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Pimpri Chinchwad Education Trust's

Pimpri Chinchwad University

Sate, Maval, Pune - 412106

PCET's Pimpri Chinchwad University
Learn | Grow | Achieve

Curriculum Structure

B.C.A.

(2025 Pattern)

School of Computer Applications

Effective from Academic Year 2025-26

BCA Curriculum

Preamble:

At Pimpri Chinchwad University, we present the Bachelor of Computer Application (BCA), an Undergraduate Program designed to equip students with a comprehensive understanding of Computer Science and Application. As aspiring professionals in the field of computing, we acknowledge the weight of responsibility that accompanies our education. Upholding the highest standards of integrity, professionalism, and ethical conduct is fundamental to our academic pursuits and beyond. We embrace the imperative of continuous learning and adaptability in an era marked by rapid technological advancement, pledging to proactively seek new knowledge and master emerging technologies.

The BCA program curriculum is designed to provide students with a strong foundation in computer science, programming languages, software engineering, database management systems, and computer networks. The program also includes courses on business management and soft skills to prepare students for a career in the IT industry

Overall, an BCA program aims to provide students with a well-rounded education that prepares them for a successful career in the IT industry and for further academic pursuits.

Vision and Mission of Program:

Vision:
Explore the different horizons in the field of Commerce, Management, and Computer Science Applications.

Mission:
To drive transformation, technology, and innovation through a problem-solving approach and research & development. To provide students with the IT tools to become productive and lifelong learners. To develop resources for an advanced career in Counter Applications, provide a sound academic base with practical business applications.

Program Educational Objectives:

Here are some possible Program Educational Objectives (PEOs) for a Bachelor of Computer Application (BCA) program:

1. To prepare the youth to take up positions as system analysts, system engineers, software engineers, and Programmers.
2. To aim at developing systems thinking, abstract thinking, skills to analyze and synthesize, and skills to apply knowledge through extensive problem-solving sessions, hands-on practice under various hardware/software environments and projects developed.
3. To prepare students with social interaction skills, communication skills, life skills, entrepreneurial skills, and research skills, which are necessary for career growth and for leading a quality life.

Program Outcome

Here are some possible Program Outcomes (POs) for a Bachelor of Computer Application (BCA) program:

1. **Computational Knowledge**: Understand and apply mathematical foundation, computing and domain knowledge for the conceptualization of computing models from defined problems.
2. **Problem Analysis:** Ability to identify, critically analyze and formulate complex computing problems using fundamentals of computer science and application domains.
3. **Design / Development of Solutions:** Ability to transform complex business scenarios and contemporary issues into problems, investigate, understand and propose integrated solutions using emerging technologies.
4. **Conduct Investigations of Complex Computing Problems:** Ability to devise and conduct experiments, interpret data and provide well informed conclusions.
5. **Modern Tool Usage:** Ability to select modern computing tools, skills and techniques necessary for innovative software solutions
6. **Professional Ethics:** Ability to apply and commit professional ethics and cyber regulations in a global economic environment.
7. **Life-long Learning:** Recognize the need for and develop the ability to engage in continuous learning as a Computing professional.
8. **Project Management:** Ability to understand management and computing principles with computing knowledge to manage projects in multidisciplinary environments.
9. **Communication Efficacy:** Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations.
10. **Societal & Environmental Concern:** Ability to recognize economical, environmental, social, health, legal, ethical issues involved in the use of computer technology and other consequential responsibilities relevant to professional practice.
11. **Individual & Team Work:** Ability to work as a member or leader in diverse teams in a multidisciplinary environment.
12. **Innovation and Entrepreneurship:** Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.

Program Specific Outcomes

On successful completion of the program, the graduates of Bachelor of Computer Application (BCA) program will be able to:

PSO-1: To produce knowledgeable and skilled human resources to pursue a career with necessary skills in the area related to Computer Science and Applications.

PSO-2: To Impart knowledge required for planning, designing and building Software Systems.

PSO-3: To explore emerging technologies and provide innovative solutions to real-life applications**.**

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I.	Programming with C++	

II.	Programming with C++ Lab.	
III.	Operating Systems - Linux	
IV.	Operating Systems Lab	
V.	MAJOR ELECTIVE-I: Software Engineering Using UML	
VI.	MAJOR ELECTIVE-I: Advance Database Management System	
VII.	Statistical Techniques	
VIII.	MIN: Minor II	
IX.	UHV-II: Understanding Harmony	
X.	COI: Constitution of India	
XI.	OPEN ELECTIVE-III: Introduction to Google Services	
XII.	OPEN ELECTIVE-III: Introduction to Ethical Hacking	
XIII.	MOOC I: Web Services And Security (MOOC)	
XIV.	MOOC II: Google Services and Ethical Hacking	
XV.	Foreign Language-I: German	
XVI.	Foreign Language-I: Japanese	
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I.	Advanced Web Technologies	
II.	Advanced Web Technologies Lab	
III.	Core Java	
IV.	Core Java Lab	
V.	MAJOR ELECTIVE-II: Software Project Management	
VI.	MAJOR ELECTIVE-II: Software Testing	
VII.	COI: Constitution of India	
VIII.	UHV-II: Understanding Harmony	
IX.	OPEN ELECTIVE-IV- Data Warehousing And Data Mining	
X.	OPEN ELECTIVE-IV- Search Engine Optimization	
XI.	**Introduction to AI(MOOC)**	
XII.	Foreign Language-II: Japanese	
XIII.	Foreign Language-II: German	
XIV.	Exit Policy-UG DIPLOMA: Advance C++ Programming	
8.	**Course Details: Semester - V**	
I.	Advanced Java Programming	
II.	Advanced Java Programming Lab	
III.	Python Programming	
IV.	Python Programming Lab.	
V.	Major Elective – III- Cloud Computing	

VI.	Major Elective – III- Business Analytics	
VII.	Competitive Mathematics	
VIII.	Mini project Using Java / Python	
IX.	User Interface and User Experience (UI-UX) Design (MOOC)	
X.	ALR: Aptitude & Logical Reasoning	
XI.	Minor IV	
XII.	Foreign Language – III: Japanese	
XIII.	Foreign Language – III: German	
9.	**Course Details: Semester - VI(SCHEME-A)**	
I.	Machine Learning	
II.	Research Methodologies and Techniques(MOOC-I)	
III.	DevOps(MOOC-II)	
IV.	EVS: Environmental Studies	
V.	Minor V	
VI.	Industrial Training / Internship / Research Internship	
VII.	Foreign Language - IV	
	Course Details: Semester - VI(SCHEME-B)	
I.	Machine Learning(MOOC)	
II.	Research Methodologies and Techniques(MOOC)	
III.	DevOps(MOOC)	
IV.	EVS: Environmental Studies	
V.	Minor V	
VI.	Industrial Training / Internship / Research Internship	
VII.	Foreign Language - IV	
10.	**Course Details: Semester - VII**	
I.	Big Data Analytics	
II.	Big Data Analytics Lab	
III.	Mobile Computing	
IV.	Mobile Computing Lab	
V.	Current trends and practices in IT	
VI	Data Privacy and Security	
VII.	Introduction to Applied Cryptography (**MOOC-I**)	
VIII.	**MOOC-II**	
IX.	ALR: Aptitude & Logical Reasoning / EVS: Environmental Studies	
X.	Mini Project	

XI.	Foreign Language - IV	

11.	**Course Details: Semester - VIII**	
I	DevOps(MOOC)	
II	Full Stack Developer(MOOC)	
III	Major Project/ Research Project / Internship	

CURRICULUM FRAMEWORK

Sr. No.	Type of course	Abbreviations
1	Major	**MAJ**
2	Elective (Minor Stream/Vocational/Program Specific)	**MIN**
3	Open Electives	**OE**
4	Ability Enhancement Courses	**AEC**
5	Skill Enhancement Courses	**SEC**
6	Vocational Skill Course	**VSC**
7	Summer Internship/ On Job Training	**OJT**
8	Project	**PROJ**
9	Field Project	**FP**
10	Indian Knowledge System	**IKS**
11	Co-Curricular	**CC**
12	Community Engagement Program	**CEP**
13	Value Education Course	**VEC**

Sr. No.	Type of course	No. of Courses	Total Credits	
			No	%
1	Major	34	81	51
2	Elective (Minor Stream/Vocational/Program Specific)	5	10	6
3	Open Electives	4	8	5
4	Ability Enhancement Courses	3	-	-
5	Skill Enhancement Courses	5	13	8
6	Vocational Skill Course	6	15	9
7	Project	2	4	3
8	Field Project	2	26	16
9	Indian Knowledge System	1	-	-
10	Value Education Course (Audit Courses)	8	3	2
Total		**70**	**160**	**100**

CREDIT DISTRIBUTION: SEMESTER WISE

Sr. No.	Type of course	No. of Credits/Semester								Total
		1	2	3	4	5	6	7	8	
1	Major	13	12	13	14	14	3	9	3	**81**
2	Elective (Minor Stream/Vocational/Program Specific)	-	2	2	2	2	2			**10**
3	Open Electives	2	2	2	2					**8**
4	Ability Enhancement Courses									**AC**
5	Skill Enhancement Courses	3	2	3	2			3		**13**
6	Vocational Skill Course	2	2			2	3	3	3	**15**
7	Summer Internship/On Job Training/Project					2		2		**4**
8	Field Project						12		14	**26**
9	Indian Knowledge System									**AC**
10	Value Education Course (Audit Courses)							3		**3**
Total		**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**160**

Course Code Nomenclature

COURSE CODE	COURSE NAME	COURSE TYPE
SEMESTER-I		
UBC101	C Programming	MAJM
UBC102	C Programming Lab	MAJM
UBC103	Web Technology	MAJM
UBC104	Web Technology Lab	MAJM
UBC105	Fundamental of Computer Architecture	SEC
UBC106	Basics of Mathematics	BSC
UEG101	Applied Communication	AEC
ACUHV101	UHV-I: Professional Ethics	AC
ACIKSET102	IKS: Concepts and Application in Science	AC
UBCM101	Introduction to IoT	MOOC
UBCM102	Introduction to Digital Electronics	MOOC
UBC107A	OPEN ELECTIVE-I: Basics of Computer Network	OE
UBC107B	OPEN ELECTIVE-I: Introduction to Cyber Security	OE
SEMESTER-II		
UBC109	Data Structure using C	MAJM
UBC110	Data Structure using C Lab	MAJM
UBC111	Database Management System	MAJM
UBC112	Database Management System Lab	MAJM
UBC113	Software Engineering	SEC
UBC114	Discrete Mathematics	BSC
ACIKSET102	IKS: Concepts and Application in Science	AC
ACUHV101	UHV-I: Professional Ethics	AC
UBC115A	OE-II: Analysis and Design of Algorithm	OE
UBC115B	OE-II: Introduction to Big Data	OE
UBCM103	Introduction to Data Science	MOOC
UBCM104	Digital Marketing and E-commerce	MOOC
UCEXBC101	VSC: PHP & MySQL	VSC
UCEXBC102	VSC: Project	VSC
SEMESTER-III		
UBC201	Programming with C++	MAJM
UBC202	Programming with C++ Lab.	MAJM
UBC203	Operating Systems - Linux	MAJM
UBC204	Operating Systems Lab	MAJM
UBC205A	MAJOR ELECTIVE-I: Software Engineering Using UML	MAJE
UBC205B	MAJOR ELECTIVE-I: Advance Database Management System	MAJE
UBC206	Statistical Techniques	BSC
ACUHV201	UHV-II: Understanding Harmony	AC
ACCOI201	COI: Constitution of India	AC
UBC207A	OPEN ELECTIVE-III-Introduction to Google Services	OE
UBC207B	OPEN ELECTIVE-III-Introduction to Ethical Hacking	OE

