research data and draw meaningful conclusions based on statistical analysis. Evaluate the validity and reliability of research findings. Critically assess the strengths and weaknesses of research methodologies used in published studies.
CO5	Evaluate the quality and credibility of research sources. Assess the ethical implications of research studies. Critique research methodologies and propose improvements or alternative approaches.
CO6	Design and develop research proposals, including clear research objectives, methodologies, and expected outcomes. Produce well-structured and properly formatted research reports or papers. Generate new research ideas and propose innovative research directions in the field of computer applications.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	2	1	1	1	1	1	1
CO2	2	2	2	2	2	2	2	2	1	2	2	2
CO3	1	1	2	2	2	2	2	1	1	1	1	2
CO4	1	1	2	2	2	2	2	1	1	1	1	2
CO5	1	1	1	2	2	2	2	1	1	1	1	2
CO6	1	1	2	2	2	2	2	1	1	1	1	2
AVG	**1.4**	**1.6**	**1.8**	**2**	**2**	**2.2**	**2**	**1.4**	**1.2**	**1.4**	**1.4**	**2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE702B**				
Course Name	**: SOFTWARE PROJECT MANAGEMENT – I**				
Semester / Year	**: 7th Semester / 4th Year**				
	L	**T**	**P**	**C**	
	3	**1**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Understand the fundamental concepts and principles of software project management.
2. Gain knowledge of project initiation, planning, and estimation techniques.
3. Develop skills in project organization, team management, and effective communication.
4. Apply project execution and monitoring methodologies, such as Waterfall and Agile.
5. Analyze project risks and implement strategies for risk mitigation.
6. Demonstrate the ability to create project charters, scope statements, and schedules.

COURSE CONTENTS

Unit 1: Introduction to Software Project Management **[No. of Hours: 3]**
Definition and importance of SPM, Characteristics of software projects, Role of project management in software development

Unit 2: Project Initiation **[No. of Hours: 5]**
Feasibility analysis, Project selection and justification, Project charter and scope statement

Unit 3: Project Planning **[No. of Hours: 12]**
Work breakdown structure (WBS), Project scheduling techniques (Gantt charts, PERT/CPM), Resource allocation and leveling, Risk identification and management

Unit 4: Project Estimation **[No. of Hours: 5]**
Estimation techniques (expert judgment, analogy, parametric), Function point analysis, COCOMO model

Unit 5: Project Organization and Team Management **[No. of Hours: 6]**
Project roles and responsibilities, Team building and team dynamics, Communication and collaboration in project teams, Project Execution and Monitoring

Unit 6: Project Execution and Monitoring **[No. of Hours: 9]**
Project execution methodologies (Waterfall, Agile, etc.), Tracking project progress, Change management, Earned value management

Text Books:

TB1. "Software Project Management: A Process-Driven Approach" by Ashfaque Ahmed
TB2. "Quality Software Project Management", Robert T. Futrell, Donald F. Shafer, and Linda I.. Shafer, 2002, Pearson Education Asia.

TB3. "Managing Global Software Projects", Ramesh Gopalaswamy, 2003, Tata McGraw-Hill

Reference Books:

RB3. "Software Project Management: A Unified Framework" by Walker Royce
RB4. "A Guide to the Project Management Body of Knowledge (PMBOK® Guide)" by Project Management Institute (PMI)
RB5. "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" by Harold Kerzner
RB6. "Managing the Software Process" by Watts S. Humphrey

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the key concepts and principles of software project management. Identify the characteristics of software projects and their role in software development.
CO2	Explain the importance of project initiation and its components. Understand different project planning techniques and their application in software projects.
CO3	Apply project estimation techniques to determine resource requirements and project schedules. Apply risk management strategies to identify and mitigate potential risks in software projects.
CO4	Analyze the impact of changes in project requirements and effectively manage change requests. Analyze project progress using earned value management techniques and make informed decisions.
CO5	Evaluate the effectiveness of project communication and collaboration strategies. Evaluate the feasibility of software projects using appropriate analysis techniques.
CO6	Develop a comprehensive project charter and scope statement for a given software project. Create a project schedule using Gantt charts or PERT/CPM techniques for effective project planning.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	1	3	1	1	2	1	2	2
CO2	2	2	2	2	2	3	2	2	1	1	2	2
CO3	1	2	2	2	2	3	2	2	2	1	2	2
CO4	1	2	2	2	2	3	2	2	2	1	2	2
CO5	1	2	2	2	2	3	2	2	2	1	2	2
CO6	2	2	2	2	2	3	2	2	3	1	2	2
AVG	**1.4**	**2**	**2**	**1.8**	**1.8**	**3**	**1.8**	**1.8**	**2**	**1**	**2**	**2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE702C**				
Course Name	**: ENTREPRENEURSHIP - 1**				
Semester / Year	**: 7th Semester / 4th Year**				
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

7. Understand the fundamental concepts and principles of software project management.
8. Gain knowledge of project initiation, planning, and estimation techniques.
9. Develop skills in project organization, team management, and effective communication.
10. Apply project execution and monitoring methodologies, such as Waterfall and Agile.
11. Analyze project risks and implement strategies for risk mitigation.
12. Demonstrate the ability to create project charters, scope statements, and schedules.

COURSE CONTENTS

Unit 1: Introduction to Entrepreneurship **[No. of Hours: 5]**
Definition and characteristics of entrepreneurship, Importance and role of entrepreneurship in the economy, Entrepreneurial mindset and qualities of successful entrepreneurs

Unit 2: Idea Generation and Opportunity Identification **[No. of Hours: 9]**
Creative thinking and idea generation techniques, Identifying and evaluating business opportunities, Market research and analysis for identifying target markets

Unit 3: Feasibility Analysis and Business Planning **[No. of Hours: 12]**
Assessing the feasibility of business ideas, Market analysis and competition evaluation, Developing a business plan, including mission, vision, and goals

Unit 4: Legal and Regulatory Environment **[No. of Hours: 7]**
Business registration and legal forms of business ownership, Intellectual property rights and protection, Understanding relevant laws and regulations for startups

Unit 5: Financing Entrepreneurial Ventures **[No. of Hours: 7]**
Sources of funding for startups (e.g., bootstrapping, angel investors, venture capital), Financial statements and forecasting for startups, Valuation of startup ventures

Text Books:

TB1. "Entrepreneurship: Development and Management" by Dr. C. B. Gupta
TB2. "Entrepreneurship Development and Small Business Enterprises" by Dr. Poornima M. Charantimath
TB3. "Entrepreneurship: Text and Cases" by Dr. C. B. Gupta
TB4. "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries

TB5. "The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything" by Guy Kawasaki
TB6. "The Entrepreneur Mind: 100 Essential Beliefs, Characteristics, and Habits of Elite Entrepreneurs" by Kevin D. Johnson

Reference Books:

RB1. "Entrepreneurship: Theory, Process, and Practice" by Donald F. Kuratko
RB2. "Entrepreneurship and Small Business Management" by Steve Mariotti and Caroline Glackin
RB3. "Entrepreneurship: Successfully Launching New Ventures" by Bruce R. Barringer and R. Duane Ireland
RB4. "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder and Yves Pigneur
RB5. "The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company" by Steve Blank and Bob Dorf

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the key characteristics of successful entrepreneurs. Identify the different sources of business ideas and opportunities. Remember the fundamental concepts and definitions related to entrepreneurship.
CO2	Explain the importance of entrepreneurship in the economy. Understand the process of market research and analysis for identifying target markets. Comprehend the components of a business plan and their significance.
CO3	Apply creative thinking techniques to generate innovative business ideas. Utilize feasibility analysis tools to evaluate the viability of business ideas. Apply market analysis and competition evaluation techniques to assess business opportunities.
CO4	Analyze the legal and regulatory environment for startups. Evaluate different sources of funding for startup ventures. Analyze financial statements and forecasting for startups.
CO5	Assess the effectiveness of marketing strategies for startups. Evaluate the impact of operations and supply chain management on startup success. Evaluate the importance of human resource management for startup teams.
CO6	Develop a comprehensive business plan for a startup venture. Design innovative marketing and sales strategies for a startup. Create a growth strategy and entrepreneurial leadership plan for a startup.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	3	1	1	1	1	2	3
CO2	1	2	2	2	2	3	1	1	1	1	2	3
CO3	2	2	3	2	2	3	1	1	1	1	2	3
CO4	1	2	2	2	2	3	1	1	1	1	2	3
CO5	1	2	2	2	2	3	1	1	1	1	2	3
CO6	2	3	3	2	3	3	1	1	1	1	2	3
AVG	**1.6**	**2.2**	**2.6**	**1.8**	**2**	**3**	**1.4**	**1.4**	**1.4**	**1.4**	**2.2**	**3**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	:	**BCADSE703A**			
Course Name	:	**DATA WAREHOUSE AND DATA MINING/ MOOC ON DATA WAREHOUSE AND DATA MINING**			
Semester /Year	:	**7th Semester / 4th Year**			
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Be familiar with mathematical foundations of data mining tools.
2. Understand and implement classical models and algorithms in data warehouses and data mining
3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
4. Master data mining techniques in various applications like social, scientific and environmental context.
5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

COURSE CONTENTS

Unit 1. Introduction to Data Warehousing **[No. of Hours: 2]**

Overview of data warehousing, Characteristics of data warehousing, Data warehousing architecture, Data warehousing components, Data warehouse lifecycle

Unit 2. Data Warehouse Design and Implementation **[No. of Hours: 4]**

Dimensional modeling, Fact and dimension tables, Star and snowflake schema, Data warehouse modeling tools, Data extraction, transformation, and loading (ETL) process, Data warehouse implementation considerations

Unit 3. Data Warehouse Querying and Optimization **[No. of Hours: 2]**

Online Analytical Processing (OLAP), OLAP operations: roll-up, drill-down, slice, and dice Data cube technology, Multidimensional Expressions (MDX), Query optimization techniques for data warehousing

Unit 4. Data Preprocessing **[No. of Hours: 6]**

Data cleaning and integration, Data transformation and reduction, Data discretization and binning, Handling missing data, Feature selection and extraction

Unit 5. Association Rule Mining **[No. of Hours: 6]**

Frequent itemset mining, Apriori algorithm, Association rule generation, Rule evaluation and selection, Applications of association rule mining

Unit 6. Classification and Prediction **[No. of Hours: 8]**

Classification vs. prediction, Decision tree induction, Rule-based classification, Bayesian classification, Evaluation of classification models

Unit 7. Cluster Analysis **[No. of Hours: 6]**

Introduction to clustering, Partitioning methods (K-means, K-medoids), Hierarchical clustering Density-based clustering, Cluster evaluation and validation

Unit 8: Text Mining and Sentiment Analysis **[No. of Hours: 2]**

Text preprocessing techniques, Text classification and clustering, Sentiment analysis methods Opinion mining, Applications of text mining

Text Books:

TB1. Data Mining-Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
TB2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education

Reference Books:

RB1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
RB2. Data Ware Housing Fundamentals, Pualraj Ponnaiah, Wiley Student Edition.
RB3. The Data Ware House Life Cycle Toolkit- Ralph Kimball, Wiley Student Edition.
RB4. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the fundamental concepts and principles of data warehousing and data mining. Identify the components and stages involved in the data warehousing lifecycle. Recognize the key techniques and algorithms used in data preprocessing, association rule mining, classification, clustering, and text mining.
CO2	Explain the architecture and characteristics of data warehousing systems. Demonstrate comprehension of dimensional modeling and schema design for data warehouses. Interpret the results and outputs of different data mining algorithms and methods.
CO3	Apply data preprocessing techniques to clean, transform, and reduce raw data for analysis. Implement data mining algorithms for association rule mining, classification, clustering, and text mining on given datasets. Utilize data visualization tools and techniques to effectively represent and interpret patterns and insights from the mined data.
CO4	Analyze data warehouse requirements and design appropriate schemas based on business needs. Evaluate the performance and efficiency of data mining algorithms in terms of accuracy, speed, and scalability. Assess the quality and validity of patterns and associations discovered through data mining techniques.

CO5	Critically evaluate the ethical and social implications of data warehousing and data mining. Assess the strengths and limitations of different data preprocessing techniques and algorithms. Evaluate the effectiveness of data mining models and propose improvements or modifications based on evaluation results.
CO6	Design and develop a data warehouse by applying dimensional modeling techniques. Construct comprehensive data mining solutions by integrating multiple algorithms and techniques. Generate actionable insights and recommendations based on the results of data mining processes.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	3	1	1	1	2	2	2
CO2	2	2	3	2	2	3	1	1	1	2	2	2
CO3	2	2	3	2	2	3	1	1	1	2	2	2
CO4	2	2	3	2	2	3	1	1	1	2	2	2
CO5	1	2	3	2	2	3	1	1	1	1	2	2
CO6	2	2	3	2	2	3	1	1	1	2	2	2
AVG	**2**	**2.2**	**3**	**2.2**	**2.2**	**3**	**1.4**	**1.4**	**1.4**	**2**	**2.2**	**2.2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE703B**				
Course Name	**: ADVANCE RDBMS/ MOOC ON ADVANCE RDBMS**				
Semester /Year	**: 7th Semester / 4th year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

- Understand the concepts and principles of transaction processing in RDBMS.
- Learn the techniques for ensuring recoverability and handling transaction failures.
- Gain knowledge of concurrency control techniques and their application in managing concurrent transactions.
- Explore the fundamentals of distributed DBMS, including data fragmentation, replication, and allocation.
- Introduce the basics of Object-Oriented DBMS (OODBMS).
- Develop critical thinking and analysis skills in evaluating and designing advanced RDBMS solutions.
- Apply acquired knowledge to real-world scenarios through practical projects and case studies.