UBCM201	Web Services And Security	MOOC
UBCM202	Google Services and Ethical Hacking	MOOC
UFL201A	Foreign Language-I: German	AEC
UFL201B	Foreign Language-I: Japanese	AEC
SEMESTER-IV		
UBC209	Advanced Web Technologies	MAJM
UBC210	Advanced Web Technologies Lab	MAJM
UBC211	Core Java	MAJM
UBC212	Core Java Lab	MAJM
UBC213A	MAJE-II: Software Project Management	MAJE
UBC213B	MAJE-II: Software Testing	MAJE
ACCOI201	COI: Constitution of India	AC
ACUHV201	UHV-II: Understanding Harmony	AC
UBC215	Mini Project using AWT/Java	
UBC214A	OPEN ELECTIVE-IV- Data Warehousing And Data Mining	OE
UBC214B	OPEN ELECTIVE-IV- Search Engine Optimization	OE
UBCM203	Introduction to AI(MOOC)	MOOC
UFL202A	Foreign Language-II: Japanese	AEC
UFL202B	Foreign Language-II: German	AEC
UDIEXBC201	VSC Advance C++	VSC
UDIEXBC202	VSC: Project	VSC
SEMESTER-V		
UBC301	Advanced Java Programming	MAJM
UBC302	Advanced Java Programming Lab	MAJM
UBC303	Python Programming	MAJM
UBC304	Python Programming Lab.	MAJM
UBC305A	Major Elective - III- Cloud Computing	MAJE
UBC305B	Major Elective - III- Business Analytics	MAJE
UBC306	Competitive Mathematics	BSC
UBC307	Mini project Using Java / Python	PROJ
UBCM301	User Interface and User Experience (UI-UX) Design	MOOC
ACALR301	ALR: Aptitude & Logical Reasoning	AC
UFL301A	Foreign Language-III: German	AEC
UFL301B	Foreign Language-III: Japanese	AEC
SEMESTER-VI (SCHEME-A)		
UBCM302/UBC308	Machine Learning(MOOC)	MOOC
UBCM303	Research Methodologies and Techniques(MOOC-1)	MOOC
UBCM304	DevOps(MOOC-2)	MOOC

ACEVS301	EVS: Environmental Studies	AC
UETAD105	Minor V	MIN
UBC309	Industrial Training / Internship / Research Internship	FP
SEMESTER-VI (SCHEME-B)		
UBC308	Machine Learning	MAJM
UBCM303	Research Methodologies and Techniques(MOOC-I)	MOOC
UBCM304	DevOps(MOOC-II)	MOOC
ACEVS301	EVS: Environmental Studies	AC
UETAD105	Minor V	MIN
UBC309	Industrial Training / Internship / Research Internship	FP
SEMESTER-VII		
UBC401	Big Data Analytics	MAJM
UBC402	Big Data Analytics Lab	MAJM
UBC403	Mobile Computing	MAJM
UBC404	Mobile Computing Lab	MAJM
UBC405	Current trends and practices in IT	VSEC
UBC406	Data Privacy and Security	VSEC
UBCM401	Introduction to Applied Cryptography	MOOC
UBCM402	**MOOC-II**	MOOC
UBC407	Mini Project	PROJ
SEMESTER-VIII		
UBCM403	DevOps	MOOC
UBCM404	Full Stack Developer	MOOC
UBC408	Major Project/ Research Project / Internship	FP

BCA CURRICULUM STRUCTURE
2025 Pattern (AS PER NEP 2020)

SEMESTER-I												
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME					ASSESSMENT SCHEME				
			TH	PR	TUT	CREDIT	HRS		CIA	ESA	PR/OR	TOTAL
UBC101	MAJM	C Programming	3	-	-	3	3		40	60		100
UBC102	MAJM	C Programming Lab	-	1	-	1	2		25		25	50
UBC103	MAJM	Web Technology	3	-	-	3	3		40	60		100
UBC104	MAJM	Web Technology Lab	-	1	-	1	2		25		25	50
UBC105	SEC	Fundamental of Computer Architecture	3	-	-	3	3		40	60		100
UBC106	BSC	Basics of Mathematics	3	-	-	3	3		40	60		100
UEG101	AEC	Applied Communication	2	-	-	-	2		50			50
ACUHV101/ ACIKSET102	AC	UHV-I: Professional Ethics/ IKS: Concepts and Application in Science	2	-	-	-	2		50			50
MOOC COURSE-I												
UBCM101	MOOC	Introduction to IoT	2	-	-	2	2		25		25	50
UBCM102	MOOC	Introduction to Digital Electronics	2	-	-	2	2		25		25	50
UBC107	OE	Open Elective – I	2	-	-	2	2		20	30		50
TOTAL			**20**	**2**	-	**20**	**26**		**380**	**270**	**100**	**750**
OPEN ELECTIVE-I												
UBC107A	OE	Basics of Computer Network	2	-	-	2	2		20	30		50
UBC107B	OE	Introduction to Cyber Security	2	-	-	2	2		20	30		50

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SEMESTER-II

COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS		CIA	ESA	PR/OR	TOTAL
UBC109	MAJM	Data Structure using C	3	-	-	3	3		40	60		100
UBC110	MAJM	Data Structure using C Lab	-	1	-	1	2		25		25	50
UBC111	MAJM	Database Management System	3	-	-	3	3		40	60		100
UBC112	MAJM	Database Management System Lab	-	1	-	1	2		25		25	50
UBC113	SEC	Software Engineering	2	-	-	2	2		20	30		50
UBC114	BSC	Discrete Mathematics	2	-	-	2	2		20	30		50
ACUHV101 / ACIKSET102	AC	IKS: Concepts and Application in Science/ UHV-I: Professional Ethics	2	-	-	-	2		50			50
	MIN	Minor-I	2	-	-	2	2		20	30		50
UBC115	OE	Open Elective-II	2	-	-	2	2		20	30		50
MOOC COURSE-II												
UBCM103	MOOC	Introduction to Data Science (MOOC)	2	-	-	2	**2**		25		25	50
UBCM104	MOOC	Digital Marketing and E-commerce	2	-	-	2	**2**		25		25	50
TOTAL			20	2	0	20	24		310	240	100	650
Open Elective - II												
UBC115A	OE	Analysis and Design of Algorithm	2	-	-	2	2		20	30		50
UBC115B	OE	Introduction to Big Data	2	-	-	2	2		20	30		50

Exit Policy: UG Certificate in BCA: A Students who opt to exit after completion of the first year and have scored the required credits offered by the school in the program structure will be awarded a UG certificate in BCA, provided they must earn additional credits during the summer vacation of the first year.

COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	Hrs		CIA	ESA	PR/OR	TOTAL
UCEXBC101	**VSC**	**Php & MySQL/MOOC**	**2**	**-**	**-**	**2**	**2**		**50**	**-**	**-**	**50**
UCEXBC102	**VSC**	**Project**	**-**	**2**	**-**	**2**	**4**		**-**	**-**	**50**	**50**

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SEMESTER-III													
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS		CIA	ESA	PR/OR	TOTAL
UBC201	MAJM	Programming with C++	3	-	-	3	3		40	60		100
UBC202	MAJM	Programming with C++ Lab.	-	1	-	1	2		25		25	50
UBC203	MAJM	Operating Systems - Linux	3	-	-	3	3		40	60		100
UBC204	MAJM	Operating Systems Lab	-	1	-	1	2		25		25	50
UBC205	MAJE	Major Elective – I	3	-	-	3	3		40	60		100
UBC206	BSC	Statistical Techniques	2	-	-	2	2		20	30		50
UBC207	OE	Open Elective – III	2	-	-	2	2		20	30		50
	MIN	Minor II	2	-	-	2	2		20	30		50
ACUHV201 / ACCOI201	AC	UHV-II: Understanding Harmony /COI: Constitution of India	2	-	-	-	2		50			50
UBCM201	MOOC	Web Services And Security (MOOC)	2	-	-	2	2		25		25	50
UBCM202	MOOC	Google Services and Ethical Hacking(MOOC)	2	-	-	2	2		25		25	50
UFL201	AEC	Foreign Language-I	2	-	-	-	2		50			50
TOTAL			23	2	0	21	27		380	270	100	750
Major Elective – I												
UBC205A	MAJE	Software Engineering Using UML	3	-	-	3	3		40	60		100
UBC205B	MAJE	Advance Database Management System	3	-	-	3	3		40	60		100
Open Elective – III												
UBC207A	OE	Introduction to Google Services	2	-	-	2	2		20	30		50
UBC207B	OE	Introduction to Ethical Hacking	2	-	-	2	2		20	30		50
Foreign Language – I												
UFL201A	AEC	Foreign Language – I: German	2	-	-	-	2		50			50
UFL201B	AEC	Foreign Language – I: Japanese	2	-	-	-	2		50			50

BCA CURRICULUM STRUCTURE
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SEMESTER-IV												
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS		CIA	ESA	PR/OR	TOTAL
UBC209	MAJM	Advanced Web Technologies	3	-	-	3	3		40	60		100
UBC210	MAJM	Advanced Web Technologies Lab	-	1	-	1	2		25		25	50
UBC211	MAJM	Core Java	3	-	-	3	3		40	60		100
UBC212	MAJM	Core Java Lab	-	1	-	1	2		25		25	50
UBC213	MAJE	Major Elective – II	3	-	-	3	3		40	60		100
ACCOI201/ ACUHV201	AC	COI: Constitution of India UHV2:Understanding Harmony	2	-	-	2	2		50	-		50
UBC214	OE	Open Elective – IV	2	-	-	2	2		20	30		50
UBC215	SEC	Mini Project using AWT/Java		2	-	2	4		25		25	50
	MIN	Minor-III	2	-	-	2	2		20	30		50
UBCM203	SEC	Introduction to AI(MOOC)	2	-	-	2	2		25		25	50
UFL202	**AEC**	**Foreign Language – II**	2	-	-	-	2		50			50
TOTAL			**19**	**4**	**0**	**21**	**27**		**360**	**240**	**100**	**700**
Open Elective – IV												
UBC214A	OE	Data Warehousing And Data Mining	2	-	-	2	2		20	30		50
UBC214B	OE	Search Engine Optimization	2	-	-	2	2		20	30		50
Major Elective – II												
UBC213A	MAJE	Software Project Management	3	-	-	3	3		40	60		100
UBC213B	MAJE	Software Testing	3	-	-	3	3		40	60		100
Foreign Language – II												
UFL202A	AEC	Foreign Language – II: Japanese	2	-	-	-	2		50			50
UFL202B	AEC	Foreign Language – II German	2	-	-	-	2		50			50

BCA CURRICULUM STRUCTURE
2025 Pattern (AS PER NEP 2020)

SEMESTER V												
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS		CIA	ESA	PR/OR	TOTAL
UBC301	MAJM	Advanced Java Programming	3	-	-	3	3		40	60		100
UBC302	MAJM	Advanced Java Programming Lab	-	1	-	1	2		25		25	50
UBC303	MAJM	Python Programming	3	-	-	3	3		40	60		100
UBC304	MAJM	Python Programming Lab.	-	1	-	1	2		25		25	50
UBC305	MAJE	Major Elective – III	3	-	-	3	3		40	60		100
UBC306	BSC	Competitive Mathematics	3	-	-	3	3		40	60		50
UBC307	PROJ	Mini project Using Java / Python	-	2	-	2	4		25		25	50
UBCM301	**MOOC**	User Interface and User Experience (UI-UX) Design (MOOC)	2	-	-	2	-		25		25	50
	MIN	MIN IV	2	-	-	2	2		20	30		50
ACALR301/ACEVS301	MIN	ALR: Aptitude & Logical Reasoning / EVS: Environmental Studies	2	-	-	-	2		50	-	-	50
UFL301	AEC	Foreign Language – III	2	-	-	-	2		50	-	-	50
TOTAL			**20**	**4**	**0**	**20**	**26**		**380**	**270**	**100**	**750**
UBC305 Major Elective – III												
UBC305A	MAJE	Cloud Computing	3	-	-	3	3		40	60	-	100
UBC305B	MAJE	Business Analytics	3	-	-	3	3		40	60	-	100

Exit Policy: UG Diploma in BCA: A Students who opt to exit after completion of the second year and have scored the required credits offered by the school in the program structure will be awarded a UG certificate in BCA, provided they must earn additional credits during the summer vacation of the second year.

COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	Hrs.		CIA	ESA	PR/ OR	TOTAL
UDIEXBC201	VSC	Advance C++/MOOC	**2**	-	-	**2**	**2**		-	-	**50**	**50**
UDIEXBC202	VSC	Project	-	**4**	-	**4**	**8**		**50**	-	**50**	**100**

BCA CURRICULUM STRUCTURE
2025 Pattern (AS PER NEP 2020)

SEMESTER VI(SCHEME-A)												
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS		CIA	ESA	PR/OR	TOTAL
UBC308	MAJ	Machine Learning	2	-	-	2	2		20	30		50
UBCM303	MOOC	Research Methodologies and Techniques(MOOC-1)	2	-	-	2	2		25		25	50
UBCM304	MOOC	DevOps(MOOC-2)	2	-	-	2	2		25		25	50
ACALR301/ ACEVS301	MIN	ALR: Aptitude & Logical Reasoning / EVS: Environmental Studies	2	-	-	-	2		50			50
	MIN	MINOR V	2	-	-	2	2		20	30		50
UBC309	FP	Industrial Training / Internship / Research Internship	-	12	-	12	12		250		250	500
UFL302	AEC	Foreign Language - IV	2	-	-	-	2		50			50
TOTAL			**12**	**12**	**0**	**20**	**24**		**440**	**60**	**350**	**800**

SEMESTER VI(SCHEME-B)												
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS		CIA	ESA	PR/OR	TOTAL
UBCM302	MAJ	Machine Learning(MOOC)	2	-	-	2	2		20	30		50
UBCM303	MOOC	Research Methodologies and Techniques(MOOC-I)	2	-	-	2	2		25		25	50
UBCM304	MOOC	DevOps(MOOC-II)	2	-	-	2	2		25		25	50
ACALR301 /ACEVS301	MIN	ALR: Aptitude & Logical Reasoning / EVS: Environmental Studies	2	-	-	-	2		50			50
	MIN	MINOR V	2	-	-	2	2		20	30		50
UBC309	FP	Industrial Training / Internship / Research Internship	-	12	-	12	12		250		250	500
UFL302	AEC	Foreign Language - IV	2	-	-	-	2		50			50
TOTAL			**12**	**12**	**0**	**20**	**24**		**440**	**60**	**350**	**800**

BCA CURRICULUM STRUCTURE
2025 Pattern (AS PER NEP 2020)

SEMESTER VII											
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME		
			TH	PR	TUT	Credit	Hrs		CIA	ESA	PR/OR	TOTAL
UBC401	MAJ	Big Data Analytics	3	-	-	3	3		40	60	-	100
UBC402	MAJ	Big Data Analytics Lab	-	2	-	2	4		25	-	25	50
UBC403	MAJ	Mobile Computing	3	-	-	3	3		40	60	-	100
UBC404	MAJ	Mobile Computing Lab	-	2	-	2	4		25	-	25	50
UBC405	VSEC	Current trends and practices in IT	2	-	-	2	2		20	30	-	50
UBC406	VSEC	Data Privacy and Security	2	-	-	2	2		20	30	-	50
UBCM401	**MOOC**	Introduction to Applied Cryptography (**MOOC-I**)	2	-	-	2	-		25		25	50
UBCM402	**MOOC**	**MOOC-II**	2	-	-	2	-		25		25	50
ACALR302/ACEVS302	MIN	ALR: Aptitude & Logical Reasoning / EVS: Environmental Studies	2	-	-	-	2		50	-	-	50
UBC407	PROJ	Mini Project	-	2	-	2	4		25		25	50
		TOTAL	**16**	**6**	**0**	**20**	**24**		**295**	**180**	**125**	**600**

BCA CURRICULUM STRUCTURE
2025 Pattern (AS PER NEP 2020)

SEMESTER-VIII												
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS		CIA	ESA	PR / OR	TOTAL
UBCM403	MOOC	DevOps(MOOC)	3	-	-	3	-		50	-	50	100
UBCM404	MOOC	Full Stack Developer (MOOC)	3	-	-	3	-		50	-	50	100
UBC408	FP	Major Project/ Research Project / Internship	-	14	-	14	28		250	-	250	500
TOTAL			6	14	0	20	28		350	-	350	700

BCA 2025 PATTERN

COURSE DETAILS

Semester - I

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COURSE CURRICULUM

Name of the Program:	**BCA**			**Semester: I**		**Level: UG**	
Course Name	C Programming			**Course Code and Course Type**		UBC101/MAJM	
Course Pattern	**2025**			**Version**		2.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	
Prerequisite:							
Course Objectives (CO):	The objectives of: 1 To introduce foundational concepts of problem solving using algorithms and flowcharts and relate them to C programming. 2 To build a solid understanding of C language constructs including variables, data types, operators, and control statements. 3 To develop modular programming skills using functions, arrays, and recursion in C. 4 To impart a clear understanding of pointers, structures, and dynamic memory allocation. 5 To enable students to perform string manipulations and file operations using C programming.						
Course Learning Outcomes (CLO):	Students will be able to: 1. Design algorithms and flowcharts to solve simple computational problems. 2. Write C programs using control structures, operators, and expressions for logical computation. 3. Apply functions, arrays, and recursion to develop structured and efficient C programs. 4. Utilize pointers and structures to manage complex data and perform dynamic memory operations. 5. Implement string handling and file processing techniques for data management and interaction in C.						

Course Contents and Syllabus:

Descriptors and Topics	**CLO**	**Hours**
UNIT I : Introduction to Programming and Basics of C		
Introduction to problem solving using computers, Problem solving steps, Algorithms-definition, characteristics, examples, advantages and limitations, Flowcharts - definition, notations, examples, advantages and limitations, Comparison with algorithms, History of 'C' language, Features of 'C', Limitations of 'C' , Structure of a 'C' program, 'C' Program development life cycle, Function as building blocks, 'C' tokens,Character set, Keywords , Identifiers	**CLO 1**	9
UNIT II : Control Statements in C		
Variables, Constants (character, integer, float, string, escape sequences, enumeration constant), Data Types (Built-in and user defined data types), Operators, Expressions, types of operators, Operator precedence and Order of evaluation, Character input and output, String input and output, Formatted input and output, Decision making structures:- if ,if-else, switch and conditional operator, Loop control structures:- while ,do while, for, Use of break and continue, Nested structures, Unconditional branching (goto statement), Role of Preprocessor, Format of preprocessor directive, File inclusion directives (#include), Macro substitution directive, argumented and nested macro,Macros versus functions	**CLO 2**	9
UNIT III : Functions and Array in C		

Concept of function, Advantages of Modular design, Standard library functions, User defined functions:- declaration , definition, function call, parameter passing (by value , by reference), return statement, Recursive functions, Scope of variables and Storage classes, Concept of array, Types of Arrays – One, Two and Multidimensional array, Array Operations - declaration, initialization, accessing array elements, Memory representation of two-dimensional array (row major and column major), Passing arrays to function.	**CLO3**	9
UNIT IV : Pointers and Structure		
Introduction to Pointers. Declaration, definition, initialization, dereferencing, Pointer arithmetic, Relationship between Arrays & Pointers- Pointer to array, Array of pointers, Multiple indirection (pointer to pointer), Functions and pointers- Passing pointer to function, Returning pointer from function,Function pointer, Dynamic memory management- Allocation(malloc(),calloc()), Resizing(realloc()),Releasing(free()), Memory leak, dangling pointers. Types of pointers, Concept of structure, definition and initialization, use of typedef, Accessing structure members, Nested Structures, Arrays of Structures, Structures and functions- Passing each member of structure as a separate argument, Passingstructure by value / address, Pointers and structures.	**CLO4**	9
UNIT V : String and File Handling		
String Literals, string variables, declaration, definition, initialization, Syntax and use of predefined string functions, Array of strings, Strings and Pointers, Command line arguments, Introduction to streams, Types of files, Operations on text files , Standard library input/output functions, Random access to files.	**CLO5**	9
Total Hours		45

Learning resources

Reference Books:

1. **"Let Us C"** by Yashavant Kanetkar
   - Publisher: BPB Publications
   - ISBN: 978-9387289903
2. **"Programming in ANSI C"** by E. Balagurusamy
   - Publisher: McGraw Hill
   - ISBN: 978-1259004612
3. **"The C Programming Language"** by Brian W. Kernighan and Dennis M. Ritchie
   - Publisher: Pearson Education
   - ISBN: 978-0131103627

Online Resources and E-Learning Resources

1. **C Programming Tutorials - GeeksforGeeks**
   - https://www.geeksforgeeks.org/c-programming-language/
2. **C Programming Documentation - TutorialsPoint**
   - https://www.tutorialspoint.com/cprogramming/index.htm
3. **C Programming Guide - Programiz**
   - https://www.programiz.com/c-programming

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: I	Level: UG
Course Name	C Programming Lab	Course Code/ Course Type	UBC102/MAJM
Course Pattern	2025	Version	2.0

Teaching Scheme				Assessment Scheme			
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/Oral**
-	2	-	2	4	25	-	25

Prerequisite: Basic Computers is required.

Course Objectives (CO):	The objectives of Programming Concepts Using C Language are: 1. To understand the fundamentals of C programming and problem-solving techniques. 2. To develop logic building and implement decision-making and looping constructs in C. 3. To apply functions, arrays, and recursion for structured programming. 4. To demonstrate the use of pointers, structures, and dynamic memory allocation in C. 5. To develop file handling and string manipulation skills using C for real-world applications.
Course Learning Outcomes (CLO):	Students would be able to: 1. Write simple programs using fundamental C concepts like data types, variables, operators, and expressions. 2. Implement decision control and iterative structures in C to solve logical problems. 3. Apply modular programming concepts using functions, arrays, and recursion. 4. Demonstrate knowledge of pointers, memory management, and structured data types. 5. Perform file handling operations and implement string manipulations using C language features.

Course Contents/Syllabus- Practical Plan

Activity Number	Assignment/Practical/Activity Title	Week Number/Turn	Details	CLO	Hours
1	**Introduction to Programming and Basics of C**	Week 1 / Turn 1 and 2	**Problem 1:** Write a C program to display "Welcome to C Programming" on the screen. **Problem 2:** Write a C program to display your name, roll number, and course details.	CLO1	4
2	**Introduction to Programming and Basics of C**	Week 2/ Turn 1 and 2	**Problem 1:** Write a program to demonstrate the use of arithmetic, relational, and logical operators. **Problem 2:** Convert temperature from Fahrenheit to Celsius and vice versa using mathematical expressions. **Problem 3:** Write a C program that contains syntax errors and debug it using an IDE.	CLO1	4
3	**Introduction to Programming and Basics of C**	Week 3/ Turn 1 and 2	**Problem 1:** Draw a flowchart and write an algorithm to find the largest of three numbers. Then, implement the program in C. **Problem 2:** Draw a flowchart and write a C program to calculate the area and circumference of a circle.	CLO1	4
4	**Control Statements in C**	Week 4/ Turn 1 and 2	**Problem 1:** Write a program to check whether a given number is even or odd using an if-else statement. **Problem 2:** Develop a program that determines if a person is eligible to vote based on their age.	CLO2	4

5	**Control Statements in C**	Week 5/ Turn 1 and 2	**Problem 1:** Write a C program to implement a simple calculator using switch case. **Problem 2:** Write a C program to print the factorial of a number using a for loop. **Problem 3:** Develop a program that takes a student's marks as input and assigns grades using the conditional operator.	CLO2	4
6	**Control Statements in C**	Week 6/ Turn 1 and 2	**Problem 1:** Write a program to print the multiplication table of a given number using a for loop. **Problem 2:** Implement a program that calculates the sum of the first N natural numbers using a while loop. Problem 3: Write a C program to check whether a number is prime using while or do-while loop.	CLO2	4
7	**Functions and Array in C**	Week 7/ Turn 1 and 2	**Problem 1:** Write a C program to calculate the sum of digits of a number using a function. **Problem 2:** Write a C program to calculate the GCD of two numbers using recursion.	CLO3	4
8	**Functions and Array in C**	Week 8/ Turn 1 and 2	**Problem 1:** Write a C program to find the average of elements in an array. **Problem 2:** Write a program to perform a linear search in an array.	CLO3	4
9	**Functions and Array in C**	Week 9/ Turn 1 and 2	**Problem 1:** Write a C program to perform matrix addition/subtraction. **Problem 2:** Write a C program to pass an array to a function and find the largest element.	CLO3	4
10	**Pointers and Structure**	Week 10/ Turn 1 and 2	**Problem 1:** Write a C program to demonstrate pointer arithmetic operations. **Problem 2:** Write a C program to swap two numbers using call by reference.	CLO4	4
11	**Pointers and Structure**	Week 11/ Turn 1 and 2	**Problem 1:** Write a C program using structures to store and display student information (name, roll no, marks). **Problem 2:** Write a C program to demonstrate an array of structures.	CLO4	4
12	**Pointers and Structure**	Week 12/ Turn 1 and 2	**Problem 1:** Write a C program using pointers and structures to calculate the total and average marks of students. **Problem 2:** Write a program using an array of structures to store and display data of 5 employees.	CLO4	4
13	**String and File Handling**	Week 13/ Turn 1 and 2	**Problem 1:** Write a C program to implement predefined string functions like strlen(), strcpy(), strcmp(), strcat(). **Problem 2:** Write a C program to read and write a string using pointers.	CLO5	4
14	**String and File Handling**	Week 14/ Turn 1 and 2	**Problem 1:** Write a C program to accept command-line arguments and print them. **Problem 2:** Write a C program to write data to a file and read it back.	CLO5	4
15	**String and File Handling**	Week 15/ Turn 1 and 2	**Problem 1:** Write a C program to perform random access operations on a file. **Problem 2:** Write a C program to **count the number of characters, words, and lines** in a file.	CLO5	4
Total					**60**

Learning resources

Textbooks:

1. E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill
2. P. K. Sinha & Priti Sinha: Computer Fundamentals.
3. Kamthane: Programming with ANSI and TURBO C (Pearson Education)

Reference Books:

1. Henry Mullish & Hubert L.Cooper: The Spirit of C, Jaico
2. Ashok N Kamthane: Programming with ANS and Turbo C, Pearson
3. V. Rajaraman: Programming in C.

Online Resources/E-Learning Resources

1. https://onlinecourses.nptel.ac.in/noc20_cs913
2. https://www.programiz.com/c-programming

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: I	Level: UG
Course Name	Web Technology	Course Code/ Course Type	UBC103/MAJM
Course Pattern	2025	Version	2.0

Teaching Scheme				Assessment Scheme			
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/Oral
3	-	-	3	3	40	60	-

Prerequisite: Basic knowledge of computers.

Course Objectives (CO):	The objectives of Web Technology are: 1. To recall different components and technologies of the World Wide Web as a platform. 2. To recognize HTML5 elements and components 3. To apply knowledge of HTML5 and CSS 4. Develop responsive web designs that adapt to various devices, and use JavaScript to enhance user interactivity and create dynamic web applications. 5. To Design and develop websites using fundamental web languages, technologies, and tools.
Course Learning Outcomes (CLO):	Students would be able to: 1. Identify basic web development methodologies 2. Understand static web-based application using suitable client-side web technologies 3. Apply Knowledge of foundational understanding of web development concepts for further study 4. Analyze and create responsive layouts that adapt to various devices and screen sizes 5. Evaluate the JavaScript, enabling dynamic content generation, effective event handling, and efficient DOM traversal techniques.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Basics of Internet and Web: Web Basics: Web Browsers, Web Servers, Three Tier Technology and its types, Static and Dynamic Web Page. Client side and Server-side Scripting. Web Protocols: details of HTTP, HTTPS, Web Hosting: Domain name, DNS, URL	**CLO 1**	**9**
UNIT II		
Dietary Assessment tools: Introduction, Document metadata, Basic structure of HTML, Sections, Grouping content, Text-level semantics, Embedded content, Tabular data, Forms, Interactive elements List, Links, Images, Frames	**CLO 2**	**9**
UNIT III		
Page Designing with CSS: Introduction to designing approaches, Table-based designs Table-less designs, Cascading Style Sheet and its properties, Introduction CSS vs CSS3, CSS properties — Text and Fonts, Colors and Backgrounds, The Box Model(dimensions, padding, margin and border) Positioning and Display, Lists, Tables, Media, Converting Image design to HTML (Slicing)	**CLO3**	**9**
UNIT IV		
DHTML: Dynamic HTML, Features of DHTML, Document Object Model, CSSP (Cascading Style Sheet Positioning),JSSS (JavaScript assisted Style Sheet),Layers of Netscape, The ID Attribute, HTML Events.	**CLO4**	**9**
UNIT V		
Java Script: Objects, Methods, Events and Functions, Tags Operators, Data Types, Literals and Type Casting in JavaScript Programming Construct, Array and Dialog Boxes, Relating JavaScript to	**CLO5**	**9**

DHTML, Dynamically Changing Text, Style, Content.		
Total		**45 hrs.**

Learning resources

Textbooks:

1. Learn HTML for Beginners: The Illustrated Guide to Coding Paperback, Jo Foster
2. HTML: A Beginner's Guide, Fifth Edition: A Beginner's Guide, Fifth Edition: CourseLoad e-book for HTML A BEGINNERS GD 5E, Wendy Willard.

Reference Books:

1. JavaScript for Absolute Beginners (Expert's Voice in Web Development) Paperback, by Terry McNavage (Author)
2. Learn JavaScript Quickly: A Complete Beginner's Guide to Learning JavaScript, Even If You're New to Programming by Code Quickly.

Online Resources/E-Learning Resources

1. https://www.w3schools.com/html/
2. https://www.tutorialspoint.com/html5/index.htm
3. https://javascript.info/

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: I	Level: UG
Course Name	Web Technology Lab	Course Code/ Course Type	UBC104/MAJM
Course Pattern	2025	Version	2.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/Oral
-	2	-	1	2	25	-	25

Prerequisite: Basic Knowledge of Computers are required.

Course Objectives (CO):	The objectives of Web Programming are: 1. To recall different components and technologies of the World Wide Web as a platform. 2. To recognize HTML5 elements and components 3. To apply knowledge of HTML5 and CSS 4. Develop responsive web designs that adapt to various devices, and use JavaScript to enhance user interactivity and create dynamic web applications. 5. To Design and develop websites using fundamental web languages, technologies, and tools.
Course Learning Outcomes (CLO):	Students would be able to: 1. Identify basic web development methodologies. 2. Comprehend static web-based application using suitable client-side web technologies 3. Apply knowledge of foundational understanding of web development concepts for further study. 4. Analyze and create responsive layouts that adapt to various devices and screen sizes. 5. Evaluate the JavaScript, enabling dynamic content generation, effective event handling, and efficient DOM traversal techniques.

Course Contents/Syllabus: Practical Plan

Activity Number	Assignment/Practical/ Activity Title	Week Number/Turn	Details	CLO	Hours
1	Write a HTML program for the demonstration of Lists.	Week 1/ Turn 1 and 2	a. Unordered List b. Ordered List c. Definition List d. Nested List	CLO1	4
2	Write a HTML program for demonstrating Hyperlinks.	Week 2/ Turn 1 and 2	a. Navigation from one page to another. b. Navigation within the page.	CLO1	4
3	Assignment on HTML5 Table Element	Week 3/ Turn 1 and 2	Write a HTML program for time-table using tables.	CLO1	4
4	Create Home Page using HTML5	Week 4/ Turn 1 and 2	Write a HTML program to develop a static Home Page using frames.	CLO1	4

5	Create Registration Page using HTML5	Week 5/ Turn 1 and 2	Write a HTML program to develop a static Registration Form.	CLO2	4
6	Create Login Page using HTML5	Week 6/ Turn 1 and 2	Write a HTML program to develop a static Login Page.	CLO2	4
7	Create Product catalog.	Week 7/ Turn 1 and 2	Write a HTML program to develop a static Web Page for Catalog.	CLO3	4
8	Create CSS	Week 8/ Turn 1 and 2	Write HTML for demonstration of cascading style sheets. a. Embedded stylesheets. b. External stylesheets. c. Inline styles.	CLO3	4
9	Create Login page using Javascript Validation	Week 9/ Turn 1 and 2	Write a javascript program to validate the USER LOGIN page.	CLO3	4
10	Create Registration page using Javascript Validation	Week 10/ Turn 1 and 2	Write a javascript program for validating REGISTRATION FORM	CLO4	4
11	Event Handling	Week 11/ Turn 1 and 2	Background Color Change	CLO4	4
12	Event Handling	Week 12/ Turn 1 and 2	calendar for the month and year by combo box [APL]	CLO5	4
13	Event Handling	Week 13/ Turn 1 and 2	OnMouseover event	CLO5	4
14	Event Handling	Week 14/ Turn 1 and 2	OnMouseover using objects	CLO5	4
15	Application	Week 15/ Turn 1 and 2	Online Exam [APL]	CLO5	4

Learning resources

Textbooks:

1. Learn HTML for Beginners: The Illustrated Guide to Coding Paperback, Jo Foster
2. HTML: A Beginner's Guide, Fifth Edition: A Beginner's Guide, Fifth Edition: CourseLoad ebook for HTML A BEGINNERS GD 5E, Wendy Willard.

Reference Books:

1. JavaScript for Absolute Beginners (Expert's Voice in Web Development) Paperback, by Terry McNavage (Author)
2. Learn JavaScript Quickly: A Complete Beginner's Guide to Learning JavaScript, Even If You're New to Programming by Code Quickly.

Online Resources/E-Learning Resources

1. https://www.w3schools.com/html/
2. https://www.tutorialspoint.com/html5/index.htm
3. https://javascript.info/

COURSE CURRICULUM

Name of the Program:	BCA	Semester: I	Level: UG
Course Name	Fundamentals of Computer Architecture	Course Code/ Course Type	UBC105/SEC
Course Pattern	2025	Version	2.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hrs.	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/Oral
3	-	-	3	3	40	60	

Prerequisite: Basic Knowledge of Computers.