COURSE CONTENTS

UNIT I **[No. of Hours: 12]**

Transaction Processing Concepts: Transaction system, testing of serializability, Serializability of Schedules Conflict & view serializable schedule

UNIT II **[No. of Hours: 6]**

Recoverability, Recovery from transaction failures, log based recovery, Checkpoints, deadlock handling

UNIT III **[No. of Hours: 12]**

Concurrency Control Techniques: Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi-version Schemes, Recovery with concurrent transaction.

UNIT IV **[No. of Hours: 8]**

Distributed DBMS Concepts and design: Introduction, functions and architecture of a DDBMS, transaction Processing in Distributed system, data fragmentation. Replication and allocation techniques for distributed system, overview of concurrency control and recovery in distrusted database,

UNIT V **[No. of Hours: 2]**

Introduction to OODBMS.

Text Books:

TB1. Adv. DBMS by V.K. Jain, Cyber Tech Publication, 5A/13 Ansari Road, Daryagang, N.Delhi.-110002

TB2. Date C.J. "An Introduction to Database System". Addision Wesley

References Books:

RB1. Korth, Silbertz, Sudarshan, "Database Concepts" McGraw Hill

RB2. Elmasri, Navathe, "Fundamentals of Database Systems" Addision Wesley

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO #	Detailed Statement of the CO
CO1	Recall the fundamental concepts of transaction processing in RDBMS. Identify the different types of serializability schedules. Memorize the techniques for recovery, concurrency control in transaction processing Recall the concept of distributed & object-oriented DBMS
CO2	Understand the concept of transaction in database and significance of serializability in transaction execution. Explain the principles and importance of recoverability and recovery in RDBMS. Comprehend the concurrency control techniques used in RDBMS. Understand the architecture and functions of a Distributed DBMS.
CO3	Apply transaction processing concepts to analyze and evaluate the serializability of given schedules. Utilize recovery techniques, such as log-based recovery and checkpoints, to ensure data consistency in case of transaction failures. Implement concurrency control techniques, including locking and timestamping protocols, to manage concurrent transactions effectively.
CO4	Apply and comparing the locking techniques for controlling concurrent transaction execution. Evaluate different data fragmentation and replication techniques in a distributed database system.
CO5	Evaluate distributed DBMS and OODBMS concepts. Assess the effectiveness of different concurrency control techniques in maintaining data consistency and ensuring transaction integrity. Evaluate the advantages and limitations of distributed database management systems. Critically analyze the applicability of various recovery strategies in different scenarios.
CO6	Case studies based on serializability and locking protocols.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	3	1	1	1	1	2	2	2
CO2	2	3	3	2	3	1	1	1	1	2	2	2
CO3	2	3	3	3	3	1	1	1	1	2	2	2
CO4	2	3	3	2	3	1	1	1	1	2	2	2
CO5	2	3	3	2	3	1	1	1	1	2	2	2
CO6	2	3	3	2	3	1	1	1	1	2	2	2
AVG	**2**	**3**	**3**	**2.4**	**3**	**1.2**	**1.2**	**1.2**	**1.2**	**2.4**	**2.4**	**2.4**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE704A**				
Course Name	**: MULTIMEDIA SYSTEM/ MOOC ON MULTIMEDIA SYSTEM**				
Semester /Year	**: 7th Semester / 4th year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

- Understand the concepts and principles of transaction processing in RDBMS.
- Learn the techniques for ensuring recoverability and handling transaction failures.
- Gain knowledge of concurrency control techniques and their application in managing concurrent transactions.
- Explore the fundamentals of distributed DBMS, including data fragmentation, replication, and allocation.
- Introduce the basics of Object-Oriented DBMS (OODBMS).
- Develop critical thinking and analysis skills in evaluating and designing advanced RDBMS solutions.
- Apply acquired knowledge to real-world scenarios through practical projects and case studies.

COURSE CONTENTS

Unit 1: Introduction to Multimedia **[No. of Hours: 3]**

Definition and characteristics of multimedia, Elements of multimedia systems: text, graphics, audio, video, and animation, Multimedia applications and their significance

Unit 2: Digital Media Basics **[No. of Hours: 5]**

Analog vs. digital signals, Sampling, quantization, and encoding, Color models and image representation

Unit 3: Graphics and Image Editing **[No. of Hours: 6]**

Introduction to graphics and image editing tools, Image formats and compression techniques, Basic image editing operations: cropping, resizing, enhancing, etc.

Unit 4: Audio and Sound Editing **[No. of Hours: 5]**

Fundamentals of audio and sound, Digital audio formats and compression algorithms, Sound editing techniques: mixing, equalization, effects, etc.

Unit 5: Video and Video Editing **[No. of Hours: 5]**

Introduction to video concepts and formats, Video editing tools and techniques, Video compression and streaming

Unit 6: Animation and 3D Graphics **[No. of Hours: 6]**

Principles of animation, Animation techniques and tools, Introduction to 3D graphics and modeling

Unit 7: Multimedia Authoring **[No. of Hours: 6]**

Introduction to multimedia authoring tools, Creating interactive multimedia presentations, Hypermedia and hypertext concepts

Unit 8: Multimedia File Formats and Standards **[No. of Hours: 4]**

Popular multimedia file formats (JPEG, GIF, MP3, MPEG, etc.), Standards and protocols for multimedia content (HTML5, CSS, SVG, etc.), Compatibility and interoperability issues

Text Books:

TB1. "Multimedia Systems" by Buford, Addison Wesley
TB2. "Multimedia Systems" by Agrawal &Tiwari, Excel
TB3. "Introduction to Multimedia Systems" by Gaurav Bhatnagar, Shikha Mehta, Sugata Mitra

References Books:

RB1."Multimedia: Making It Work" by Tay Vaughan

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO #	Detailed Statement of the CO
CO1	Recall and recognize fundamental concepts and terminology related to multimedia, including multimedia elements, file formats, and basic multimedia tools.
CO2	Understanding of the principles and components of multimedia systems, explain the processes involved in creating and editing multimedia content, and interpret multimedia file formats and standards.
CO3	Apply multimedia tools and techniques to create, edit, and enhance multimedia content such as images, audio, video, and animations. They will also be able to utilize multimedia authoring tools to create interactive multimedia presentations.
CO4	Analyze multimedia components, such as images, audio, and video, to evaluate their quality, relevance, and effectiveness in conveying information. They will also examine multimedia file formats and standards to assess their compatibility and interoperability.
CO5	Evaluate multimedia content, including presentations, websites, or applications, based on their design, usability, and effectiveness.
CO6	Create comprehensive multimedia projects that incorporate various multimedia elements, techniques, and tools. They will integrate text, graphics, audio, video, and animations to develop engaging and interactive multimedia applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	1	2	1	2	2	2	2
CO2	2	2	3	2	2	2	3	2	3	2	2	3
CO3	2	2	3	2	2	2	3	2	3	2	2	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3	3
AVG	**2.3**	**2.3**	**2.5**	**2.1**	**2.3**	**2.1**	**2.5**	**2.1**	**2.5**	**2.3**	**2.3**	**2.5**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE704B**				
Course Name	**: NETWORK SECURITY AND CRYPTOGRAPHY/ MOOC ON NETWORK SECURITY AND CRYPTOGRAPHY**				
Semester / Year	**: 7th Semester / 4th Year**				
	L	**T**	**P**	**C**	
	4	**0**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

1. Understand the basic Knowledge of Network Security Concepts & the Challenges and Scope of Information Security
2. Understand the basic Concept of Block Cipher, stream ciphers &the Importance of Cryptographic Algorithms and their Uses.
3. Learn and Understand Encryption Techniques & Access Control Mechanism Used for User Authentication and Authorization.
4. Understand the concept of authentication of message in network by using different techniques.
5. Aware and Learn the Usages of Sockets Layer (SSL), Secure Internet Protocol (IP) and HTTPS, Secure Electronic transaction.