Course Objectives (CO):	The objectives of Introduction to Cyber Security are: 1. To remember network basics and familiarize on the security of network protocols. 2. To understand the field of digital security and concepts of access control mechanisms. 3. To apply keywords and jargons involved in securing browsers. 4. To examine the need of cyber-attacks and data privacy. 5. To analyze the significance of security methods in the cyber domain.
Course Learning Outcomes (CLO):	Students would be able to: 1. Identify the digital security measures taken to protect device from threats 2. Explain the access control mechanism and understand how to protect servers. 3. Explain the importance of network basics and security of network protocols. 4. Analyze the cyber-attacks, learn data privacy issues and preventive measures. 5. Discuss the various attacks in the web interface.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Basic Structure of Computers: Functional unit, Basic Operational concepts, Bus structures, System Software,Performance,The history of computer development, Machine Instruction and Programs, Instruction and Instruction Sequencing, Register Transfer Notation, Assembly Language Notation, Basic Instruction Types.	**CLO1**	**9**
UNIT II		
Addressing Modes: Basic Input/output Operations, The role of Stacks and Queues in computer programming equation, Component of Instructions, Logic Instructions, shift and Rotate Instructions, Type of Instructions, Arithmetic and Logic Instructions, Branch Instructions, Addressing Modes, Input/output Operations.	**CLO2**	**9**
UNIT III		
Digital Security: Basics of digital security, protecting personal computers and devices, protecting devices from Virus and Malware, Identity, Authentication and Authorization, need for strong credentials, keeping credentials secure, protecting servers using physical and logical security, World Wide Web (www), the Internet and the HTTP protocol, security of browser to web server interaction.	**CLO3**	**9**
UNIT IV		
Cyber Attacks: Introduction to cyber-attacks, application security(design, development and	**CLO4**	**9**

testing),operations security,monitoring,identifying threats and remediating them, Principles of data security,Confidentiality,Integrity and Availability, Data Privacy, Data breaches, preventing attacks and breaches with security controls, Compliance standards, Computer Ethics.		
UNIT V		
Cybercrime and Cyber law: Classification of cybercrimes, Common cybercrimes, cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi,Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments,Cybercrime and offenses, Organizations dealing with Cybercrime and Cyber security in India, Case studies.	**CLO5**	**9**
Total		**45**

Learning resources

Textbooks:

1. Cybersecurity For Dummies by Joseph Steinberg
2. Big Breaches: Cybersecurity Lessons for Everyone by Neil Daswani, Moudy Elbayadi

Reference Books:

1. Cybersecurity: The Beginner's Guide by Dr. Erdal Ozkaya
2. Confident Cybersecurity: How to Get Started in Cybersecurity and Futureproof Your Career by Dr. Jessica Barker

Online Resources/E-Learning Resources:

1. The Complete Cyber Security Course: Hackers Exposed --- https://www.udemy.com/course
2. Foundations of Cybersecurity----- https://www.coursera.org/

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: I	Level: UG
Course Name	Basic of Mathematics	Course Code/ Course Type	UBC106/BSC
Course Pattern	2025	Version	2.0

Teaching Scheme				Assessment Scheme			
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/Oral
3	-	-	3	3	40	60	-

Prerequisite: Basics of Mathematics

Course Objectives (CO):	The objectives of Basic Mathematics are: 1. To memorize the Matrices and its operations. 2. Classify the trigonometric functions. 3. To execute various operations on analytical geometry. 4. To compare the various forms of differential calculus. 5. To evaluate the different forms of calculus.
Course Learning Outcomes (CLO):	Students would be able to: 1. Identify the matrices and the operations associated with it. 2. Explain the various trigonometric functions. 3. Apply knowledge of geometry to various real-life situations. 4. To examine the differential calculus with respect to different forms. 5. To execute gamma functions and its properties.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Matrices: Matrices, Types of matrices, Elementary properties of matrices, inverse matrices, Rank of a matrix, Symmetric, Skew symmetric and Orthogonal matrices, system of linear equations, Gauss elimination method and Gauss Jordan method.	**CLO 1**	**9**
UNIT II		
Trigonometry: Introduction, Trigonometric ratios, Transformations, Identities, Inverse trigonometric functions (only elementary topics)	**CLO 2**	**9**
UNIT III		
Analytical Geometry: Scalar product, vector product, angle between two vectors, shortest distance between two lines, conditions for two lines to intersect, point of intersection, collinearity of three points (self- study topics),Direction ratios, direction cosines of a line passing through two points, equation of a line in space, angle between two lines, shortest distance between two lines, plane, equation of a plane in normal form.	**CLO3**	**9**
UNIT IV		
Differential Calculus: Limit continuity, differentiability, Roll's Theorem, Mean value theorems (Cauchy's and Lagrange's), Power series, expansions of functions in Taylor's and Maclaurin's forms, indeterminate forms and L Hospital's rule.	**CLO4**	**9**
UNIT V		
Integral Calculus: Integral as limit of sum, Fundamental theorem of calculus, indefinite integrals, Methods of Integration, Substitution method, Integration by parts and by partial fraction technique, Beta Gamma functions and their properties.	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Hugh Neill, Trigonometry: A complete Introduction, John Murray Learning, 2018.
2. George B. Thomas and Ross L. Finney, Calculus and Analytical Geometry, Addison- Wesley, 9th Edn, 1998.

Reference Books:

1. Erwin Krayzie, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2010.

Online Resources/E-Learning Resources

1. https://bs-ug.iisc.ac.in/UG-Math.pdf
2. https://mathinova.com/

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COURSE CURRICULUM

Name of the Program:		BCA		Semester: I		Level: UG	
Course Name		Applied Communication		Course Code/ Course Type		UEG101/AEC	
Course Pattern		2025		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/Oral
2	-	-	-	2	50	-	-
Prerequisite: Anyone can take this course with basic knowledge of English communication.							
Course Objectives (CO):		The objectives of Applied Communication are: 1. To comprehend the basic English communication components. 2. To Identify the Factors influencing interpersonal communication. 3. To Apply the knowledge of written communication. 4. To Demonstrate English communication in public speaking and presentation. 5. To develop students' understanding of digital communication tools, media literacy skills, and ethical considerations in online communication.					
Course Learning Outcomes (CLO):		Students would be able to: 1. Define communication and explain its significance in personal, professional, and societal contexts. 2. Apply interpersonal communication skills in various contexts, such as social interactions, group discussions, teamwork, leadership, and professional settings. 3. Understand the fundamental principles of effective writing, including clarity, coherence, conciseness, and correctness. 4. Reflect on their presentation experiences, seek feedback from peers. 5. Use digital tools for collaboration, communication, and productivity, including project management platforms.					

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Communication: Definition and models of communication, Importance of effective communication in personal and professional contexts, Basic elements of communication: sender, receiver, message, channel, feedback, Communication barriers and strategies for overcoming them, Verbal and nonverbal communication skills.	**CLO 1**	**6**
UNIT II		
Interpersonal Communication: Understanding interpersonal relationships, Factors influencing interpersonal communication: culture, gender, perception, and self-concept, Effective listening skills and techniques, Assertiveness and conflict resolution strategies, Building and maintaining healthy, relationships	**CLO 2**	**6**
UNIT III		
Written Communication: Principles of effective writing,clarity, coherence,conciseness and correctness,Types of written communication, emails, memos,letters,reports and resumes,Planning and organizing written documents,Grammar, punctuation and style conventions, Proofreading and editing techniques	**CLO3**	**6**
UNIT IV		
Public Speaking and Presentation Skills: Understanding the importance of public speaking,Preparing and organizing a presentation,topic selection, audience analysis and speech outline,Delivery techniques,voice modulation, body language, and eye contact,Overcoming stage fright and anxiety,Handling questions and feedback from the audience	**CLO4**	**6**

UNIT V		
Digital Communication and Media Literacy: Overview of digital communication tools,email,social media,instant messaging and video conferencing,Netiquette and online professionalism, Understanding media messages and sources	**CLO5**	**6**
Total Hours		**30 Hours**

Learning resources

Textbooks:

1. Communication in Everyday Life: A Social Interpretation" by Steve Duck and David T. McMahan
2. Applied Communication in the 21st Century" by Carole L. Huston and Ronald B. Adler

Reference Books:

1. The SAGE Handbook of Communication and Instruction" edited by Deanna L. Fassett and John T. Warren
2. Communication: Principles for a Lifetime" by Steven A. Beebe, Susan J. Beebe, and Diana K. Ivy

Online Resources/E-Learning Resources

1. https://www.udemy.com/topic/communication-skills/free/
2. https://www.uou.ac.in/sites/default/files/slm/BHMAECC-II.pdf

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: I	Level: UG
Course Name	UHV-I: Professional Ethics	Course Code/ Course Type	ACUHV101/AC
Course Pattern	2025	Version	2.0

Teaching Scheme				Assessment Scheme			
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/Oral
2	0	0	0	2	50	-	-

Pre-Requisite: UHV-I

Course Objectives (CO):	The objectives of Universal Human Value- Professional Ethics are: 1. To make the students understand the importance of ethical behaviour. 2. To expose the students to the ethical practices to be followed in profession. 3. To sensitize the students to become responsible persons who will uphold ethics in profession when they pursue their career. 4. To make students understand Psychological and Philosophical approaches. 5. To make students understand social responsibility and corporate Sustainability.
Course Learning Outcomes (CLO):	Students would be able to: 1. Equip themselves with an understanding of moral, professional and personal values. 2. Understand the need of ethics in shaping their profession The learners will hone their decision-making skills. 3. Refine their business ethics based on psychological and philosophical perspective. 4. Assess the need for a balance between ecology, and economy. 5. Equip themselves with a better understanding of themselves and the society they live in and the responsibilities they shoulder in creating a sustainable world.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Individual and Professional Ethics: Introduction to Professional Ethics, Morals, Values and Ethics – Personal and Professional- Sensé of Professional Ethics – Code of Ethics by NSPE-Making decisions with ethical dimensions–definition–roadmap to ethical decision making–common standards– internal obstacles – bias – empathy.	**CLO 1**	**5**
UNIT II		
Business Ethics: Philosophical approaches to Business Ethics – ethical reasoning – ethical issues in business - Social Responsibility of Business- conflict of interest–cultural relativism-Ethical Leadership-Resisting un-ethical authority and domination-Global Business Ethics	**CLO 2**	**5**
UNIT III		
Psychological Approaches: Ethical Theories-Psychological and Philosophical Approaches-Myths about Morality-conflict of interest in psychological perspective - Courage-Integrity – ethical dilemma – Emotional Intelligence (Mahabharata- Iskcon Publications)	**CLO 3**	**5**
UNIT IV		
Workplace Ethics: Ethics in changing domains of Research–academic integrity–intellectual honesty-Role of Engineers and Managers-Ethical issues in Diverse workplace – competition – free will- Confidentiality – employee rights – Intellectual property rights – discrimination	**CLO 4**	**5**
UNIT V		

Safety, Responsibilities and Rights: Ecology, and Economy-Risk benefit analysis and reducing risk SDGs–Corporate social responsibility and Corporate Sustainability - CSR in India - Sustainability Case Studies.	**CLO 5**	**5**
Total Hours		**30**

Learning resources

Textbooks:

1. Subramanian. R. Professional Ethics, Oxford Publication,2013.
2. Nagarasan. R. S. Professional Ethics and Human Values. New Age International Publications, 2006.

Reference Book:

Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014

Online Resources/E-Learning Resources

1. https://www.nspe.org/resources/ethics/code-ethics
2. https://www.toolshero.com/tag/ethical-decision-making/
3. https://pagecentertraining.psu.edu/public-relations-ethics/introduction-to-public-relations ethics/lesson-1/ethical-theories
4. https://peer.asee.org/case-studies-in-engineering-ethics.pdf

CIA Guidelines

Online Quiz (Based on MCQ)- 20 marks
Activity (with short Report Submission) - 20 Marks
Academic Sincerity - 10 marks
Few of the suggested activities are Assignments, Debates, Poster presentations, Model making, Group presentation, Field visits and Group Discussions.
Few of suggested topics related to UHV1- Professional Ethics are:

Debate Topics

• Ethical Approach versus Realistic Approach
• Individual and Social Approach
• Dilemma between heart and Mind

Activity

• Analyze the wastage (Electricity or any other) at work place? How you managed.
Assignment
• Analyze the code of ethics at work place.
• If you fulfil the duties, rights will automatically fall in place. Justify the statement

References:

1. https://uhv.org.in/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf

COURSE CURRICULUM

Name of the Program:	BCA	Semester: I	Level: UG
Course Name	Basic of Computer Network	Course Code/ Course Type	UBC107A/OE
Course Pattern	2025	Version	2.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hrs.	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Prerequisite: Basic Knowledge of Computer Network

Course Objectives (CO):	The objectives of Introduction to IoT are: 1. To understand various computer networks and technologies behind networks. 2. To study TCP/IP protocol suite, IP addressing schemes and link layer communication 3. To study routing concept along with Routing protocols. 4. To study application layer protocols 5. To understand basics of cryptography and socket programming.
Course Learning Outcomes (CLO):	Students would be able to: 1. Understand the basic concepts of Computer Network, and principle of layering. 2. Apply the error detection and correction techniques used in data transmission. 3. Apply IP addressing schemes and sub netting. 4. Understand the concept of routing protocols, Application layer protocols and Network Security. 5. Apply the socket programming basics to create a simple chat application.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Data Communication and Computer Networks Internet basics and network components. [Transmission Media-Guided, Unguided, Network Devices] Various types of Networks (only overview) Connection Oriented N/Ws Vs Connectionless N/Ws, Ethernet- Ethernet standards ZigBee, WiFi, Access Technique -CSMA-CD, Negotiation technique Overview, Wireless Network, Unified Communication	**CLO1**	**6**
UNIT II		
Principle of Layering concept: Need for layering, ISO-OSI 7 Layer Model, TCP/IP model, OSI Model vs TCP/IP mode, Data Encapsulation	**CLO2**	**6**
UNIT III		
Link Layer Communication: Error detection and correction techniques, Framing and its types, Flow and error control, HDLC protocol, P2P Protocol	**CLO3**	**6**
UNIT IV		
IP Addressing: Internet Protocol and IPv4 Packet format, Addressing, Physical Addresses, Logical Addresses, Port Addresses, Specific Addresses, IP Address- Network Part and Host Part, Network Masks, Network Addresses and, Broadcast Addresses, Loop Back Address, TCP and UDP Connections, TCP Performance in wireless network	**CLO4**	**6**
UNIT V		
Application Layer Protocols: DHCP – DHCP Client, DHCP server, DHCP scope, DNS – Resolution process, Resource Records, DNS protocol structure, HTTP – WWW architecture, HTTP: Request and Response Message, Email protocols – SMTP, POP3, IMAP4 & MIME, FTP, Telnet	**CLO5**	**6**
Total		**30 hrs.**

Learning resources

Textbooks:

1. Data and Computer Communication 8th Edition – William Stallings
2. Internetworking Technology Handbook CISCO System

Reference Books:

1. Data Communication and Networking Behroz A.Forouzan, TMH, 4th Edition

2. Computer Networks and Internets with Internet Applications Douglas Comer

Online Resources/E-Learning Resources

1. https://docs.oracle.com.javase/tutorial/networkingindex.html
2. https://docs.oracle.com/javase/tutorial/networking/overview/networking.html

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: I	Level: UG
Course Name	Introduction to Cyber Security	Course Code/ Course Type	UBC107B/OE
Course Pattern	2025	Version	2.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hrs.	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	

Prerequisite: Basic Knowledge of Computers & Electronics

Course Objectives (CO):	The objectives of Introduction to Cyber Security are: 1. To remember network basics and familiarize on the security of network protocols. 2. To understand the field of digital security and concepts of access control mechanisms. 3. To apply keywords and jargons involved in securing browsers. 4. To examine the need of cyber-attacks and data privacy. 5. To analyze the significance of security methods in the cyber domain.
Course Learning Outcomes (CLO):	Students would be able to: 1. Identify the digital security measures taken to protect device from threats 2. Explain the access control mechanism and understand how to protect servers. 3. Explain the importance of network basics and security of network protocols. 4. Analyze the cyber-attacks, learn data privacy issues and preventive measures. 5. Analyze the various attacks in the web interface.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Cyber security: 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.	**CLO1**	**6**
UNIT II		
Networking: Networking basics (home network and large-scale business networks), Networking protocols, Security of protocols, Sample application hosted on-premises.	**CLO2**	**6**
UNIT III		
Digital Security: Basics of Digital security, Protecting personal computers and devices, Protecting devices from Virus and Malware,Identity,Authentication and Authorization,Need for strong credentials,Keeping credentials secure, Protecting servers using physical and logical security,World Wide Web (www),The Internet and the HTTP protocol,Security of browser to web server interaction.	**CLO3**	**6**
UNIT IV		
Cyber Attacks: Introduction,Application security(design, development and testing),Operations Security,Monitoring,identifying threats and remediating them, Principles of data security,Confidentiality,Integrity and Availability,Data Privacy,Data breaches,Preventing attacks and breaches with security Controls,Compliance standards,Computer Ethics.	**CLO4**	**6**
UNIT V		
Cybercrime and Cyber law: Classification of cybercrimes,Common cyber crimes cybercrime targeting computers and mobiles,Cybercrime against women and children,financial frauds, social engineering attacks,malware and ransomware attacks,zero day and zero click attacks,Cybercriminals modus operandi,Reporting of cybercrimes,Remedial and mitigation measures,Legal perspective of cybercrime,IT Act 2000 and its amendments,Cybercrime and offenses,Organizations dealing with Cybercrime and Cyber security in India,Case studies.	**CLO5**	**6**
Total hours		**30 hrs.**

Learning resources

Textbooks:

1. Cybersecurity For Dummies by Joseph Steinberg
2. Big Breaches: Cybersecurity Lessons for Everyone by Neil Daswani, Moudy Elbayadi

Reference Books:

1. Cybersecurity: The Beginner's Guide by Dr. Erdal Ozkaya
2. Confident Cybersecurity: How to Get Started in Cybersecurity and Futureproof Your Career by Dr. Jessica Barker

Online Resources/E-Learning Resources

1. The Complete Cyber Security Course: Hackers Exposed --- https://www.udemy.com/course
2. Foundations of Cybersecurity----- https://www.coursera.org/

BCA 2025 PATTERN

COURSE DETAILS

Semester - II

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COURSE CURRICULUM

Name of the Program:	BCA	**Semester: II**	**Level: UG**
Course Name	Data Structure Using C	**Course Code and Course Type**	UBC109
Course Pattern	**2025**	**Version**	2.0

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3			3	3	40	60	

Prerequisite: Basic Programming Knowledge

Course Objectives (CO):	1. The objectives of: Perform basic operations on Arrays. 2. Apply different Searching and Sorting methods. Implement basic operations on Linked List. 3. Perform operations on Stack using Array and Linked List Implementations. 4. Perform operations on Queue using Array and Linked List Implementations. 5. Create and Traverse Tree and Graph to solve problems.
Course Learning Outcomes (CLO):	Students will be able to: 1. To Explain the concepts, types, and applications of data structures and algorithm complexities. 2. To Apply arrays for data storage, searching, and sorting using standard algorithms. 3. To Implement linked lists with dynamic memory management and perform basic operations. 4. To Use stacks and queues for expression evaluation and sequential data processing. 5. To Construct and traverse trees and graphs using appropriate representations and methods.

Course Contents and Syllabus:

Descriptors and Topics	**CLO**	**Hours**
UNIT I		
Introduction:-Definition of data structure, data structure operations. Algorithms : Complexity, Time Space trade off, Complexity of Algorithms, Asymptotic Notations for Complexity of Algorithms, Sub algorithms, Variables, data., Concept and Need of Data Structure, Definition, Abstract Data Type Applications of Data Structures, Types of Data Structures: (i) Linear Data Structures, (ii) Non-Linear Data Structures	**CLO 1**	9
UNIT II		
Array With Searching And Sorting: Introduction, One Dimensional Array, Memory Representation of One Dimensional Array, Traversing, Insertion, Multidimensional Arrays, Memory Representation of Two Dimensional Arrays, General Multi-Dimensional Arrays, Sparse Arrays, Sparse Matrix, Memory Representation of Special kind of Matrices, Advantages and Limitations of Arrays., Searching: Searching for an item in a data set usingthe following methods: (i) Linear Search (ii) BinarySearch, Sorting: Sorting of data set in an order using the following methods: (i) Bubble Sort (ii) Selection Sort (iii) Insertion Sort	**CLO 2**	9
UNIT III		
Linked List: Difference between Static and Dynamic Memory Allocation., Introduction to Linked List, Terminologies: Node, Address, Pointer, Information field / Data field, Next pointer, Null Pointer, Empty List, Type of Lists: Linear List, Circular List, Representation of Doubly Linked List., Operations on a Singly Linked List: Creating a Linked List, Inserting a new node in a Linked List,	**CLO3**	9

Deleting a node from a Linked List, Searching a key in Linked List, Traversing a Singly Linked List. Applications of Linked List.		
UNIT IV		
Stacks and Queue:-Stacks : Definition, Array representation of stacks, Linked representation of stacks, Polish notation, Evaluation of a Postfix Expression, Transforming Infix Expressions into Postfix Expressions., Queues : Definition, Array representation of Queues, Linked representation of Queues, Circular queues, Priority Queue, Introduction To Dqueue.	**CLO4**	9
UNIT V		
Tree And Graph:- Introduction to Trees Terminologies: Tree, Degree of a Node, Degree of a Tree, Level of a node, Leaf Node, Depth / Height of a Tree, In-Degree and Out- Degree, Path, Ancestor and Descendant Nodes. Tree Types and Traversal methods, Types of Trees: General Tree, Binary Tree, Binary Search Tree (BST). Binary Tree Traversal: In-Order Traversal, Preorder Traversal, Post-Order Traversal. Graph:- Graph and multigraphs. Directed Graphs, Sequential representation of graphs: Adjacent matrix, Path matrix, Linked representations of a Graph	**CLO5**	9
Total Hours		45

Learning resources

Textbooks:

1. 1. Seymour Lipchutz, "Theory and Problems of Data Structures", Tata Mc Grew

Reference Books:

1. Robert Kruse, C.L Tondo and Bruce Leung, "Data Structure and Programming in C", Pearson Education.
2. Yedidyah Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, "Data Structure using C and C++", Pearson Education 2nd Edition.
3. Seymour Lipschutz and G A Vijayalakshmi Pai, "Data Structures", Tata Mc Grew Hills
4. Robert Lafore, " Sams Teach Yourself Data Structures and Algorithms in 24 Hours", Sams Techmedia
5. Alfred V Aho, John E Hopcroft and Jeffery D Ullman, " Data Structures and Algorithms", Pearson Education.
6. Samiran Chattopadhyay, Debabrata Ghosh Dastidar and Matagini Chattopadhyay, " Data Structures through C Language", BPB Publication.