COURSE CONTENTS:

UNIT 1: Introduction to security **[No. of Hours: 10]**

Basic aspects of Network security, Attacks active & passive attacks, Types of attack, VIRUS and its categories, Conventional Encryption, Conventional Encryption Model, Substitution & transposition techniques, Bit level encryption and operations. Block Cipher Design (Feistel and SP Network), Block Cipher Modes of Operations.

UNIT 2: Conventional Encryption Algorithms **[No. of Hours: 10]**

DES, DES Algorithm, DES standard, DES strength ,2DES, 3 DES, Men in Middle attack, AES, Blowfish, International Data Encryption Algorithm IDEA, RC-5, CAST-128, RSA, Key Distribution, Diffie Helmen Key Exchange Algorithm.

UNIT 3: Message Authentication & Hash Functions **[No. of Hours: 10]**

Authentication Requirements, Authentication Functions, Message Authentication Codes MAC, HMAC, Hash Function, Message Digest Algorithm: MD5 & SHA, Digital Signature, Standard (DDS), Proof of Digital Signature Algorithm, Digital certificate, X.509, X.25, Secure Electronic Transaction, Authentication Protocol, Authentication Applications: Kerberos.

UNIT4: Email, Internet Protocol Security **[No. of Hours: 10]**

Secure Socket Layer, Electronic Mail Security: PEM, Pretty Good Privacy (PGP), IP security Authentication Header, Encapsulating Security Payloads.

Text Book:

TB1. William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice hall, New Jersey

Reference Books:

RB1. Johannes A. Buchmann, "Introduction to Cryptography" Springer-Verlag
RB2. Atul Kahate, "Cryptography and Network Security" TMH3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated.

Course Outcomes (OCs)

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Able to understand & remember basics of cryptography &security like active and passive attacks and encryption and decryption techniques
CO2	Able to understand and apply the concept of linear and differential crypt analysis
CO3	Able to understand & remember basics of conventional encryption techniques like DES, Blowfish etc.
CO4	Able to understand basics of message authentication like digital signature, SET Authentication protocol like Kerberos etc.
CO5	Able to understand & remember the concept of SSL.
CO6	To design and compose Email security, Authentication Header, & Encapsulating Payload etc.

CO-PO Mapping:

	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1			1	1						
CO2	1	2	1	2	1							
CO3	2	2		2	1	1		1				
CO4	1	2	2	1		2	1					
CO5		2	1	2	1	2		1				
CO6	1	2	1	2	1							
AVG	**1.1**	**1.8**	**0.8**	**1.5**	**0.8**	**1**	**0.1**	**0.3**				

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE802A**				
Course Name	**: RESEARCH PUBLICATION & ETHICS**				
Semester / Year	**: 8th Semester / 4th Year**				
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Understand the research publication process and its significance in computer science.
2. Develop skills in academic writing, including research paper structure and citation styles.
3. Recognize and avoid plagiarism while ensuring integrity in research.
4. Gain knowledge of intellectual property rights, copyright, and patents in research publications.
5. Explore ethical considerations in research, including human participant involvement and data handling.
6. Understand the social implications of research and practice responsible conduct.
7. Familiarize with databases, indexing databases, and research metrics for evaluating research impact.
8. Learn about ethical guidelines and professional organizations in the field.
9. Prepare for a successful research career by building a research profile and networking.

Course Contents

Unit 1: Introduction to Research Publication **[No. of Hours: 3]**

Importance of research publication in computer science, Different types of research publications (conference papers, journal articles, etc.), Overview of the research publication process

Unit 2: Academic Writing and Paper Structure **[No. of Hours: 6]**

Elements of a research paper (title, abstract, introduction, methodology, results, conclusion), Literature review and referencing, Writing clear and concise research papers, Formatting guidelines and citation styles (e.g., APA, MLA)

Unit 3: Plagiarism and Intellectual Property **[No. of Hours: 5]**

Understanding plagiarism and its consequences, Techniques to avoid plagiarism (paraphrasing, citing sources, etc.), Intellectual property rights and copyright, Patents and their role in protecting research innovations

Unit 4: Responsible Authorship and Collaboration **[No. of Hours: 5]**

Guidelines for responsible authorship and contributorship, Collaboration in research and authorship order, Handling authorship disputes and conflicts of interest, Acknowledgments and funding disclosure

Unit 5: Research Ethics **[No. of Hours: 5]**

Ethical considerations in research involving human participants, Informed consent and ethical review boards, Ethical handling of data and privacy issues, Research misconduct and ethical violations

Unit 6: Social Implications of Research **[No. of Hours: 4]**

Impact of research on society and technological advancements, Responsible conduct of research in the context of social implications, Ethical considerations in emerging areas (e.g., artificial intelligence, data science, cybersecurity), Ethical considerations in publishing controversial research

Unit 7: Ethical Guidelines and Professional Organizations **[No. of Hours: 4]**

Overview of ethical guidelines and codes of conduct (e.g., ACM Code of Ethics), Introduction to professional organizations and their role in promoting ethical research practices, Ethical responsibilities of researchers and professionals in computer science, Research Publication and Career Development

Unit 8: Importance of research publications in academic and professional careers **[No. of Hours: 4]**

Strategies for successful publication and dissemination of research, Evaluating the quality and impact of research publications, Building a research profile and networking in the research community

Unit 9: Databases and Research Metrics **[No. of Hours: 4]**

Databases, indexing databases, Citation databases: Web of Science, Scopus, etc., Research Metrics, Impact factor of journal as per journal Citation report, SNP, SJR, IPP, Cite score, Metrics: h-index, g index, i10 index, altimetric.

Text Books:

TB1. **"Research and Publication Ethics"** by Wakil Kumar Yadav
TB2. **"Handbook of Research and Publication Ethics"** edited by Nimit Chowdhary and Sarah Hussain
TB3. **"Good Practices and Ethics in Research and Publication"** by Dr. Partha Pratim Ray
TB4. **"Research and Publications Ethics"** by Dr. S.B. Kishor, Dr. Ajay S. Kushwaha, and Dr. Gitanjali J

Reference Books:

RB1. "How to Write a Better Thesis" by David Evans, Paul Gruba, and Justin Zobel
RB2. "Publish and Flourish: Become a Prolific Scholar" by Tara Gray

Course Outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the importance of research publication in the field of computer science. Memorize the elements and structure of a research paper. Identify different types of research publications.

CO2	Explain the ethical considerations involved in research, such as plagiarism, data integrity, and conflicts of interest. Understand the process of responsible authorship and collaboration in research. Comprehend the social implications of research and the responsible conduct of research in various contexts.
CO3	Apply proper citation styles and formatting guidelines in academic writing. Demonstrate the ability to avoid plagiarism and appropriately use referencing techniques. Apply ethical principles in research design and data handling.
CO4	Analyze the social and ethical implications of research in computer science. Evaluate the credibility and reliability of research publications. Analyze authorship order and resolve authorship disputes in research collaboration.
CO5	Assess the quality and impact of research publications using research metrics and indicators. Evaluate ethical issues and considerations in controversial research areas. Critically evaluate the ethical conduct of researchers in relation to research participants and data handling.
CO6	Create well-structured research papers adhering to academic writing standards. Design and propose research projects that follow ethical guidelines and address social implications. Develop strategies to build a research profile and network in the research community.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	1	1	1	2	2	2	2
CO2	2	3	3	2	3	2	2	2	3	2	3	3
CO3	2	3	3	2	3	2	2	2	3	2	3	3
CO4	1	2	2	1	2	1	1	1	2	1	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
CO6	2	2	2	2	2	2	2	2	2	2	2	2
AVG	**1.8**	**2.4**	**2.4**	**1.8**	**2.4**	**1.8**	**1.8**	**1.8**	**2.4**	**1.8**	**2.4**	**2.4**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE802B**				
Course Name	**: SOFTWARE PROJECT MANAGEMENT – II**				
Semester / Year	**: 8th Semester / 4th Year**				
	L	**T**	**P**	**C**	
	3	**1**	**0**	**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

13. Gain a thorough understanding of software quality assurance and testing principles.
14. Learn effective software configuration management practices, including version control.
15. Enhance project communication and documentation skills for successful project delivery.
16. Develop expertise in identifying, analyzing, and managing project risks.
17. Gain proficiency in project closure activities and conducting post-implementation reviews.
18. Acquire knowledge of software project management tools and their practical applications.

COURSE CONTENTS

Unit 1: Quality Assurance and Testing **[No. of Hours: 7]**
Software quality concepts, Software testing techniques, Test planning and execution

Unit 2: Software Configuration Management **[No. of Hours: 5]**
Version control systems, Change management and release management, Software baselines

Unit 3: Project Communication and Documentation **[No. of Hours: 7]**
Effective project communication, Project documentation (requirements, design, test cases, etc.) Configuration management of project documents,

Unit 4: Project Risk Management **[No. of Hours: 7]**
Risk assessment and prioritization, Risk mitigation strategies, Risk monitoring and control

Unit 5: Project Closure and Post-Implementation Review **[No. of Hours: 7]**
Project closure activities, Lessons learned and knowledge transfer, Post-implementation review and maintenance

Unit 6: Software Project Management Tools **[No. of Hours: 7]**
Introduction to project management software (e.g., Microsoft Project, JIRA), Collaboration tools and version control systems

Text Books:

TB4. "Software Project Management: A Process-Driven Approach" by Ashfaque Ahmed
TB5. "Quality Software Project Management", Robert T. Futrell, Donald F. Shafer, and Linda I.. Shafer, 2002, Pearson Education Asia.

TB6. "Managing Global Software Projects", Ramesh Gopalaswamy, 2003, Tata McGraw-Hill

Reference Books:

RB7. "Software Project Management: A Unified Framework" by Walker Royce
RB8. "A Guide to the Project Management Body of Knowledge (PMBOK® Guide)" by Project Management Institute (PMI)
RB9. "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" by Harold Kerzner
RB10. "Managing the Software Process" by Watts S. Humphrey

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the principles and best practices of software quality assurance and testing. Remember the key concepts of software configuration management and version control.
CO2	Understand the importance of effective project communication and documentation. Comprehend the key elements of project risk management and its impact on project success.
CO3	Apply software testing techniques to design and execute test cases for software projects. Apply configuration management practices to track and manage software versions effectively.
CO4	Analyze the effectiveness of project communication strategies and recommend improvements. Analyze and evaluate project risks, prioritize them, and develop appropriate risk mitigation strategies.
CO5	Evaluate the effectiveness of software quality assurance processes and suggest enhancements. Evaluate project closure activities and conduct post-implementation reviews for lessons learned.
CO6	Create comprehensive project documentation, including requirements, design, and test cases. Design and implement a software configuration management plan for a given project.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	2	1	1	3	1	2	2
CO2	1	2	2	2	2	2	1	1	1	1	2	2
CO3	2	2	3	2	2	3	1	1	3	1	2	2
CO4	2	2	3	2	2	3	1	1	3	1	2	2
CO5	2	2	3	2	2	3	1	1	3	1	2	2
CO6	3	3	3	3	3	3	1	1	3	1	2	3
AVG	**2**	**2.2**	**2.8**	**2.4**	**2.4**	**2.8**	**1.4**	**1.4**	**2.8**	**1.4**	**2.2**	**2.4**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE802C**				
Course Name	**: ENTREPRENEURSHIP - II**				
Semester / Year	**: 8th Semester / 4th Year**				
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

19. Understand the fundamental concepts and principles of software project management.
20. Gain knowledge of project initiation, planning, and estimation techniques.
21. Develop skills in project organization, team management, and effective communication.
22. Apply project execution and monitoring methodologies, such as Waterfall and Agile.
23. Analyze project risks and implement strategies for risk mitigation.
24. Demonstrate the ability to create project charters, scope statements, and schedules.

COURSE CONTENTS

Unit 1: Marketing and Sales for Startups **[No. of Hours: 8]**
Marketing strategies and tactics for startups, Customer segmentation and targeting, Building a brand and effective sales techniques

Unit 2: Operations and Supply Chain Management **[No. of Hours: 6]**
Operations management for startups, Supply chain management and logistics, Quality management and process improvement

Unit 3: Human Resource Management for Startups **[No. of Hours: 6]**
Recruitment and selection of employees, Training and development of startup teams, Employee motivation and performance management

Unit 4: Innovation and Technology Management **[No. of Hours: 6]**
Managing innovation and technological change in startups, Technology commercialization and intellectual property management, Digital transformation strategies for startups

Unit 5: Growth Strategies and Entrepreneurial Leadership **[No. of Hours: 8]**
Scaling up and growth strategies for startups, Strategic planning and execution, Leadership and team management in entrepreneurial ventures

Unit 6: Entrepreneurship Ecosystem and Support Structures **[No. of Hours: 6]**
Understanding the entrepreneurship ecosystem, Government policies and initiatives to support startups, Incubators, accelerators, and other support organizations for startups

Text Books:

TB1. "Entrepreneurship: Development and Management" by Dr. C. B. Gupta

TB2. "Entrepreneurship Development and Small Business Enterprises" by Dr. Poornima M. Charantimath
TB3. "Entrepreneurship: Text and Cases" by Dr. C. B. Gupta
TB4. "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries
TB5. "The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything" by Guy Kawasaki
TB6. "The Entrepreneur Mind: 100 Essential Beliefs, Characteristics, and Habits of Elite Entrepreneurs" by Kevin D. Johnson

Reference Books:

RB6. "Entrepreneurship: Theory, Process, and Practice" by Donald F. Kuratko
RB7. "Entrepreneurship and Small Business Management" by Steve Mariotti and Caroline Glackin
RB8. "Entrepreneurship: Successfully Launching New Ventures" by Bruce R. Barringer and R. Duane Ireland
RB9. "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder and Yves Pigneur
RB10. "The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company" by Steve Blank and Bob Dorf

Course Outcomes (CO):

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall key concepts and theories related to marketing, operations, human resource management, innovation, growth strategies, and the entrepreneurship ecosystem.
CO2	Explain the fundamental principles and theories of marketing, operations, human resource management, innovation, growth strategies, and the entrepreneurship ecosystem. Interpret the interrelationships between different functional areas within entrepreneurial ventures.
CO3	Apply marketing strategies and tactics to develop a comprehensive marketing plan for a startup venture. Utilize operations management principles to optimize processes and enhance efficiency in a startup. Apply human resource management techniques to recruit, train, and motivate employees in a startup environment.
CO4	Analyze market research data to identify customer needs, preferences, and market opportunities for a startup venture. Evaluate the supply chain and logistics management of a startup and propose improvements. Analyze the financial statements and forecasts of a startup to assess its financial health and viability.

CO5	Evaluate different growth strategies and assess their suitability for specific startup contexts. Critically evaluate leadership styles and their impact on entrepreneurial ventures. Evaluate the role of government policies and support structures in fostering entrepreneurship.
CO6	Design an innovative business model for a startup venture, considering technology, market trends, and customer needs. Create a comprehensive business plan for a new entrepreneurial venture, integrating various functional areas. Generate creative solutions to overcome challenges and barriers faced by startups in a rapidly changing business environment.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	3	1	1	1	2	2	2
CO2	2	2	3	2	2	3	1	1	1	2	2	2
CO3	2	2	3	2	2	3	1	1	1	2	2	2
CO4	1	2	2	2	2	3	1	1	1	1	2	2
CO5	1	2	3	2	3	3	1	1	1	2	2	3
CO6	2	3	3	2	3	3	1	1	1	2	3	3
AVG	**1.8**	**2.2**	**2.8**	**2**	**2.4**	**3**	**1.4**	**1.4**	**1.4**	**1.8**	**2.4**	**2.6**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE803A**				
Course Name	**: MACHINE LEARNING/ MOOC ON MACHINE LEARNING**				
Semester / Year	**: 8th Semester / 4th Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

1. Understand the fundamentals of Machine Learning, its definition, and its importance in various fields.
2. Explore the applications of Machine Learning in real-world scenarios.
3. Gain knowledge of different types of Machine Learning approaches: supervised, unsupervised, and reinforcement learning.
4. Develop skills in exploratory data analysis, including data preprocessing, cleaning, and visualization techniques.
5. Learn and implement various supervised learning algorithms such as linear regression, logistic regression, decision trees, random forests, SVM, and Naive Bayes.
6. Familiarize oneself with unsupervised learning algorithms like clustering and dimensionality reduction techniques.
7. Understand the concepts of model evaluation and selection, including cross-validation, overfitting, underfitting, and hyperparameter tuning.
8. Gain knowledge of ensemble learning methods, such as bagging, boosting, random forests, and AdaBoost.
9. Learn feature selection and engineering techniques, including scaling, normalization, handling categorical data, and feature extraction.
10. Acquire skills in evaluating and deploying Machine Learning models, including performance evaluation, model deployment, and ethical considerations.
11. Study case studies and practical applications to understand real-world examples of Machine Learning implementations.
12. Gain hands-on experience in implementing Machine Learning algorithms using programming languages Python along with relevant libraries such as scikit-learn..

COURSE CONTENTS:

Unit 1: Introduction to Machine Learning **[No. of Hours: 3]**

Definition and importance of Machine Learning, Applications of Machine Learning, Supervised, unsupervised, and reinforcement learning

Unit 2: Exploratory Data Analysis **[No. of Hours: 4]**

Data preprocessing and cleaning, Data visualization techniques, Handling missing data and outliers

Unit3: Supervised Learning Algorithms **[No. of Hours: 9]**

Linear regression, Logistic regression, Decision trees, Random forests, Support Vector Machines (SVM), Naive Bayes classifier, Evaluation metrics for classification and regression tasks

Unit 4: Unsupervised Learning Algorithms **[No. of Hours: 5]**
Clustering algorithms (e.g., K-means, hierarchical clustering), Dimensionality reduction techniques (e.g., Principal Component Analysis, t-SNE), Association rule learning (e.g., Apriori algorithm)

Unit 5: Model Evaluation and Selection **[No. of Hours: 4]**
Cross-validation techniques, Overfitting and underfitting, Bias-variance trade-off, Hyperparameter tuning

Unit 6: Ensemble Learning **[No. of Hours: 4]**
Bagging and boosting techniques, Random forests, Gradient Boosting Machines (GBM), AdaBoost

Unit 7: Feature Selection and Engineering **[No. of Hours: 4]**
Feature selection techniques, Feature scaling and normalization, Handling categorical data, Feature extraction

Unit 8: Evaluation and Deployment of Machine Learning Models **[No. of Hours: 3]**
Model performance evaluation, Model deployment and integration into applications, Ethical considerations and bias in Machine Learning

Unit 9: Case Studies and Practical Applications **[No. of Hours: 4]**
Real-world examples of Machine Learning applications. Implementation of Machine Learning algorithms using programming languages in Python, Working with popular Machine Learning libraries

Text Book:

TB1. "Understanding Machine Learning: From Theory to Algorithms" by Shai Shalev-Shwartz and Shai Ben-David
TB2. "Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili
TB3. "Machine Learning for Dummies" by John Paul Mueller and Luca Massaron

Reference Books:

RB1. "Pattern Recognition and Machine Learning" by Christopher M. Bishop
RB2. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy
RB3. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron
RB4. "Introduction to Machine Learning" by Ethem Alpaydin
RB5. "Machine Learning: The Art and Science of Algorithms that Make Sense of Data" by Peter Flach
RB6. "Applied Predictive Modeling" by Max Kuhn and Kjell Johnson

Course Outcomes (OCs)

After completion of the course, a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the definitions and key concepts related to Machine Learning and identify different types of Machine Learning algorithms and their applications.
CO2	Explain the principles and techniques of supervised and unsupervised learning and demonstrate an understanding of evaluation metrics and model selection techniques in Machine Learning.
CO3	Apply data preprocessing and cleaning techniques to prepare data for Machine Learning algorithms and implement & apply various Machine Learning algorithms to solve classification and regression problems.
CO4	Analyze the performance of Machine Learning models using evaluation metrics and interpret the results and evaluate the impact of different hyperparameter settings on model performance.
CO5	Critically evaluate the strengths and weaknesses of different Machine Learning algorithms for specific tasks and assess the ethical implications and considerations of using Machine Learning algorithms in real-world applications.
CO6	Design and create Machine Learning models to solve complex problems and develop innovative solutions by combining different Machine Learning techniques and algorithms.

CO-PO Mapping:

	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	1	1	1	1	1	1	1	1
CO2	2	2	3	2	1	2	2	2	1	1	1	2
CO3	2	2	3	2	1	2	2	2	1	1	1	2
CO4	2	1	2	1	1	2	2	2	1	1	1	1
CO5	1	1	2	2	2	2	2	2	1	1	2	2
CO6	2	2	2	3	2	3	3	3	1	1	2	3
AVG	**1.8**	**1.6**	**2.4**	**1.8**	**1.4**	**2**	**2**	**2**	**1**	**1**	**1.4**	**1.8**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE803B**				
Course Name	**: CLOUD COMPUTING/ MOOC ON CLOUD COMPUTING**				
Semester	**: 8th Semester / 4th Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Understand the fundamental concepts, characteristics, and benefits of cloud computing.
2. Explain the different service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid) in cloud computing.
3. Apply virtualization technologies to create and manage virtual machines or containers.
4. Deploy and manage applications on cloud platforms using IaaS and PaaS models.
5. Analyze the security challenges in cloud computing and implement appropriate security measures.
6. Evaluate and compare cloud storage, database services, and cloud service providers.
7. Develop strategies for cloud migration, integration, and cost optimization.
8. Monitor and manage cloud resources using automation and orchestration techniques.
9. Design scalable and resilient cloud architectures for real-world scenarios.

COURSE CONTENTS

Unit 1: Introduction to Cloud Computing **[No. of Hours: 4]**

Definition and characteristics of cloud computing, Evolution and history of cloud computing, Benefits and challenges of cloud computing, Cloud service models: IaaS, PaaS, SaaS, Cloud deployment models: Public, private, hybrid, community clouds

Unit 2: Virtualization **[No. of Hours: 4]**

Virtualization concepts and benefits, Types of virtualization: Server, storage, network, Virtualization technologies: VMware, Xen, Hyper-V

Unit 3: Infrastructure as a Service (IaaS) **[No. of Hours: 4]**

Introduction to IaaS, Virtual machines and containers, Managing virtualized infrastructure IaaS providers: Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform

Unit 4: Platform as a Service (PaaS) **[No. of Hours: 4]**

Introduction to PaaS, Cloud application development platforms, Deployment and scaling of applications, PaaS providers: Heroku, Google App Engine, Microsoft Azure App Service

Unit 5: Software as a Service (SaaS) **[No. of Hours: 4]**

Introduction to SaaS, Cloud-based productivity tools, Collaboration and communication applications, SaaS providers: Salesforce, Google Workspace, Microsoft 365

Unit 6: Cloud Storage and Database Services **[No. of Hours: 4]**

Cloud storage concepts and services: Amazon S3, Google Cloud Storage, Cloud-based

databases: Amazon RDS, Google Cloud SQL, NoSQL databases in the cloud: MongoDB, Apache Cassandra

Unit 7: Cloud Security and Privacy **[No. of Hours: 4]**

Security challenges in cloud computing, Identity and access management, Data privacy and compliance, Cloud security best practices

Unit 8: Cloud Migration and Integration **[No. of Hours: 4]**

Planning and strategies for cloud migration, Cloud integration technologies: API, web services, message queues, Hybrid cloud architectures

Unit 9: Cloud Monitoring and Management **[No. of Hours: 4]**

Monitoring and logging in the cloud, Infrastructure automation and orchestration, Cost optimization and resource management, Cloud management platforms: AWS CloudFormation, Azure Resource Manager

Text Books:

TB1. V.K. Pachghare ,"Cloud Computing "PHI Learning, 1st Edition,2016.

TB2. Venkata Josyula, Malcom Orr, Greg Page, "Cloud Computing Automating the Virtualized Data Center", Cisco Press,1st Edition,2016.

TB3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing a Practical Approach", McGraw Hill,1st Edition,2015.

Reference Books:

RB1. Erl Thomas, Puttini Ricardo, Mahmood Zaigham, "Cloud Computing-Concepts, Technology and Architecture", Pearson India,1st Edition, 2014.Srinivas Cheemalapti Yi-an Chang, Shahir Daya, Matthieu Debeaux, Odilon

RB2. Magroski Goulart, VasfiGucer, Rahul Gupta, Shamim Hossain, David Kwock, Jordan T Moore, David N Nguyen, Bobby Woolf, "Hybrid Cloud Data and API Integration: Integrate Your Enterprise and Cloud with Bluemix Integration Services", IBM Redbooks, 2nd Edition,2016.

Course Outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall the fundamental concepts and characteristics of cloud computing. Identify the different service models and deployment models in cloud computing.
CO2	Explain the benefits and challenges of cloud computing. Understand the roles of virtualization and its significance in cloud computing.
CO3	Apply virtualization technologies to create and manage virtual machines or containers. Deploy and configure applications on cloud platforms using Infrastructure as a Service (IaaS) or Platform as a Service (PaaS) models.
CO4	Analyze the security challenges in cloud computing and propose appropriate security measures.

	Evaluate different cloud storage and database services based on their features and use cases.
CO5	Evaluate the suitability of different cloud deployment models for specific organizational requirements. Assess the cost optimization strategies and resource management techniques in cloud computing.
CO6	Design and implement a cloud migration plan for an existing application or system. Create a scalable and resilient cloud-based architecture for a given scenario.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	1	1	1	1	1	1	1	1
CO2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	1	1	1	1	1	1	1	1	1
CO4	1	1	2	2	1	1	1	1	1	1	1	1
CO5	1	1	2	1	1	1	1	1	1	1	1	1
CO6	2	1	2	2	1	1	2	1	1	1	1	2
AVG	**1.8**	**1.8**	**2.2**	**1.6**	**1.4**	**1.4**	**1.6**	**1.4**	**1.4**	**1.4**	**1.4**	**1.6**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE804A**				
Course Name	**: ALGORITHMS ANALYSIS & DESIGN/ MOOC ON ALGORITHMS ANALYSIS & DESIGN**				
Semester /Year	**: 8th Semester / 4th Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

COURSE OBJECTIVES:

In this course, the learners will be able to develop expertise related to the following:-

1. Understand the important concepts of algorithms design and their analysis.
2. Analyze the efficiency of alternative algorithmic solutions to the problem.
3. Understand different algorithm paradigms like Divide and Conquer, Greedy, Dynamic,Backtracking and Branch and Bound.
4. Identify the appropriate data structures, algorithm design techniques and assess theirimpact on the performance of programs.

COURSE CONTENTS

UNIT-I **[No. of Hours: 09]**

Algorithms, Analysis of Algorithms, Design of Algorithms, and Complexity of Algorithms Growth of Functions: Asymptotic notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms. Recurrences and Solution of Recurrence Equations- The Substitution method, The Recurrence–Tree Method, The Master Method.

UNIT-II **[No. of Hours: 09]**

Sorting in polynomial Time: Insertion sort, Merge sort, Heap sort, and Quick sort, Sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort. Red-Black Trees, Augmenting Data Structure.

UNIT-III **[No. of Hours: 09]**

Greedy Technique: Fractional Knapsack Problem, Activity Selection Problem, Dynamic Programming: 0/1 Knapsack Problem, Matrix-Chain Multiplication. Backtracking: Hamiltonian Circuit Problem; Branch-and-Bound: Assignment Problem, Traveling Salesperson Problem;

UNIT-IV **[No. of Hours:09]**

Graph: Introduction, Representation of Graph, BFS, DFS, Minimum Spanning Tree: Prims Algorithm, Kruskal Algorithm, Single Source.

Shortest Paths: Bellman-Ford Algorithm, Dijkstra Algorithm, All Pair Shortest Paths: Floyd-Warshall Algorithm,

Text Books:

TB1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, "Introduction to Algorithms", PHI, 2nd Edition, 2006

TB2. S. Dasgupta, C. Papadimitriou and U.Vazirani, "Algorithms", McGraw Hill Higher

Education, 1st Edition, 2017.
TB3. J. Kleinberg and E. Tardos, "Algorithm Design", Pearson Education, 2nd Edition, 2009.

Reference Books:

RB1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India,
RB2. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of ComputerAlgorithms, 2nd Edition, Universities press,
RB3. Anany Levitin: Introduction to The Design & Analysis of Algorithms, 2nd Edition,Pearson Education.
RB4. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning.
RB5. Baase: Computer Algorithms: Introduction to Design and Analysis, 2nd ed., Addis

Course Outcomes (COs):

Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Remember the basic concepts and complexities for various algorithms. Demonstrate P and NP complexity classes of the Problem.
CO2	Understand the concepts of asymptotic notations to explain the complexities of various algorithms.
CO3	Apply and solve various sorting and tree-based algorithms.
CO4	Finding efficient solutions using various algorithms for given problems.
CO5	Evaluate and checking innovative solutions for real-world problems using different paradigms.
CO6	Construct the solution for real-world problems using various problem-solving techniques

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	2	3	3	2	-	-	-	-	-	-	-	-
CO3	3	2	3	2	1	-	-	-	-	-	-	-
CO4	2	2	2	3	2	1	-	-	-	2	-	-
CO5	2	3	2	2	3	2	1	-	2	1	2	2
CO6	2	2	2	1	-	-	1	1	1	1	-	-
AVG	2.33	2.33	2.16	1.66	1	0.5	0.33	0.16	0.5	0.66	0.33	0.33

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: BCADSE804B**				
Course Name	**: COMPUTER GRAPHICS/ MOOC ON COMPUTER GRAPHICS**				
Semester /Year	**: 8th Semester / 4th Year**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. introduces the basic concepts of computer graphics
2. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
3. Use of geometric transformations on graphics objects and their application in composite form.

COURSE CONTENT

Unit 1: Introduction to Computer Graphics **[No. of Hours: 2]**

Overview of computer graphics and its applications, Graphics pipeline and stages, Raster and vector graphics

Unit 2: Mathematics for Computer Graphics **[No. of Hours: 6]**

Vector algebra and geometry transformations, Matrices and transformations, Homogeneous coordinates and transformations, 2D and 3D coordinate systems

Unit 3: 2D Graphics **[No. of Hours: 8]**

Graphics primitives and attributes, Scan-conversion algorithms, Line drawing algorithms (Bresenham's line algorithm), Circle drawing algorithms, Filling algorithms (Boundary fill, flood fill)

Unit 4: 3D Graphics **[No. of Hours: 8]**

3D transformations (translation, rotation, scaling), Projection and viewing transformations
Hidden surface removal algorithms (depth sorting, z-buffering), Shading and lighting models

Unit 5: Rendering Techniques **[No. of Hours: 8]**

Introduction to rendering and rasterization, Color models and color spaces, Anti-aliasing techniques, Texture mapping and mapping coordinates, Ray tracing basics

Unit 6: Computer Animation **[No. of Hours: 8]**

Animation principles and techniques, Keyframe animation, Interpolation methods (linear, quadratic, cubic), Skeletal animation and inverse kinematics, Particle systems

Text Books:

TB1. Donald Hearn and M Pauline Baker, "Computer Graphics" PHI
TB2. Steven Harrington, "Computer Graphics: A Programming Approach" TMH

TB3. Prajapati A.K. "Computer Graphics" PPM Ed2

References Books:

RB1. Foley James D, "Computer Graphics" AW Ed2
RB2. Newman and Sproull, "Principle of to Interactive Computer Graphics" McGraw Hill
RB3. Rogers, "Procedural Elements of Computer Graphics", McGraw Hill
RB4. Rogers and Adams, "Mathematical Elements of Computer Graphics" McGraw Hill

Course Outcomes (COs):
Upon successful completion of the course a student will be able to

CO#	Detailed Statement of the CO
CO1	Recall and describe the fundamental concepts and principles of computer graphics. Identify and explain the stages of the graphics pipeline. Recognize and differentiate between raster and vector graphics.
CO2	Demonstrate a deep understanding of the mathematical foundations underlying computer graphics, including vector algebra and transformations. Explain the techniques and algorithms used in 2D and 3D graphics, rendering, and animation. Describe the key concepts and components of shading, lighting, and projection in computer graphics.
CO3	Implement and apply various graphics algorithms, such as line drawing and circle drawing algorithms. Utilize transformation matrices to perform 2D and 3D transformations on objects. Develop interactive graphics applications that respond to user input and incorporate animation.
CO4	Analyze and compare different rendering techniques and algorithms, including their advantages and limitations. Evaluate the impact of different shading models on the visual quality of rendered images.
CO5	Assess the strengths and weaknesses of different graphics algorithms and techniques.
CO6	Design and create visually appealing 2D and 3D graphics using appropriate software tools

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	1	2	1	1	1	2	2	2
CO2	1	2	2	1	1	2	1	1	1	2	2	2
CO3	1	1	2	1	1	2	1	1	1	1	1	2
CO4	1	2	2	1	1	2	1	1	1	2	2	2
CO5	1	1	2	1	1	2	1	1	1	1	1	2
CO6	1	1	2	1	1	2	1	1	1	1	1	2
AVG	**1.2**	**1.6**	**2.2**	**1.2**	**1.2**	**2.2**	**1.2**	**1.2**	**1.2**	**1.6**	**1.6**	**2.2**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

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