Online Resourses:

1. https://www.audisankara.ac.in/has/pdf/DATA%20STRUCTURE.pdf
2. https://github.com/Rustam-Z/data-structures-and-algorithms/tree/master/lecture%20notes
3. https://www.programiz.com/dsa/linked-list

COURSE CURRICULUM

Name of the Program:	**BCA**	**Semester : II**	**Level: UG**
Course Name	**Data Structure And Algorithm Lab**	**Course Code/ Course Type**	UBC110
Course Pattern	**2024**	**Version**	1.0

Teaching Scheme

Assessment Scheme

Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/Oral**
	1		1	2	25		25

Prerequisit: Student should learn at least one programming language, such as C++, Java, or Python

Course Objectives (CO):	The objectives of (Name of course) are: 1. To Comprehend basic techniques of algorithm analysis 2. To Identify the factors implementation of linked list,Stack,Queue data structures. 3. To Apply the different algorithms For sorting and searching techniques. 4. To Demonstrate and create tree structure 5. To develop and evaluate the graph algorithms on real life applications.
Course Learning Outcomes (CLO):	Students would be able to: 1. Students will be able to identify the time and space complexities of various algorithms. 2. Students will be able to Explain the appropriate data structures like Linked List, stack, Queue as applied to the specified problem definition. 3. Students will be able to apply the concepts of trees on given data 4. Students will be able to apply knowledge of Handle operations like searching, insertion, deletion, and traversing mechanisms on various data structures 5. Students will be able to evaluate the linear and non-linear data structures through graph theory.

Course Contents/Syllabus: Practical Plan

Practical Number	**Practical Title**	**Week Number /Turn**	**CLO**	**Hours**
1	Write a 'C' program to perform following Operations on Array: Create, Insert, Delete, Display.	Week 1 Turn 1	CLO1	2
2	Write a 'C' Program to Search a particular data from the given Array of numbers using: Linear Search Method, Binary Search Method	Week 2/3	CLO2	4
3	Write a 'C' Program to Sort an Array of numbers using Bubble Sort Method, Selection Sort Method	Week 4/5	CLO 2	4
4	Write a 'C' Program to Implement Singly Linked List with Operations: (i) Insert at beginning, (ii) Search, (iii) Display	Week6/7	CLO2	4
5	Write a C Program to Implement Singly Linked List with Operations: (i) Insert at end, (ii) Insert After, (iii) Delete (iv) Display	Week8	CLO3	2
6	Write a 'C' Program to perform PUSH and POP Operations on Stack using an Array.	Week 9	CLO4	2
7	Write a 'C' Program to perform PUSH and POP Operations on Stack using Linked list.	Week 10	CLO4	2
8	Write a 'C' Program to perform INSERT and DELETE operations on Linear Queue using a Array.	Week11	CLO4	2

9	Write a 'C' Program to perform INSERT and DELETE operations on Linear Queue using a Linked List	Week12	CLO4	2
10	Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using an Array.	Week 13	CLO4	2
11	Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using a Linked List.	Week 14	CLO4	2
12	Write a 'C' Program to Implement BST (Binary Search Tree) and Traverse in In-Order.	Week 15	CLO5	2

Learning resources

Textbooks:

1. Mark Allen Weiss, Data Structure and Algorithm Analysis in C++, 2014, 4th Edition, Pearson Education Limited.
2. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
3. Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International.

Reference Books:

1. AnanyLevitin, Introduction to design and analysis of algorithm, 2012, 3rd Edition, Addison Wesley.
2. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms,PaperBack, 2010, 3rd Edition, MIT Press.

Online Resources/E-Learning Resources

1. https://www.audisankara.ac.in/has/pdf/DATA%20STRUCTURE.pdf
2. https://github.com/Rustam-Z/data-structures-and-algorithms/tree/master/lecture%20notes
3. https://www.programiz.com/dsa/linked-list

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: II	Level: UG
Course Name	Database Management System	Course Code and Course Type	UBC111
Course Pattern	2025	Version	2.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical and Oral
3	-	-	3	3	40	60	-

Prerequisite: Fundamentals of Operating System.

Course Objectives (CO):	The objectives of Database Management System: - 1. To Introduce core concepts and architecture of Database Management Systems, including data models and database characteristics. 2. To Equip students with the knowledge of relational models and ER modelling for effective database design and querying. 3. To Develop understanding and application of normalization techniques for designing efficient databases. 4. To Provide insights into transaction management, including ACID properties, to ensure reliable and consistent database operations. 5. To Introduce concurrency control protocols to maintain database consistency in multi-user environments.
Course Learning Outcomes (CLO):	Students will be able to: 1. To Demonstrate an understanding of DBMS architecture, concepts, and the roles of database administrators and users. 2. To Design and model databases using Entity-Relationship (ER) models, and translate ER models into relational database structures. 3. To Implement relational algebra and Structured Query Language (SQL) to query and manipulate relational databases. 4. To Analyze functional dependencies and apply normalization techniques (1NF, 2NF, 3NF) for optimizing database design. 5. To Manage transactions and apply concurrency control techniques to ensure isolation, atomicity, and data consistency in multi-user settings.

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
INTRODUCTION TO DATABASE MANAGEMENT SYSTEM: Overview of Concepts and Conceptual Database Design, Database Administrator and Database Users, Characteristics of the Database, Database Systems, Concepts and Architecture, Data Models, Schemes & Instances, DBMS Architecture & Data Independence, Database Languages & Interfaces, Overview of Hierarchical, Network & Relational Database Management Systems, Data Modeling using Entity-Relationship Model, Strong and Weak Entity Sets, Generalization, Specialization, and Aggregation.	**CLO1**	**9**
UNIT II		

INTRODUCTION TO RELATIONAL MODEL & ER MODEL: Relational Model, Languages & Systems: Relational Model Concepts, Relational Model Constraints, Translating your ER Model into Relational Model, Relational Algebra, SQL, A Relational Database Language, Data Definition in SQL, View and Queries in SQL, Specifying Constraints and Indexes in SQL, Practicing SQL commands ***Cases based on ER Model should be covered**	**CLO 2**	**9**
UNIT III		
NORMALIZATION: Relational Database Design: Functional Dependencies & Normalization for Relational Databases, Functional Dependencies, Normal Forms (1NF, 2NF, 3NF), Lossless Join and Dependency Preserving Decomposition, Multivalued Dependency, Join dependency. ***Cases based on Normalization.**	**CLO3**	**9**
UNIT IV		
TRANSACTION MANAGEMENT: Transaction Management: Transaction Concept and its States, ACID properties, Implementation of Atomicity and Durability, Serializability, Recoverability, Schedules, Implementation of Isolation**.** **Examples to be Covered/Cases.**	**CLO4**	**9**
UNIT V		
CONCURRENCY CONTROL: Concurrency Control, 2PL, Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols. Examples Based on Concurrency Control and Lock based Protocols. Examples to be Covered.	**CLO5**	**9**
Total Hours		**45**

Learning Resources

TEXT BOOKS:

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education (India) Private Limited, 3rd Edition. (Part of UNIT-I, UNIT-II, UNIT-III, UNIT-V)
2. Data base System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw Hill Education (India) Private Limited l, 6th edition. (Part of UNIT-I, UNIT-IV)

REFERENCE BOOKS:

1) Database systems, 6th edition, Ramez Elmasri, Shamkant B.Navathe, Pearson Education.
2) Database Systems Design, Implementation, and Management, Peter Rob & Carlos Coronel, 7th Ed.
3) Fundamentals of Database Systems, ElmasriNavrate, Pearson Education

Online Resources

1. https://www.scaler.com/topics/course/dbms/
2. https://www.geeksforgeeks.org/dbms/

E-Learning Resources

1. https://www.udemy.com/topic/database-management/
2. https://github.com/vinabi/e_learning-db

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: II	Level: UG
Course Name	Database Management System Lab	Course Code/ Course Type	UBC112
Course Pattern	2024	Version	1.0

Teaching Scheme

Assessment Scheme

Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/Oral
-	2	-	1	2	25	-	25

Prerequisite: Basic Understanding of Tables, Schemas and Instances

Course Objectives (CO):	The objectives of Database Management System Lab 1. To Develop a foundational understanding of SQL commands (DDL, DML, DCL) to structure and manipulate relational databases. 2. To construct complex queries using SELECT statements, arithmetic expressions, and operator precedence rules. 3. To filter data efficiently, leveraging comparison, string, and null conditions. 4. To Explore advanced SQL concepts like single-row and multiple-row functions, joins, subqueries, and views. 5. To Gain hands-on experience with database indexing, including creation, renaming, copying, and dropping indices.
Course Learning Outcomes (CLO):	Students would be able to: 1. To create, alter, and drop tables using SQL syntax. 2. To Manipulate Data with DML Commands perform insert, update, delete operations effectively. 3. To manage access permissions through SQL commands like GRANT and REVOKE. 4. To write SELECT statements incorporating arithmetic expressions, operator precedence, and concatenation. 5. To Implement Filtering Techniques with the use of WHERE clauses with comparison, NULL conditions, AND/OR/NOT operators.

Course Contents/Syllabus: Practical Plan

Activity Number	Assignment/ Practical/Activity Title	Week Number/ Turn	Details	CLO	Hours
1	Creation of database SQL Queries.	Week 1/ Turn 1 and 2	Components of SQL with Examples and Syntax. DDL Commands	CLO1	2
2	DML	Week 2/ Turn 1 and 2	Data Manipulation Language (DML) Commands Operations on DML	CLO1	2
3	DCL	Week 3/ Turn 1 and 2	DCL Commands	CLO1, CLO2	2
4	Select Statements	Week 4/ Turn 1 and 2	Basic Select Statements, Arithmetic Expressions, Examples to Be covered	CLO1, CLO2	2
5	Operator And its Operations	Week 5/ Turn 1 and 2	Operations based on Operator Precedence., Concatenation Operator, Literal Character Strings	CLO2	2
6	Limiting the Rows Selected	Week 6/ Turn 1 and 2	Using the WHERE Clause Character Strings and Dates Comparison Conditions	CLO2, CLO3	2
7	Wild Card	Week 7/	Using the LIKE Condition	CLO3	2

	Characters	Turn 1 and 2	Using the NULL Conditions		
8	Logical Conditions	Week 8/ Turn 1 and 2	AND OR NOT	CLO3	2
9	Rules of Precedence Functions	Week 9/ Turn 1 and 2	Examples based on Rules of Precedence.	CLO3	2
10	Functions	Week 10/ Turn 1 and 2	Single Row Functions and its types Multiple Row Functions.	CLO4	2
11	Functions	Week 11/ Turn 1 and 2	Arithmetic Operations on Date Functions Conversion Functions	CLO4, CLO5	2
12	Functions Displaying Data from Multiple Tables	Week 12/ Turn 1 and 2	General Functions Joins and its Types	CLO5	2
13	Types of Joins	Week 13/ Turn 1 and 2	Joining Tables Using Oracle Syntax Joining Tables Using SQL: Retrieving Records with Natural Joins	CLO5	2
14	Aggregate Functions Subqueries	Week 14/ Turn 1 and 2	Types of Group Functions Group Functions and Null Values GROUP BY Clause HAVING Clause Single-Row Subqueries Executing Single-Row Subqueries. HAVING Clause with Subqueries	CLO5	2
15	Index And View	Week 15/ Turn 1 and 2	Experiment using database index creation, Renaming a index, Copying another index, Dropping a index . Create Views, Operations on Views	CLO5	2
Total					**30 hrs.**

Learning resources

Textbooks:

1. SQL QuickStart Guide: The Simplified Beginner's Guide to Managing, Analyzing, and Manipulating Data With SQL
2. SQL All-in-One For Dummies

Reference Books:

1. SQL: The Ultimate Beginners Guide
2. Practical SQL, 2nd Edition: A Beginner's Guide to Storytelling with Data

Online Resources/E-Learning Resources

1. https://learnsql.com/
2. https://www.w3schools.com/sql/

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: II	UG
Course Name	Software Engineering	Course Code/Course Type	UBC114 /VSC
Course Pattern	2025	Version	2.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Prerequisite: ER Modeling

Course Objectives (CO):	The objectives of Operating Systems Fundamentals are: 1. To learn and understand the principles of System Engineering. 2. To learn and understand the principles of Software Engineering. 3. To gain the knowledge of Software Development Life Cycle and methodology. 4. To impart various software requirement techniques. 5. To demonstrate the different system analysis and design engineering.
Course Learning Outcomes (CLO):	Students would be able to: 1. Compare and contrast various Software Engineering models. 2. Decide on an appropriate process model for developing a software project. 3. Classify software applications and Identify unique features of various domains. 4. Prepare System Requirement Specification (SRS) for the given problem. 5. Design and analyze Data Flow diagrams.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to System Engineering: Definition,Basic Components,Elements of the system, System Components, Types of System.	**CLO 1**	**6**
UNIT II		
Introduction to Software Engineering: Definition of Software, Characteristics of Software, Software Application Domain, Definition of Software Engineering, Need for software Engineering, Mc Call's Quality factors, The Software Process, Software Engineering Practice.	**CLO 2**	**6**
UNIT III		
Software Development Life Cycle (SDLC) and Methodologies: Introduction, Activities of SDLC, A Generic Process Model, Prescriptive Process models- Waterfall Model, Incremental Process Models, Evolutionary process Models (Prototyping and Spiral Model), Concurrent Models, Types	**CLO3**	**6**
UNIT IV		
Requirement Engineering: Introduction, Requirement Engineering Tasks, Establishing Groundwork for understanding of Software Requirement, Requirement Gathering, Feasibility study, Fact Finding Techniques.	**CLO4**	**6**
UNIT V		
Analysis and Design Engineering: Decision Tree and Decision Table, Data Flow Diagrams (DFD), Data Dictionary, Elements of DD, Advantages of DD, Input and Output Design, Entity Relationship Diagram (ERD), Case Studies on above topics**.**	**CLO5**	**6**
Total Hours		**30**

Learning resources

Textbooks:

1. Rajib Mall, "Fundamentals of Software Engineering", PHI 2018, 5th Edition.

Reference Books:

1. Roger S. Pressman, "Software Engineering - A Practitioner's Approach", McGraw Hill 2010, 7th Edition.
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa Publishing House 2011, 3rd Edition.

Online Resources/E-Learning Resources

1. https://www.javatpoint.com/software-engineering
2. https://www.scaler.com/topics/software-engineering/

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: II	Level: UG
Course Name	Discrete Mathematics	Course Code/ Course Type	UBC115/BSC
Course Pattern	2025	Version	2.0

Teaching Scheme				Assessment Scheme			
Theory	Practical	Tutorial	Total Credits	Hrs.	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Prerequisite: None

Course Objectives (CO):	The objectives of Discrete Mathematics are: 1. To remember Graph theory and associated concepts. 2. Recognize the mathematical logic of truth tables. 3. To apply set operations in algebraic structures. 4. Classify the different properties of relations. 5. To evaluate the relative frequency.
Course Learning Outcomes (CLO):	Students would be able to: 1. Identify the fundamental concepts of graph theory. 2. Explain the use of the truth table in mathematical logic. 3. Complete the operations on sets, 4. Assess the various operations on relations. 5. Justify the use of Probability.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Graph Theory: Introduction, Simple graph, adjacency/ incident/ neighborhood/ degree of a vertex, degree sequence of a graph, first fundamental theorem of graphs, subgraph and induced sub-b graphs, Adjacent matrices and incidence matrices, walk, length of a walk, open and closed walks, trial and path, circuit and cycle, connected graph and disconnected graph.	**CLO1**	**6**
UNIT II		
Mathematical Logic: Introduction, proposition, connectives, truth tables and duality, converse/contrapositive/inverse,tautology,contradiction,contingency,logically equivalent, DNF, CNF, PDNF, PCNF	**CLO2**	**6**
UNIT III		
Algebraic Structures:Introduction,sets and set operations,functions,relations and their properties & representations of relation by matrix,closure of different types of relations,equivalence relations,primitive recursive function.	**CLO3**	**6**
UNIT IV		
Relations and Partially Ordering: Introduction,Properties of relations,relation matrix,directed graph,closures of relation,equivalence relations, congruence relation, equivalence classes,equivalence classes and partitions,Partially ordered set,lexicographic ordering, Hesse diagrams, minimal and maximal elements, upper and lower bounds.	**CLO4**	**6**
UNIT V		
Probability and Statistics: Introduction,Classical relative frequency and axiomatic,Definition of probability,Addition rule and conditional probability,multiplication rule and total probability,Bayes' theorem and independence problems,measures of central tendency,measures of dispersion,coefficient of variation.	**CLO5**	**6**
Total Hours		**30**

Learning resources

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2014.
2. Ronald E Walpole, Raymond H Myers, Sharon L Myers, and Keying E Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi-9th edition, 2012.
3. B S Grewal, "Higher Engineering Mathematics", 44th edition, Khanna Publishers.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2010.
2. B S Grewal, Numerical methods in engineering and science, 10th Edition, Khanna publishers, 2016.
3. Kishor S Trivedi, "Probability and Statistics with reliability, Queuing and Computer Science Applications", John Wiley & Sons, 2nd edition, 2008.

Online Resources/E-Learning Resources

1. https://www.edx.org/learn/discrete-mathematics
2. https://www.codecademy.com/learn/discrete-math

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COURSE CURRICULUM

Name of the Program:	B.C.A	Semester: II	Level: UG
Course Name	UHV-I: Professional Ethics	Course Code/ Course Type	ACUHV101/AC
Course Pattern	2025	Version	2.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA(Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	50	-	-

Pre-Requisite: UHV-I

Course Objectives (CO):	The objectives of Universal Human Value- Professional Ethics are: 1. To make the students understand the importance of ethical behavior 2. To expose the students to the ethical practices to be followed in profession 3. To sensitize the students to become responsible persons who will uphold ethics in profession when they pursue their career 4. To make students understand Psychological and Philosophical approaches 5. To make students understand social responsibility and corporate Sustainability
Course Learning Outcomes (CLO):	Students would be able to: 1. Equip themselves with an understanding of moral, professional and personal values. 2. Understand the need of ethics in shaping their profession The learners will hone their decision-making skills. 3. Refine their business ethics based on psychological and philosophical perspective. 4. Assess the need for a balance between ecology, and economy. 5. Equip themselves with a better understanding of themselves and the society they live in and the responsibilities they shoulder in creating a sustainable world.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Individual and Professional Ethics: Introduction to Professional Ethics, Morals, Values and Ethics – Personal and Professional- Sensé of Professional Ethics – Code of Ethics by NSPE-Making decisions with ethical dimensions–definition–roadmap to ethical decision making–common standards– internal obstacles – bias – empathy.	**CLO 1**	**8**
UNIT II		
Business Ethics: Philosophical approaches to Business Ethics – ethical reasoning – ethical issues in business - Social Responsibility of Business- conflict of interest–cultural relativism-Ethical Leadership-Resisting un-ethical authority and domination-Global Business Ethics	**CLO 2**	**5**
UNIT III		
Psychological Approaches: Ethical Theories-Psychological and Philosophical Approaches-Myths about Morality-conflict of interest in psychological perspective - Courage-Integrity – ethical dilemma – Emotional Intelligence (Mahabharata- Iskcon Publications)	**CLO 3**	**5**
UNIT IV		
Workplace Ethics: Ethics in changing domains of Research–academic integrity–intellectual honesty-Role of Engineers and Managers-Ethical issues in Diverse workplace – competition – free will- Confidentiality – employee rights – Intellectual property rights – discrimination	**CLO 4**	**5**
UNIT V		
Safety, Responsibilities and Rights: Ecology, and Economy-Risk benefit analysis and reducing risk SDGs–Corporate social responsibility and Corporate Sustainability - CSR in India - Sustainability Case Studies	**CLO 5**	**7**
Total Hours		**30**

Learning resources

Textbooks:

1. Subramanian. R. *Professional Ethics*, Oxford Publication,2013.
2. Nagarasan. R. S. *Professional Ethics and Human Values*. New Age International Publications, 2006.

Reference Book:

1. Mike W Martin and Roland Schinzinger, *Ethics in Engineering*,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014

Online Resources/E-Learning Resources

1. https://www.nspe.org/resources/ethics/code-ethics
2. https://www.toolshero.com/tag/ethical-decision-making/
3. https://pagecentertraining.psu.edu/public-relations-ethics/introduction-to-public-relations-ethics/lesson-1/ethical-theories/
4. https://peer.asee.org/case-studies-in-engineering-ethics.pdf

CIA Guidelines

Online Quiz (Based on MCQ)- 20 marks
Activity (with short Report Submission) - 20 Marks
Academic Sincerity - 10 marks
Few of the suggested activities are Assignments, Debates, Poster presentations, Model making, Group presentation, Field visits and Group Discussions.
Few of suggested topics related to UHV1- Professional Ethics are:

Debate Topics
• Ethical Approach versus Realistic Approach
• Individual and Social Approach
• Dilemma between heart and Mind

Activity
• Analyze the wastage (Electricity or any other) at work place? How you managed.

Assignment

• Analyze the code of ethics at work place

• If you fulfil the duties, rights will automatically fall in place. Justify the statement

References:

1. https://uhv.org.in/

2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf

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COURSE CURRICULUM

Name of the Program:	BCA	Semester: II	Level: UG
Course Name	Analysis and Design of Algorithm	Course Code and Course Type	UBC116A/OE
Course Pattern	2025	Version	2.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical and Oral
2	-	-	2		20	30	

Prerequisite: Basic knowledge of any programming language

Course Objectives (CO):	The objectives of Design Analysis of Algorithm are: 1. To Describe the fundamentals of Algorithms. 2. Solve problems using the Divide and Conquer strategy. 3. Develop solutions using Greedy and Dynamic programming and compare both. 4. Classify the methods for Backtracking Strategy. 5. To Evaluate NP Complete and NP Hard Problems.
Course Learning Outcomes (CLO):	Students will be able to: 1. Students will be able to understand the Basics Algorithms and types. 2. Divide the problem into two or more sub-problems of the same or related type. 3. Apply knowledge of different algorithm design techniques for a given problem. 4. Analyze different algorithm design techniques. 5. Examine the techniques to account for the true cost of the computation.

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction to Algorithms: Fundamentals of Algorithm, Asymptotic Notations and their Properties, Time and Space Complexity, Union and Find Algorithms, Sorting in Linear Time, Tower of Hanoi.	**CLO 1**	**6**
UNIT II		
Divide And Conquer: Divide and Conquer General Strategy, Exponentiation, Binary Search, Quick Sort, Merge Sort, Heaps and Heap Sort.	**CLO 2**	**6**
UNIT III		
Greedy Method and Dynamic Programming: Knapsack Problem, Job sequencing with Deadlines, Optimal Merge Patterns, Minimal Spanning Trees-Prim's Algorithms, Kruskal's Algorithms, Travelling Salesman Problem.	**CLO3**	**6**
UNIT IV		
Backtracking: Backtracking: General Strategy, N- Queen's Problem, Graph Coloring, The Maximum Matching Problem, Maximum Matching in Bipartite Graph, Stable Marriage Problem.	**CLO4**	**6**
UNIT V		
NP-Complete and NP-Hard Problems: Basic Concepts of P, NP, NP Complete and NP Hard Problems, Hamiltonian Cycle, LIFO and FIFO Search, Assignment Problem.	**CLO5**	**6**
Total Hours		**30**

Learning resources

Textbooks:

1. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2017.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

Reference Books:

1. "Fundamental of Algorithm" Bressard, PHI
2. "Fundamentals of computer Algorithms" Horowitz/Sahani, Galgotia
3. Data Structures and Algorithms, Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Pearson Education

Online Resources and E-Learning Resources

1. https://soumadip.github.io/courses/DAA/
2. https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms