Department of Computer Application
Bachelor of Computer Application
Evaluation Scheme

Credit Framework for the BCA -NEP-2020									
Sem.	Major (Core)	Minor Stream	Multidisciplinary	Ability Enhancement Course	Skill Enhancement Course	Value Added Courses Common	Summer Internship	Research Project/ Dissertation	Total Credit
1	13	4	1		2				20
2	14	4	2						20
Students exiting the programme after securing 40 credits will be awarded UG Certificate in the relevant Discipline / Subject provided they secure 4 credits in work based vocational courses offered during summer term or internship / Apprenticeship in addition to 6 credits from skill-based courses earned during first and second semester									
3	8	3	2	2	2	3			20
4	12	3			2	3			20
Students exiting the programme after securing 80 credits will be awarded UG Diploma in the relevant Discipline / Subject provided they secure 4 credits in skill based vocational courses offered during first year or second year summer term.									
5	14	3				3		4	24
6	4	3				3		12	22
Students who want to undertake 3-year UG Programme will be awarded UG Degree in the relevant Discipline/ Subject Upon securing 120 credits									
7	10	3				3		6	22
8	4	3				3		12	22
Students will be awarded UG Degree(Honors) with Research in the relevant Discipline/ Subject provided they secure 160 credits									

Total   = 170 Credit

			Future University								
			BCA (Undergraduate Regular)								
			Course Structure/ Degree Award Checklist 2024-2028								
Program Name:				BCA						Program Code: 04	
Total Credit of Program: 170											
			Semester-I								
SN.	Course Category	Course Code	Theory		Week			Evaluation Scheme		Total	Credit
			Course Title	L	T	P	CA	EE		
1	Major Core Course	BCA101	Computer Fundamental & Emerging Technology	4	0	0	30	70	100	4
2	Major Core Course	BCA103	Software Engineering	3	0	0	30	70	100	3
3	Major Core Course	BCA105	Principles of Problem Solving using C	4	0	0	30	70	100	4
4	Minor Course	BAS105	Mathematical Foundation	4	0	0	30	70	100	4
5	Skill Enhancement Course	BAS107	Remedial English	2	0	0	30	70	100	2
6	Multidisciplinary	IKS101	IKS-I (Indian Knowledge System - I)	1	0	0	50	0	50	1
Practical										
1	Major Core Course	BCA171	Office Automation Lab	0	0	2	50	50	100	1
2	Major Core Course	BCA173	Principles of Problem Solving using C Lab	0	0	2	50	50	100	1
			TOTAL	**18**	**0**	**4**	**300**	**450**	**750**	**20**

			Semester -II							
			Theory	**Week**			**Evaluation Scheme**		**Total**	**Credit**
SN.	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**		
1	Minor Course	BAS106	Discrete Mathematics	4	0	0	30	70	100	4
2	Major Core Course	BCA102	Python Programming	4	0	0	50	100	150	4
3	Major Core Course	BCA104	Computer Network	4	0	0	30	70	100	4
4	Major Core Course	BCA106	Advance Database Management System	4	0	0	30	70	100	4
5	Multidisciplinary	BAS108	Environmental Science	2	0	0	50	50	100	2
6	Skill Enhancement Course	LSM102	LSM-I (Life Skills & Mentoring – I)	0	0	0	0	0	0	0
1	Major Core Course	BCA180	ADBMS Lab	0	0	2	50	50	100	1
2	Major Core Course	BCA182	Python Programming Lab	0	0	2	50	50	100	1
			TOTAL	**18**	**0**	**4**	**290**	**460**	**750**	**20**

	Semester -III									
			Theory	**Week**			**Evaluation Scheme**		**Total**	**Credit**
SN.	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**		
1	Multidisciplinary	BCA201	Management Information Systems (MIS)	2	0	0	30	70	100	2
2	Major Core Course	BCA203	Data Structure Using C	3	0	0	30	70	100	3
3	Minor Course	BAS205	Mathematics-III	3	0	0	30	70	100	3
4	Minor Course	BCA205	Web Development	3	0	0	30	70	100	3
5	Skill Enhancement Course	BCS213	AI for Everyone	2					0	0
6	Ability Enhancement Course	BAS207	Foreign language (French/German)	2	0	0	30	70	100	2
7	Value Added Course	BCA207	**MOOC-I**	Self-Paced Learning					100	3
			Practical							
1	Major Core Courses	BCA271	Data Structure Using C Lab	0	0	2	50	50	100	1
2	Major Core Courses	BCA273	Web Development Lab	0	0	2	50	50	100	1
			TOTAL	**15**	**0**	**4**	**280**	**520**	**900**	**20**

Note: In the second semester, mathematics (FBCA203) will be a compulsory subject from the list of papers for those students who did not have Mathematics in Intermediate (12th) class.

			Semester-IV							
			Theory		**Week**		**Evaluation Scheme**			
SN.	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**	**Total**	**Credit**
1	Major Core Course	BCA202	Advance Python Programming	3	0	0	30	70	100	3
2	Major Core Course	BCA204	OOP Concepts using Java	3	0	0	30	70	100	3
3	Major Core Course	BCA206	Operating Systems	3	0	0	30	70	100	3
4	Minor Course	BCA208	**Elective-I**	3	0	0	30	70	100	3
5	Value Added Course	BCA214	**MOOC-II**	Self-Paced Learning					100	3
6	Skill Enhancement Course	BCA218	AI for Developers	2	0	0	30	70	100	2
			Practical							
1	Major Core Course	BCA280	Advance Python Programming Lab	0	0	2	50	50	100	1
2	Major Core Course	BCA282	OOP using Java Lab	0	0	2	50	50	100	1
3	Research Project/ Dissertation	BCA284	Minor Project	0	0	2	50	50	100	1
			TOTAL	**14**	**0**	**6**	**300**	**500**	**900**	**20**

			Semester -V							
			Theory	**Week**			**Evaluation Scheme**			
SN.	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**	**Total**	**Credit**
1	Major Core Course	BCA301	Machine Learning	3	0	0	30	70	100	3
2	Major Core Course	BCA303	Digital Electronics	3	0	0	30	70	100	3
3	Major Core Course	BCA305	Computer Architecture	3	0	0	30	70	100	3
4	Major Core Course	BCA307	Mobile Application Development	3	0	0	30	70	100	3
5	Minor Course	BCA309	**Elective-II**	3	0	0	30	70	100	3
6	Value Added Course	BCA315	**MOOC-III**	Self-Paced Learning					100	3
			Practical							
1	Major Core Course	BCA371	Digital Electronics LAB	0	0	2	50	50	100	1
2	Major Core Course	BCA373	Mobile Application Development LAB	0	0	2	50	50	100	1
3	Research Project/ Dissertation	BCA375	(Internship)/Minor Project	0	0	8	50	100	150	4
			TOTAL	**15**	**0**	**12**	**300**	**550**	**950**	**24**

Semester-VI

SN.	Course Category	Course Code	Course Title	L	T	P	CA	EE	Total	Credit
			Theory		Week		Evaluation Scheme			
1	Major Core Courses	BCA302	Digital Image Processing	3	1	0	30	70	100	4
2	Minor Courses	BCA304	**Elective-III**	3	0	0	30	70	100	3
3	Value Added Courses	BCA310	**MOOC-IV**		Self-Paced Learning				100	3
			Practical							
1	Research Project/ Dissertation	BCA380	Major Project	0	0	24	200	300	500	12
			TOTAL	6	1	24	260	440	800	22

Semester -VII

SN.	Course Category	Course Code	Course Title	L	T	P	CA	EE	Total	Credit
			Theory		Week		Evaluation Scheme			
1	Major Core Courses	BCA401	Data Mining	3	0	0	30	70	100	3
2	Major Core Courses	BCA403	Soft Computing	3	0	0	30	70	100	3
3	Minor Courses	BCA405	Research Methodology	3	0	0	30	70	100	3
4	Minor Courses	BCA407	**Elective-IV**	3	0	0	30	70	100	3
5	Value Added Courses	BCA413	**MOOC-V**						100	3
			Practical							
1	Major Core Courses	BCA471	Research Methodology Lab	0	0	2	50	50	100	1
2	Research Project/ Dissertation	BCA473	Minor Dissertation	0	0	12	100	100	200	6
			TOTAL	12	0	14	270	430	800	22

			Semester-VIII							
			Theory		Week		Evaluation Scheme			
SN.		Course Code	Course Title	L	T	P	CA	EE	Total	Credit
1	Major Core Courses	BCA402	R Programming	3	0	0	30	70	100	3
2	Minor Courses	BCA404	**Elective-V**	3	0	0	30	70	100	3
3	Value Added Courses	BCA410	**MOOC-VI**	Self-Paced Learning					100	3
Practical										
1	Major Core Courses	BCA480	R Programming Lab	0	0	2	50	50	100	1
2	Research Project/ Dissertation	BCA482	Major Dissertation	0	0	24	200	300	500	12
			TOTAL	6	0	26	310	490	900	22

Sr.N	Course Category
1	Major(Core)
2	Minor Stream
3	Multidisciplinary
4	Ability Enhancement Course
5	Skill Enhancement Course
6	Value Added Courses Common for All UG
7	Summer Internship
8	Research Project/ Dissertation

List of Elective Courses		
SN.	ELECTIVE-I:	
1	BCA208	Introduction to AI and ML and Data Science (EL)
2	BCA210	Data Warehousing and Data Mining (EL)
3	BCA212	Data Compression and Multimedia System (EL)

SN.	ELECTIVE-II:	
1	BCA309	Social Media Analytics (EL)
2	BCA311	Big Data Analytics (EL)
3	BCA313	Natural Language Processing (EL)
SN.	**ELECTIVE-III:**	
1	BCA304	Deep Learning (EL)
2	BCA306	Neural Network (EL)
3	BCA308	Introduction To Internet Of Things (EL)
SN.	**ELECTIVE-IV**	
1	BCA407	Mobile Computing (EL)
2	BCA409	Fundamentals of Data Privacy (EL)
3	BCA411	Soft Skills And Interpersonal Communications (EL)
SN.	**ELECTIVE-V:**	
1	BCA404	Cloud Computing (EL)
2	BCA406	Storage Area Network (EL)
3	BCA408	Cyber Analytics (EL)

BCA101: COMPUTER FUNDAMENTAL & EMERGING TECHNOLOGY		
Course Outcome (CO)		
CO1	Demonstrate the knowledge of the basic structure, components, features and Generations of computers.	
CO2	Describe the concept of computer languages, language translators and construct Algorithms to solve problem using programming concepts.	
CO3	Compare and contrast features, functioning & types of operating system and computer networks.	
CO4	Demonstrate architecture, functioning & services of the Internet and basics of Multimedia.	
CO5	Illustrate the emerging trends and technologies in the field of Information Technology.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Computer:** Definition, Computer Hardware & Computer Software, Types of computers, evolution of computers. **Components:** Hardware – Introduction, Input devices, Output devices, Central Processing Unit, Memory-Primary and Secondary Software-Introduction, Types – System and Application. **Computer Languages:** Introduction, Concept of Compiler, Interpreter & Assembler. **Computer Generations**: Generations of Computers.	**8**
II	**Operating system:** Definition, Functions, Types, Classification, concept of multiprogramming, multitasking, multithreading, multiprocessing, single-user & multi-user operating system. **Computer Network:** Overview, Types (LAN, WAN and MAN), Transmission medium, topologies.	**8**
III	**Internet:** Overview, Architecture, Functioning, Basic services like- WWW, FTP, HTTP, Telnet, etc., Search engines-mail, Web Browsers. **Internet of Things (IOT):** Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.	**8**
IV	**Block chain:** Introduction, overview, features, limitations and application are as fundamentals of Block Chain. **Cloud Computing:** It nature and benefits, AWS, Google, Microsoft & IBM Services.	**8**
V	**Emerging Technologies:** Introduction, overview, features, limitations and application areas of Augmented Reality, Virtual Reality, Grid computing, Green computing, Bigdata analytics, Quantum Computing and Brain Computer Interface	**8**

Reference Books:

1. Gupta Seema (2020), Digital Marketing, Mc Graw Hill Publications.
2. Puthussery Antony (2020), Digital Marketing. Notion Press.
3. Bhatia Puneet (2019), Fundamentals of Digital Marketing, Pearson Publications.
4. Greenstein, Electronic Commerce, Tata McGraw Hill, New Delhi.
5. Norton, Peter: Introduction to Computer 4/E, Tata McGraw Hill (P) Ltd., New Delhi.

BCA103: SOFTWARE ENGINEERING		
Course Outcome (CO)		
CO1	To apply fundamental software engineering principles.	
CO2	To apply fundamental software engineering practices to real-world scenarios.	
CO3	To compare and contrast different SDLC models.	
CO4	To analyze user needs and translate into clear, concise, and measurable requirements.	
CO5	To apply fundamental project management principles.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	Introduction of Software Engineering ,Software Development Life Cycle, Software Process Introduction, S/W Engineering Paradigm life cycle models: waterfall, incremental, spiral, win-win spiral, Agile, evolutionary, prototyping , Object-Oriented life cycle models-system engineering , computer-based system, life cycle process, development process.	**8**
II	Requirements Software Requirements: Functional & non-functional ,user- system requirement engineering process , feasibility studies , elicitation, validation & management , software prototyping ,S/W documentation, Analysis and modeling, Case Tools.	**8**
III	Design: Design Concepts and Principles Modular design, design heuristic, Software architecture, data design, architectural design, transform & transaction mapping, Introduction to SCM process, Software Configuration Items.	**8**
IV	Testing, Software Testing Taxonomy of Software testing, levels , black box testing, testing boundary conditions ,structural testing ,regression testing, Software testing strategies, unit testing, integration testing ,validation testing, system testing and debugging , Traceability matrix.	**8**
V	Software Project Management Software cost estimation, Function point models, COCOMO model, Project Scheduling-Delphi method, Software challenges, and Software Maintenance, Reliability, Reliability and availability models.	**8**

Reference Books:

1. Roger S.Pressman, Software Engineering- A practitioner's Approach, McGraw-Hill
2. Ian Sommerville, Software engineering, Pearson education Asia
3. Pankaj Jalote, Software Engineering – A Precise Approach Wiley
4. Behhforoz & Frederick Hudson, Software Engineering Fundamentals, OXFORD
5. Rajib Mall, Fundamentals of software Engineering, Prentice Hall of India.
6. Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner's ViewPoint, Wiley
7. Merlin Dorfman (Editor), Richard H. Thayer (Editor) ,Software Engineering
8. Robert C. "Uncle Bob" Martin, Clean Architecture: A Craftsman's Guide to Software Structure and Design.

BCA105: PRINCIPLES OF PROBLEM SOLVING USING C		
Course Outcome (CO)		
CO1	Elucidate the basic architecture and functionalities of a Computer	
CO2	Apply programming constructs of C language to solve the real-world problems	
CO3	Explore user-defined data structures like arrays, structures and pointers in implementing solutions to problems	
CO4	Design and Develop Solutions to problems using structured programming constructs such as functions and procedures	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction**: Introduction to C, Assembler, Compiler, Interpreter, Loader and Linker. Algorithm: Representation of Algorithm, Flowchart. **Programming Basics:** Structure of C Program, Writing and Executing the First C Program, Syntax and Logical Errors in Compilation, Object and Executable Code. Components of C Language. Standard I/O in C, Fundamental Data types, Variables and Memory Locations, Storage Classes.	8
II	**Conditional Control Statements:** if statement, if-else statement, if-else-if statement, nested-if statement, While-loop, do-while loop, for-loop, break statements, continue statements, switch statement, goto statement. **Operators**- Operators, Types of operators. **Functions**: Introduction, Types, Declaration of a Function, Function calls, Defining functions, Function Prototypes, Passing arguments to a function Return values and their types, Writing multi-function program, Calling function by value, Recursive functions.	8
III	**Arrays**: Array and representation of an array, Declaring one-dimensional array, Initializing arrays, Accessing array elements, Manipulating array elements, Arrays of unknown or varying size, Two-dimensional arrays, Multidimensional arrays. **Strings**: Introduction, Initializing strings, Accessing string elements, Array of strings, Passing strings to functions, String functions. **Pointers**: Introduction, Characteristics, Pointer type declaration and assignment, Pointer arithmetic, Call by reference, Passing pointers to functions, array of pointers, Pointers to functions, Pointer to pointer, Array of pointers.	8
IV	**Structure**: Introduction, Initializing, defining and declaring structure, Accessing members, Operations on individual members, Operations on structures, Structure within structure, Array of structure, Pointers to structure. **Union**: Introduction, Declaring union, Usage of unions, Operations on union. Enumerated data types	8
V	**Dynamic Memory Allocation:** Introduction, Library functions– malloc(), calloc(), realloc() and free. **File Handling:** Basics, File types, File operations, File pointer, File opening modes, File handling functions, File handling through command line argument, Record I/O in files.	8
Reference Books:		

1. Let Us C (17th Edition) – Yashavant Kanetkar, BPB Publications, 2023
2. Programming in ANSI C (8th Edition) – E. Balagurusamy, McGraw Hill Education, 2023.
3. K.R.Venugopal, Programming with C,1997, McGraw-Hill.

BAS105: MATHEMATICAL FOUNDATION		
	Course Outcome (CO)	
CO1	Students will be able to demonstrate competency in the areas that comprise the core of the mathematics major.	
CO2	They will be able to solve applied problems with the application of differentiation and integration.	
CO3	They will be able to use appropriate technologies to solve mathematical problems.	
CO4	They will be able to apply matrices in different industry problems.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**BASIC CONCEPTS:** Definition of Sets, Number systems, Relations Functions. **LIMIT CONTINUITY:** Definition of limit, Limit of a function, Right and Left hand Limits, Algebra of limits, General principle for existence of limit, limit of inequalities, Method of finding limits, Continuity of functions, Cauchy's definition, graphical meaning of continuity, Kinds of discontinuities. **DIFFERENTIAL CALCULUS:** Successive differentiation, Leibnitz theorem, Partial differentiation, Euler's Theorem, change of variables, Jacobian theorem.	8
II	**SEQUENCE:** Definition of Sequence, Series and Progression; Definition of Arithmetic Progression (AP); nth term of an AP; sum of n terms of an AP; Arithmetic Mean (AM); Properties of AP; Definition of Geometric Progression (GP); nth term of a GP; Sum of n terms of a GP; Geometric Mean (GM); Properties of GP; Definition of Harmonic Progression (HP); Harmonic Mean (HM); Relations between AM, GM and HM.	8
III	**MATRICES:** Definition of a Matrix; Various Types of Matrices; Operations on Matrices; Symmetric and Skew-Symmetric Matrices; Row Operations, Column Operations; Inverse of a Matrix by Elementary Row Operations. Determinants: Concept of Determinant; Minors and Co-factors in Determinants; Expansion of a Determinant; Properties of Determinants.	8
IV	**DIFFERENTIATION:** Basic Formulae of Differentiation; Differentiation from the First Principle; Derivative of the Product of Functions, Quotient of two functions, Function of a function (Chain Rule). Derivatives of Exponential functions, Logarithmic functions, Inverse Trigonometric functions; Differentiation by Trigonometrical Transformations; Differentiation of Implicit functions; Differentiation using Logarithms.	8
V	**COORDINATE GEOMETRY:** Straight lines, Circles and the system of circles; standard equations and properties of Parabola. Ellipse and Hyperbolas, General equation of second degree in two variables, tracing of simple conic section.	8

Reference Books:

1. E. Kreyzig, "Engineering Mathematics".
2. B.S. Grewal, "Higher Engineering Mathematics"
3. Shanti Narayan, "Differential Calculus"

BAS107: REMEDIAL ENGLISH		
Course Outcome (CO)		
CO1	To develop awareness of the complexity of the communication process	
CO2	To develop effective listening skills in student	
CO3	To develop effective oral skills	
CO4	To develop effective oral skills	
CO5	To develop ability to communicate effectively	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Basic Language Skills and Grammar**: learn and practice basic communicative skills such as themselves, interact with strangers and to open the conversation, basics of reading phonetic transcript and pronunciation.	*8*
II	**Communicative English:** understand the purpose and responses in an interpersonal communication understand the dynamics of group communication, Group Presentations.	*8*
III	**Listening Skills:** Importance of Listening Skills, Obstacles to listening, cultivating good.	*8*
IV	**Business Correspondence:** Theory of Business Letter Writing, Effective Letter Writing, effective Email Writing, Job Application Letter and Resume.	8
V	**Language and Writing Skills:** Commercial Terms used in Professional Communication, Interpretation of technical data, Composition on a given situation, a short informal report etc.	8

Reference Books:

1. Lesikar " Business Communication" AITBC
2. S. M. Ray "Business Communication" HP

IKS101: IKS-I (INDIAN KNOWLEDGE SYSTEM – I)

	Course Outcome (CO)	
CO1	Creating awareness amongst the youths about the true history and rich culture of the country.	
CO2	Understanding the scientific value of the traditional knowledge of Bharata.	
CO3	Promoting the youths to do research in the various fields of Bhartiya knowledge system.	
CO4	Converting the Bhartiya wisdom into the applied aspect of the modern scientific paradigm.	
CO5	Adding career, professional and business opportunities to the youths.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Indian Education** • Vedic Education: Focuses on the traditional system of learning during the Vedic period. • Spiritual and Moral Development: The role of education in promoting ethics and spiritual growth. • Intellectual Growth: How Vedic education contributed to intellectual advancement. Social and Cultural Refinement: The cultural impact of education on society.	3
II	**Methodology of Indian Knowledge System** • **Pramana:** The means of obtaining knowledge and validation in Indian philosophy. • **Nyaya:** Logical reasoning and debate in the Indian knowledge tradition.	3
III	**Indian Metallurgy** • **Indian Text for Metallurgy:** Ancient Indian scriptures related to metallurgy. • **Important Specimens of Metals Preserved/Found:** Notable examples of metalwork from Indian history. • **Vedic References of Metals:** Mentions of metals in Vedic texts and their significance.	3

IV	**Indian Health Sciences**
	
	• **Literature:**
	  o **Vedic Foundations of Ayurveda:** Ancient texts that form the basis of Ayurveda.
	  o **Ayurveda Concern for Good Health:** Focus on holistic well-being.
	  o **Three Guna, Three Dosha, Panch Mahabhoot, Sapta Dhatu, Six Rasa:** Concepts central to Ayurveda.
	  o **Dincharya & Ritucharya:** Daily and seasonal regimens for health.
	• **Practical:**
	  o **Sushruta Samhita:** Ancient text on surgery.
	  o **Charaka Samhita:** Ayurvedic text on medicine.
		3

	o **Ashtanga Hridaya – Sutra Sthana:** An Ayurvedic classic. o **Qualities of a Surgeon:** The required attributes of a good surgeon. **Surgical Practices:** Ancient Indian surgical methods.	
V	**Foundational Literature of Indian Civilization** **Vedang, Ayurveda, Natya Shastra, Dharma Shastra, Arthashastra:** Key texts that shaped Indian civilization in various fields like linguistics, health, arts, law, and politics.	3
VI	**Bharata varsha—A Land of Rare Natural Endowments** **Seasons, Land Variations, Heritage, Natural Resources, Geographical Isolation:** The geography of India and how it shaped the country's culture, heritage, and resources.	3

<u>**Reference Books:**</u>

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

	BCA171: OFFICE AUTOMATION LAB	
	Course Outcome (CO)	
CO1	Demonstrate the knowledge of the basic structure, components, features and Generations of computers.	
CO2	Describe the concept of computer languages, language translators and construct Algorithms to solve problem using programming concepts.	
CO3	Compare and contrast features, functioning & types of operating system and computer networks.	
CO4	Demonstrate architecture, functioning & services of the Internet and basics of Multimedia.	
CO5	Illustrate the emerging trends and technologies in the field of Information Technology.	
	DETAILED SYLLABUS	
Unit	**Topic**	**Proposed Lecture**

	Demonstrate the various hardware components of computer system.
	
	 1. Open the command prompt and create a directory in C: system drive using MS DOS commands. Now change the directory and create a subdirectory in this folder.
	 2. Create the following directory structure using MS DOS commands
	
	     ❖ UIM
	     ❖ UIT
	        • CSE
	        • MECH
	     ❖ LAW
	     ❖ USCS
	        • MCA
	        • BCA
	        • BSCIT
	
	 i. Remove the directory named MECH and MGT.
	 ii. Remove the directory named UIT in single step.
	 iii. Rename the directory LAW to LLB
	 iv. Display the directory structure of UU.
	 v. Rename the directory named BSCIT to BSIT.
	
	 3. Create Microsoft Word document with the name as UIM-MY-BIOGRAPHY. Write about your basic information, likes, dislikes, strengths and weakness. Along with, write the fields in which you excel. Also write about the concepts that inspire you. The font size of the title must be 14 and that of remaining text as 12. The font must be Times New Roman. Write a short biography having not more than 150 words.
	
	 4. Create your C.V. using pre-installed templates in WORD.
	 1- Use table for education qualification, apply paragraph formatting while stating the summary at the end of your C.V., use bullets and numbering wherever applicable
	 2- Use TIMES NEW ROMAN with font of size 12 and for heading size 14.
	
	 5. Invite your friends and relatives to your birthday party by creating a .mdb and linking it with the word document using a utility called Mail Merge. The list of invitees should not be less than 15. Apply formatting to the invitation - apply page borders to the final merged document. Provide the word "birthday invitation " in the header part and "name and contact number" in the footer part.	

6. Create the following table in MS Word and name it as UIM-Student.

Roll no.	Name	Father's Name
1	Aman	Akhilesh Sharma
2	Raman	Narendra Gupta

Insert one more row in the existing table and input the data as: Roll no=3, Name= Daman, Father's Name= Anuj Kumar. Insert one more column named Mother's Name, next to the Column named Father's Name and complete the data of existing records. The student named "Raman" decided to leave the course, so his record needs to be removed from the table. Apply table design to improve its visibility.

7. Create a power point presentation of topic of your own choice and apply different transitions, animations to the slide in your presentation. You must have at least 15 slides in your presentation.

NOTE:- The presentation must have table of contents, consisting of
1. Introduction
2. History/ Background
3. Features
4. Working
5. Advantages
6. Limitation
7. Conclusion, if applicable
8. References- mandatory
9. Thank you .

8. Create the record of at least 10 students in MS Excel consisting of the following Columns:-
   Column 1. Serial number
   Column 2. Roll number
   Column 3. University ID
   Column 4. Your name
   Column 5. Father's name
   Column 6. Mother's name
   Column 7. Address
   Column 8. Your contact number
   Column 9. Father's contact number
   Column 10. Mother's contact number
   Column 11. Date of birth
   Column 12. Total Marks obtained in previous semester
   Column 13. Percentage obtained in previous semester
   Consider the following sample table:

						Student Data						
S. No.	R. No.	UID	Name	Father's Name	Mother's Name	Address	Contact No.	Father's Contact no.	Mother's Contact no.	Date of Birth	Marks Obtained in Previous Semester	Percentage Obtained in Previous Semester
1	1	UU101	Aman	Anvit	Sunita	#123, Prem Nagar, Dehradun, UK	7060909060	7060610908	7060615756	12 March 2000	404	
2	3	UU104	Cherry	Amar	Priya	#199, Inkapot, Dehradun, UK	7060607272	7060611120	7060610960	24 March 2000	408	
4	5	UU105	Daman	Simar	Anita	#1233, Clement Town, Dehradun, UK	7060607876	7060612726	7060617574	15 April 2000	433	
5	6	UU106	Elvish	Amit	Priya	#1323, Sudhowala, Dehradun, UK	7060608484	7060613332	7060616180	26 April 2000	340	
6	7	UU107	Gagan	Gurishal	Vishudhvi	#1324, Sudhowala, Dehradun, UK	7060609090	7060613938	7060618786	17 March 2000	350	
7	9	UU109	Ishar	Janjeet	Manria	#1234, Clement Town, Dehradun, UK	7060609696	7060614544	7060619362	28 October 2000	359	
8	10	UU110	Jagan	Anuj	Rajshree	#1235, Clement Town, Dehradun, UK	7060610202	7060615150	7060619998	19 January 2000	351	
9	11	UU111	Komal	Abhishek	Priyanka	#1026, Vasant Vihar, Dehradun, UK	7060610908	7060615756	7060620604	22 March 2000	440	
10	12	UU112	Madan	Pururaj	Anamika	#126, Prem Nagar, Dehradun, UK	7060611514	7060616362	7060621210	26 June 2000	468	

9. Display 10 student's result with
   Column 1. Roll number
   Column 2. Name
   Column 3. Subject 1
   Column 4. Subject 2
   Column 5. Subject 3
   Column 6. Subject 4
   Column 7. Subject 5
   Column 8. Calculate the sum of marks obtained in all the subject
   Column 9. Calculate percentage marks obtained
   Column 10. If percentage is >=40 then display "Pass" in front of that cell otherwise display "Fail"?
   Consider the following sample data:

									Student Data				
S. No.	R. No.	UID	Name	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Marks Obtained	Percentage	Result	Remarks	
1	1	UU101	Aman	61	76	88	66	67	358	71.6	Pass	
2	2	UU102	Baman	43	82	40	82	87	334	66.8	Pass	
3	4	UU104	Cherry	90	67	52	81	82	372	74.4	Pass	
4	5	UU105	Daman	40	78	54	58	67	297	59.4	Pass	
5	6	UU106	Elvish	89	63	85	62	83	382	76.4	Pass	
6	7	UU107	Gagan	98	54	90	56	68	366	73.2	Pass	
7	9	UU109	Ishar	97	74	61	68	94	394	78.8	Pass	
8	10	UU110	Jagan	50	93	72	71	58	344	68.8	Pass	
9	11	UU111	Kamal	92	88	72	83	40	375	75	Pass	
10	12	UU112	Madan	91	51	57	83	48	330	66	Pass	

10. In the above task include the following column as well:
Column 11. Display remarks as "Excellent" if percentage of student is greater than or equal to 85 but less than 95 and display remarks as "Distinction" if percentage is greater than or equal to 95 but less than or equal to 100.

11. Consider the following sample data of students:

S. No.	Male Height	Female Height
1	159	152
2	162	148
3	163	156
4	164	155

1. Find the average height of male and female students respectively.
2. Find the maximum and minimum height of male and female students respectively.

	BCA173: PROGRAMMING IN C LAB	
	Course Outcome (CO)	
CO1	Elucidate the basic architecture and functionalities of a Computer	
CO2	Apply programming constructs of C language to solve the real-world problems	
CO3	Explore user-defined data structures like arrays, structures and pointers in implementing solutions to problems	
CO4	Design and Develop Solutions to problems using structured programming constructs such as functions and procedures	
	DETAILED SYLLABUS	

S.No	PRACTICAL NO.	PRACTICAL TITLE
1	01	Design, Develop Program in C for the following a. to find the greatest of the three numbers. b. to check the entered number is odd or even c. to swap the values of variables using third variable. d. to swap the values of variables without using third variable.
2	02	Design, Develop Program in C for the following a. to check whether the given number is Palindrome number. b. to check whether the number is prime or not.
3	03	Design, Develop and Implement a menu driven Calculator Program in C for the following operations on Integers a. Find addition b. Find subtraction c. Find multiplication d. Find division e. Find reminder f. Exit
4	04	Design, Develop and Implement a Program in C a. to reverse a four-digit integer without using loop. b. to reverse an integer Using While loop.
5	05	Design, Develop Program in C for the following a. to check Fibonacci series of any given number. b. to check factorial of a number using for loop
6	06	Design, Develop and Implement a Program in C to print different Patterns using for loops.
7	07	Design, Develop Program in C for the following a. to show the use of function. b. to show call by value c. to show call by reference
8	08	Design, Develop Program in C for the following a. to show the use of array. b. to sort an array in ascending order c. use of recursive function
9	09	Design, Develop and Implement a menu driven Program in C for the following operations on two-dimensional array of Integers a. Find addition of two matrix b. Find subtraction of two matrix c. Find transpose of a matrix

			d. Exit
	10	10	Design, Develop and Implement a Program in C to show different string operations.
	11	11	Design, Develop and Implement a Program in C a. to show use of structures. b. to show use of nested structures.
	12	12	Design, Develop and Implement a Program in C a. to show use of pointes. b. to show dereferencing of pointer c. to show pointer to pointer.
	13	13	Design, Develop and Implement a Program in C to show the use of calloc() and malloc () function
	14	14	Design, Develop and Implement a Program in C to write the data in file.

Syllabus

BCA 1st Year
IIn^{d} Semester

BSA106: DISCRETE MATHEMATICS	
Course Outcome (CO)	
CO1	Discuss mathematical logic and Boolean algebraic switching circuits & logic circuits.
CO2	Discuss the type of relationship and apply the knowledge using the Hass diagram.
CO3	Discuss the set theory and recursive function. Also, they will construct the grammars.
CO4	Describe graph theory and its applicability in various computer applications.
CO5	Discuss problem in various fields in computer application using the basic concepts of group theory and coding.

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Mathematical Logic:** Proposition & Propositional Form conditional and Bi- conditional Statements, Negation operation, Logic connectives and compound statements, conjunction, disjunction, truth tables, Duality conditional and in-conditional statements.	8
II	**Boolean Algebra**: Development of Boolean Algebra, Truth functions, The AND, OR, NOT operators, Laws of Boolean Algebras, Reducing Boolean Expressions, Boolean expressions and logic diagrams Universal Building blocks, Negative Logic Min terms, Truth tables and K-maps, Reduction of K maps Disjunctive normal form.	8
III	**Set Theory:** Sets, Types of Sets, Basic Operations on Sets, Venn diagram, Cartesian product of two sets, Distributive law, De Morgan's Law. Functions: Interval and sub-intervals. Definition of function and examples, polynomial, rational, exponential, logarithmic and trigonometric functions.	8
IV	**Function and Relation:** Injective and subjective functions, composition of function, Inverse function, Use of function in coding theory, Relation composition of relation, Equivalence relation.	8
V	**Graph theory:** Definition of a graph, finite and infinite graphs, Incidence and degree, null graph, Sub graphs walks, Paths and circuits in a graph, connected graphs, Trees, Properties of Trees, Planner graphs. Incidence Matrix.	8

Reference Books:

1. C.L. Liu, "Elements of Discrete Mathematics" Mc Graw Hill Book Co., 1985
2. N. Deop, "Graph Theory with applications to Engineering and Computer Science", PHI 1993.
3. B. Colman and Robert C. Busby, "Discrete Mathematical structure for Computer Science," PHI.
4. Olympia Nicodemi, "Discrete Mathematics" CBS Publication, Delhi.
5. M.N.S. Swamy and K. Thulasiraman, "Graphs, Networks and Algorithms," Wiley Inter Science, NY, 1989.

BCA102: PYTHON PROGRAMMING		
Course Outcome (CO)		
CO1	Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.	
CO2	Express proficiency in the handling of strings and functions.	
CO3	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.	
CO4	Identify the commonly used operations involving file systems and regular expressions.	
CO5	Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.	

	DETAILED SYLLABUS	
Unit	**Topic**	**Proposed Lecture**
I	**Introduction and Overview: Overview of Python Programming**: Structure of Python Program, Elements of Python, Python Interpreter, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings.	**8**
II	**Operators and Statements:** Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator). Creating Python Programs: Input and Output Statements	**8**
III	**Decision making and Branching:** Control statements (Branching, Looping, Conditional Statement, Difference between break, continue and pass, default Arguments. Defining Functions.	**8**
IV	**Classes and Objects:** An introduction to object-oriented programming in Python. Objects, operator overloading, overriding, special methods. Inheritance, polymorphism and composition	**8**
V	**Iterators and Generators**: Iteration protocol, Inerrable objects, generators and Generator expressions. Use of generators, assertions. Testing and debugging of a python project, Web Scrapping in Python.	**8**

Reference Books:

1. Core Python Programming, W.Chun, Pearson.
2. Introduction to Python, Kenneth A. Lambert, Cengage
3. Learning Python, Mark Lutz, Orielly

BCA104: COMPUTER NETWORK		
Course Outcome (CO)		
CO1	Students will be able to identify some of the factors driving the need for network security.	
CO2	Students can identify and classify particular examples of attacks.	
CO3	Students will able define the terms vulnerability, threat and attack.	
CO4	They may identify physical points of vulnerability in simple networks.	
CO5	Students can compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Network**: Definition, Goals, Point-To Point Networks; Network Topology and their various Types; Types of Network: LAN, MAN, WAN; Modes of Communication: Simplex, Half Duplex, Full Duplex; Protocols and Standards.	8
II	**Network Models:** Design Issues of the Layer, Protocol Hierarchy, ISO-OSI Reference Model: Functions of each Layer, Various Terminology used in Computer Network, Connection-Oriented & Connectionless Services, TCP/IP Model.	8
III	**Transmission Media**: Transmission Media, Guided Media (Wired): Coaxial Cable: Physical Structure, Standards, Twisted Pair, UTP vs. STP, Connectors, Fiber Optics Cable: Advantages & Disadvantages; Unguided Media (Wireless): Wireless Network, Bluetooth.	8
IV	**Network Connectivity Devices**: Categories of Connectivity Devices, Passive and Active Hubs, Repeaters, Bridges, Switches (2-Layer Switch, 3-Layer, Switch (Router), Gateways, Network Security Devices (Firewalls, Proxy Servers).	8
V	**Internet Basics**: Internet: Growth, Architecture, Accessing, Internet Service Providers (ISP), Internet Addressing System: IP Address, DNS, URL; World Wide Web(WWW): Web Servers, Web Browsers, Search Engine; Concept of Intranet & Extranet.	8

Reference Books:

1. Tanenbaum, A.S. "Computer Networks," PHI, 1990.
2. Stallings, W: Data and Computer Communication, Prentice Hall of India.
3. Fororuzan "Data Communication and Networking" TMH.

BCA106: ADVANCE DATABASE MANAGEMENT SYSTEM		
Course Outcome (CO)		
CO1	Identify the basic concepts and various data model used in database design ER modelling concepts and architecture use and design queries using SQL.	
CO2	Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression from queries.	
CO3	Recognize and identify the use of normalization and functional dependency, indexing and hashing technique used in database design.	
CO4	Recognize/ identify the purpose of query processing and optimization and also demonstrate the basic of query evaluation.	
CO5	Apply and relate the concept of transaction, concurrency control and recovery in database.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction**: Data, information and knowledge, Characteristics of database approach, Data independence, Architecture of database system, Data dictionary, Types of database language, database system life cycle, Overview of hierarchical, network and relational model. Relations and Codd's rules, Concepts of keys.	**8**
II	**Relation Algebra**: Select, Project, Joins, Set operations, Update operations – tuple relational calculus, Relational Calculus vs. relational algebra. Data definition, data manipulation, view definition, nested queries, updation, Embedded SQL, Handling of nulls and cursors.	**8**
III	**Data Models**: Conceptual, Logical and Physical design, ER models, ER diagrams, Strong and weak entity sets, Generalization, Specialization and Aggregation, Conversion of ER model into relational schemas, Extended Relational Model & Object Oriented Database System; New Data Types, User Defined Abstract Data Types	**8**
IV	**Normalization**: Normalization concepts, Functional dependencies and dependency preservations, Normal forms – 1NF, 2NF, 3NF, BCNF, 4NF, 5NF. **SQL**: Introduction, Data definition, views and queries in SQL, SQL construct, Type of SQL (Brief Overview), SQL Join: Multiple table queries, Built-in functions, Specifying constraints and indexes in SQL, Data Manipulation, Data maintenance, Multiple Table Operations, Transaction integrity facilities, Overview of ORACLE; (Data Type, DDL, DML, DCL).	**8**
V	**Transaction Handling**: Transaction recovery, System recovery, two phase commit, concurrency problems, locking, deadlocks, security.	**8**

Reference Books:

1. C.J. Date, "An introduction to Database system: Vol. 1, Addision Weseley.
2. Bipin Desai, "An introduction to Database system", Galgotia Publications, New Delhi.
3. Korth, "Database and its Concept", TMH.
4. DBMS, Katson Publication, New Delhi.

BAS108: ENVIRONMENTAL SCIENCE		
Course Outcome (CO)		
CO1	This course will help students understand the importance of these resources and how to preserve these resources.	
CO2	Environment studies will also help students to develop the knowledge and skills required to address challenging environmental issues.	
CO3	It will help them understand how their decisions and actions affect the environment.	
CO4	Students will be made aware about the various types of pollution, and how to minimize them.	

DETAILED SYLLABUS		
Unit	Topic	Proposed Lecture
I	**Origin of Earth and System processes :** Solar system formation and planetary differentiation; formation of the Earth: formation and composition of core, mantle, crust; chemical composition of Earth; geological time scale and major changes on the Earth's surface; Holocene and the emergence of humans. Concept of plate tectonics and continental drift theory, continental collision and formation of the Himalaya; ocean floor spreading; mantle convection and, major plates; earthquakes; volcanic activities; orogeny; isostasy; gravitational and magnetic fields of the earth; paleontological evidences of plate tectonics.	6
II	**Minerals and rocks:** Minerals and important rock forming minerals; rock cycle: lithification and metamorphism; Three rock laws; rock structure, igneous, sedimentary and metamorphic rocks; weathering: physical, biogeochemical processes; erosion: physical processes of erosion, factors affecting erosion; agents of erosion: rivers and streams, glacial and aeolian transportation and deposition of sediments by running water, wind and glaciers.	6
III	**Earth surface processes:** Atmosphere: evolution of earth's atmosphere, composition of atmosphere, physical and optical properties, circulation; interfaces: atmosphere–ocean interface, atmosphere–land interface, ocean–land interface; land surface processes: fluvial and glacial processes, rivers and geomorphology; types of glaciers, glacier dynamics, erosional and depositional processes and glaciated landscapes; coastal processes.	6
IV	**Importance of being a mountain:** Formation of Peninsular Indian mountain systems - Western and Eastern Ghats, Vindhyas, Aravalli, etc. Formation of the Himalaya; development of glaciers, perennial river systems and evolution of monsoon in Indian subcontinent; formation of Indo-Gangetic Plains, arrival of humans; evolution of Indus Valley civilization; progression of agriculture in the Indian subcontinent in Holocene; withdrawing monsoon and lessons to draw.	6

Reference Books:

1. Anji Reddy .M (2007), Textbook of Environmental Sciences and Technology, Hyderabad, BS Publications.
2. Y Anjaneyulu.(2004), Introduction to Environmental Sciences, BS Publications

BCA180: ADVANCE DATABASE MANAGEMENT SYSTEM LAB		
Course Outcome (CO)		
CO1	Identify the basic concepts and various data model used in database design ER modelling concepts and architecture use and design queries using SQL.	
CO2	Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression from queries.	
CO3	Recognize and identify the use of normalization and functional dependency, indexing and hashing technique used in database design.	
CO4	Recognize/ identify the purpose of query processing and optimization and also demonstrate the basic of query evaluation.	
CO5	Apply and relate the concept of transaction, concurrency control and recovery in database.	
DETAILED SYLLABUS		

1. Create a table named uim_employee having attributes such as: Employee id, Employee name, Employee's department number, Employee's date of joining, Employee's salary, Employee's email_id and Employee's contact number.
Consider the following table:

Attribute	Datatype	Size
employee_id	Varchar2	10
employee_name	Char	25
employee_department_no	Number	03
employee_date_of_joining	Date	-
employee_salary	Number	8,2
employee_email_id	Varchar2	30
employee_contact_no	Number	12

Note: Insert department number values as 111, 222, 333, 444, ...etc.

Note: Insert employee id values as UU1001, UU1002, UU1003, UU1004, ...etc.

Write SQL queries to:

i. Insert at least 10 tuples in the table.

ii. Display employee's complete details including *employee_id*, *employee_name*, *employee_department_no*, *employee_date_of_joining*, *employee_salary*, *employee_email_id* and *employee_contact_no*.

iii. Display employee's complete details including *employee_id*, *employee_name*, *employee_department_no*, *employee_date_of_joining*, *employee_salary*, *employee_email_id* and *employee_contact_no* who work in department number 444.

iv. Display *employee_id, employee_name* and *employee_date_of_joining* who work in work in department number 222.

v. Delete the employee's details having *employee_id* as UU1003.

vi. Update employee_contact_no to 9592929295 having *employee_id* as UU1007.

2. Implement DDL and DML on the uim_employee table.
Consider the following table:

Attribute	Datatype	Size
employee_id	Varchar2	10
employee_name	Char	25
employee_department_no	Number	03
employee_date_of_joining	Date	-
employee_salary	Number	8,2
employee_email_id	Varchar2	30
employee_contact_no	Number	12

i. Add a new column named *employee_address* having data type as varchar2, size 30 in the uim_employee table.

ii. Update the addresses of existing uim_employees in the table.

iii. Drop the column named *employee_date_of_joining* from the table.

iv. Modify the size of the column named *employee_contact_no* to 14.

v. Rename the table to *uim_employee_details* from the table name *uim_employee*.

vi. Truncate as the records from the *uim_employee_details* table.

vii. Drop the table named *uim_employee_details*.

3. Implementation of keys and constraints concept. Create a table named uim_student having attributes such as: student's roll number, student's name, student's date of birth, student's course, student's house address, student's contact number, student's aadhaar number. The attribute named: student_roll_no has a PRIMARY KEY constraint, student_name has NOT NULL constraint, student_ aadhaar _no as UNIQUE constraint. Consider the following table:

Attribute	Datatype	Size	Constraint
student_roll_no	Number	3	PRIMARY KEY
student_name	Char	25	NOT NULL
student_date_of_birth	Date	-	-
student_course	Varchar	15	-
student_address	Varchar2	30	-
student_contact_no	Number	10	-
student_aadhaar_no	Number	12	UNIQUE

i. Describe the structure of uim_student table.

ii. Insert few tuples in the table.

iii. Examine the error message by inserting same *student_roll_no* values for two rows. Write the error message and reason.

iv. Examine the error message by NOT inserting *student_name* value in a row in the table.

Write the error message and reason.

v. Examine the error message by inserting same *student_ aadhaar_no* values for two rows. Write the error message and reason.

4.　　Implementation of Foreign key concept using two tables named: uim_employee and uim_department. The employee table has employee's id, employee's name and employee's department number. The department table has department number, department name and department location.
Consider the following two tables:

Table name: uim_employee				Table name: uim_department			
Attribute	Data type	Size	Constraint	Attribute	Data type	Size	Constraint
employee_id	Char	8	-	department_no	Number	3	PRIMARY KEY
employee_name	Varchar2	20	-	department_name	Char	15	-
employee_department_no	Number	3	FOREIGN KEY	department_location	Varchar2	20	-

i. Display the structure of uim_employee table

ii. Display the structure of uim_department table

ii. Insert at least three department details in the uim_department table.

iv. Display the data of uim_department table.

v. Insert employee's details working in the corresponding departments as in the uim_department table.

vi. Display the data of uim_department table.

ii. Examine the error message by inserting a value in *employee_department_no* which is NOT there in uim_department table's *department_no*. Write the error message and reason.

ii. Delete any department number from the uim_department table and examine its effects in uim_employee table.

5.　　Create a table named *employee_contact_details* from *employee* table by taking the attribute named: *employee_id*.
　　Consider the table below:

Table name: employee_contact_details		
Attribute	Datatype	Size
employee_id	employee_id from employee table	

i. Display the contents of *employee_contact_details*table

ii. Add a new column employee_contact_no having data type as Number and size as 12 in *employee_contact_details* table

iii. Display the contents of employee_contact_details table.

iv. Update the contact details of existing employees

BCA182: PYTHON PROGRAMMING LAB		
Course Outcome (CO)		
CO1	Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.	
CO2	Express proficiency in the handling of strings and functions.	
CO3	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.	
CO4	Identify the commonly used operations involving file systems and regular expressions.	
CO5	Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.	
DETAILED SYLLABUS		
	LIST OF PROGRAMS:	

1. Input and Output

(a) Write a program to find the largest element among three Numbers.

(b) Write a program to print the sum of all the even numbers in the range 1 - 50 and print the even sum.

(c) Write a Program to display all prime numbers within an interval of given X1 & X2.

2. Variables and Functions

a. Write a program to swap two numbers without using a temporary variable.

b. Write a program to define a function with multiple return values.

c. Write a program to define a function using default arguments.

3. Loops and conditionals

a. Write a program to print the following patterns using loop: *

** *** ****

b. Write a program to print multiplication table of a given number X1 to range X2.

4. Strings

a. Write a program to find the length of the string without using any library functions.

b. Write a program to check if two strings are anagrams or not.

c. Write a program to check if the substring is present in a given string or

not.

5. Lists

 a. Write a program to perform the given operations on a list:
   i. add   ii. insert   iii. slicing

 b. Write a program to perform any 5 built-in functions by taking any list.

 c. Write a program to get a list of the even numbers from a given list of numbers. (use only comprehensions)

6. Tuples

 a. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.

 b. Write a program to return the top 'n' most frequently occurring chars and their respective counts. e.g. aaaaabbbbcccc, 2 should return [(a 5) (b 4)]

7. Sets

 a. Write a program to count the number of vowels in a string (No control flow allowed).

 b. Write a program that displays which letters are present in both strings.

 c. Write a program to sort given list of strings in the order of their vowel counts.

8. Dictionaries

 a. Write a program to check if a given key exists in a dictionary or not.

 b. Write a program to add a new key-value pair to an existing dictionary.

 c. Write a program to sum all the items in a given dictionary.

9. Files

 a. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper case words from source must be lowered.

 b. Write a program to find the most frequent words in a text. (read from a text file).

10. Classes

 a. Write a Python class named Person with attributes name, age, weight (kgs), height (ft) and takes them through the constructor and exposes a method get_bmi_result() which returns one of "underweight", "healthy", "obese".

 b. Write a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle.

11. Arrays

 a. Write a program to create, display, append, insert and reverse the order of the items in the array.

 b. Write a program to add, transpose and multiply two matrices.

Syllabus

BCA 2nd Year
IIIrd Semester

BCS213: AI FOR EVERYONE		
Course Outcome (CO)		
CO1	**Understand** the fundamental principles and applications of AI in different industries.	
CO2	**Explain** key AI techniques, including supervised and unsupervised learning, deep learning, and neural networks.	
CO3	**Analyze** ethical challenges and biases in AI systems and their impact on society.	
CO4	**Apply** AI-driven solutions in fields like healthcare, finance, and automation.	
CO5	**Critically evaluate** the benefits and risks associated with AI technologies.	
DETAILED SYLLABUS		
Unit	Topic	Proposed Lecture
I	**Introduction to AI (Concept + Hands-on):** What is AI? Understanding AI vs. Machine Learning vs. Deep Learning, AI in daily life: Smart assistants, AI in social media, AI in e-commerce, Prompt Engineering, Real Life Applications of AI. Tools: Explore AI-based tools (Google AI, ChatGPT , MetaAI,Gemini).	8
II	**Introduction to Machine Learning and Deep Learning:** Introduction to learning theory, Methods and Models.Supervised vs. Unsupervised Learning (Examples from real life), Reinforcement Learning, Introduction to ANN and Deep Learning.	9
III	**Computer Vision & Image Processing:** Introduction to Image processing and Computer Vision ?, Hardware used, Face Recognition, Object Detection, and AI-powered Cameras, How AI understands text & speech, AI in Chatbots, Sentiment Analysis, and AI-based Translation Practical	9
IV	**AI in Automation & Robotics:** AI-powered automation in businesses, How AI is used in robotics and smart homes, Ethical AI & Responsible AI, Bias in AI and fairness in decision-making, How to use AI responsibly.	8
V	**Mini AI Projects (Without Coding):** Hands-on Project Options: AI for Image Classification: Train an AI model to recognize objects Create an AI Chatbot: Use Dialog flow or Chatbot.com AI in Business: Automate tasks using AI-based productivity tools.	8

Suggested Readings:

1. **Software Engineering**, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
2. Software **2Engineering: A Primer**, Waman S Jawadekar, Tata McGraw-Hill, 2008
3. Software Engineering, **3Principles and Practices**, Deepak Jain, Oxford University Press.
4. Software Engineering1: **4Abstraction and modelling**, Diner Bjarne, Springer International edition, 2006.
5. Software **5Engineering2:** Specification of systems and languages, Diner Bjorner, Springer International edition 62006.
6. **Software Engineering** Principles and Practice, Hans Van Vliet, 3rd edition, John Wiley & 7Sons Ltd.
7. **7. Software Engineering3**: Domains, Requirements, and Software Design, D. Bjorner, 8Springer International Edition. 8. Introduction to Software Engineering, R. J. Leach, CRC Press.

BCA201: Management Information Systems (MIS)		
Course Outcome (CO)		
CO1	Explain the importance and functioning of MIS in business contexts.	
CO2	Analyze and evaluate decision support systems and their business impact.	
CO3	Apply database and data management techniques in business solutions.	
CO4	Understand and assess e-commerce and enterprise applications.	
CO5	Address security challenges and explore emerging trends in MIS.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Definition and components of MIS** Types of Information Systems: TPS, MIS, DSS, ESS, Role of MIS in business organizations, System development life cycle (SDLC), Information system resources: hardware, software, people, data, processes, Ethical and social issues in IS	8
II	**Decision-Making Process and types of decisions**, Simon's Model of Decision-Making, DSS and GDSS (Group Decision Support Systems), Role of MIS in decision support, Business Intelligence (BI) and Data Mining, Case studies on decision-making using MIS	9
III	**Basics of Data, Information, and Knowledge** Database Management Systems (DBMS) – concepts and types Data Models: Relational, Hierarchical, Network, Data Warehousing and Data Mining, Big Data & Cloud Computing in MIS,SQL Basics and database applications in business.	9
IV	**E-commerce:** types, models (B2B, B2C, C2C, G2C), advantages & challenges ERP Systems: Introduction, modules, implementation, benefits, Supply Chain Management (SCM) and Customer Relationship Management (CRM, E-Governance and E-Business Applications, Mobile Commerce (M-commerce), Digital Payments, and Security	8
V	**Information Systems Security and Emerging Trends** IS Security Threats: malware, phishing, hacking, cybercrime, Security Measures: encryption, firewalls, antivirus, disaster recovery, Information Security Policies and Governance, Emerging trends: IoT, AI in MIS, Blockchain, Cloud Services, Case Studies on security breaches and mitigation.	8

Suggested Readings:

Textbook:
   1. "Management Information Systems" by **Kenneth C. Laudon & Jane P. Laudon**, Pearson Education
Reference Books:
   1. "Management Information Systems" by W.S. Jawadekar, Tata McGraw-Hill
   2. "Information Systems for Managers" by Gordon B. Davis
   3. "MIS: Managing the Digital Firm" by Laudon & Laudon, Pearson
   4. "Enterprise Resource Planning" by Alexis Leon, Tata McGraw-Hill
   5. "Introduction to Information Systems" by James A. O'Brien & George M. Marakas, McGraw-Hill

BCA203: DATA STRUCTURE USING C		
Course Outcome (CO)		
CO1	Able to understand basics of C programming language and arrays.	
CO2	Able to understand basic concepts of linked list.	
CO3	To understand the basic concepts of stack and queues through array and linked list.	
CO4	To understand the basic knowledge of trees and graph.	
CO5	Able to understand the concepts of sorting and searching techniques.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Introduction to Data Structure, Efficient use of memory, Elementary Data Organization, Structure operations, Time and space complexity of algorithms and asymptotic notations. Array Definition and Representation, Single and Multidimensional Arrays, Address calculation, Application of arrays, Character String in C, Character string operation, Array as Parameters	8
II	**Linked list:** Representation and Implementation of Singly Linked List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, doubly linked list and dynamic storage management, Circular Link List, Garbage Collection and Compaction.	9
III	**Stacks & Queues:** Introduction to Stack, Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Linked Representation of Stack, Application of stack: Postfix and Prefix conversions, Evaluation of expressions using stack. Introduction to Queue, Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues and De-queue, Priority Queues.	9
IV	**Trees & Graph Theory:** Basic terminology, Binary Trees, Binary tree representation and Traversal, Algebraic Expressions, Complete Binary Tree, Threaded Binary trees, Binary Search Tree (BST), Height balanced tree and various Rotations. Graph Theory: Terminology & Representations, Traversal- BFS and DFS, Dijkstra's algorithm for shortest path, Prim's and Kruskal's Algorithm for Minimal Spanning tree	8
V	**Searching & Sorting:** Sequential search, Binary search, and Hash search, Comparison and analysis. Sorting: Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Two Way Merge Sort and Heap Sort.	8
Suggested Readings: **Reference Books:** 1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia Publication Pvt. Ltd., New Delhi 2. M. Tenenbaum, "Data Structures using C & C++", Prentice-Hall of India Pvt. Ltd., New Delhi.		

BAS205: MATHEMATICS-III		
	Course Outcome (CO)	
CO1	Recalls limit continuity & differentiation.	
CO2	Describe various theorems of calculus.	
CO3	Recall proper and improper integrals.	
CO4	Compute multiple integrals.	
CO5	Interpret vector calculus.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	Differential Calculus-I Review of limit, continuity and differentiability, uniform continuity, Sequences and series, limsup, liminf, convergence of sequences and series of real numbers, absolute and conditional convergence, Successive differentiation, Leibnitz"s theorem for the nth derivative of the product of two function.	8
II	Differential Calculus-II Mean value theorem, Maclaurin"s & Taylor"s expansion of functions, Functions of several variables, limit and continuity, partial derivatives and differentiability, gradient, directional derivatives, chain rule, Taylor"s theorem, maxima and minima and the method of Lagrange multipliers, curve tracing.	9
III	Integral Calculus Riemann integral, fundamental theorem of integral calculus, applications of definite integrals, improper integrals, beta and gamma functions.	9
IV	Multiple Integrals Double Integration: Evaluation of Double Integral (In Cartesian and Polar form), change of order of integration, Jacobian and change of variables. Triple integrals: Triple integration, change to spherical- Coordinates, calculation of volume, surface area, mass.	8
V	Vector Calculus Vector differentiation, scalar and vector point function, Geometric meaning of gradient, Equation of normal line and normal plane, Equation of tangent line and tangent plane, Directional derivative, Divergence of vector function and its interpretation, Curl and their physical interpretation, Line integral, Surface integral, Volume integral, Gauss and Stokes" theorems with applications.	8

Suggested Readings:

1. Dass, H.K; Introduction to Engg. Mathematics, Vol-I, S.Chand
2. Bali, N. P.; Engg. Mathematics Vol-I, Laxmi Publication
3. Grewal, BS; Engg. mathematics Vol-I, Khanna Publication
4. Vashishtha, A.R.; Engg. Mathematics Vol-I, PragatiPrakashan

BCA205: WEB DEVELOPMENT		
Course Outcome (CO)		
CO1	Know different OS types and basic component of OS Architecture.	
CO2	Analyze issues in process management and evaluations of various scheduling algorithms.	
CO3	Understand process synchronization problem and provide solution for critical section problem and deadlock management.	
CO4	Analyze and implement various memory management techniques.	
CO5	Understand various disk scheduling algorithms and Process Management in Unix.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction**: Introduction to Internet, www, Internet browsers, what is web, Introduction to Client Server Concepts, History of the web, Growth of the web, protocols governing the web, web development strategies, Web applications, web project, web team.	8
II	**Web Page Designing**: HTML: list, table, images, frames, forms, Cascading Style Sheet (CSS); XML: Introduction to XML, DTD, XML schemes, presenting and using XML.	9
III	**Scripting:** Introduction to Java script, variables, control structures, looping structures, documents, forms, statements, functions, objects, event and event handling, Arrays; Introduction to VB Script, Fundamental of AJAX.	9
IV	**Server Site Programming**: Introduction to java server pages (JSP), JSP application design, tomcat server, JSP Life Cycle, JSP Implicit objects, JSP Scripting Elements, declaring variables, and methods, debugging, sharing data between JSP pages, Session, Database with JSP, Introduction to active server pages (ASP), ASP.NET.	8
V	**PHP (Hypertext Preprocessor**): Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form mail, file upload, session, error, exception, filter, PHP-ODBC.	8

Suggested Readings:

Reference Books:
1. Burdman, Jessica, "Collaborative Web Development" Addison Wesley
2. Xavier, C, "Web Technology and Design", New Age International
3. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication
4. Hans Bergsten, "Java Server Pages", SPD O'Reilly
5. Margaret Levine Young, "The Complete Reference Internet", McGraw Hill.
6. Greg Lim, "Beginning Node.js, Express & MongoDB Development", 1 September 2020, Greg Lim
7. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, "MongoDB: The Definitive Guide, 3rd Edition", December 2019, O'Reilly Media, Inc.

BCA271: DATA STRUCTURE USING C LAB		
Course Outcome (CO)		
CO1	Understand and apply fundamental data structures (arrays, stacks, queues, linked lists) using C.	
CO2	Implement non-linear data structures like trees and graphs.	
CO3	Analyze algorithm efficiency using sorting and searching techniques.	
CO4	Solve real-world problems using appropriate data structures.	
CO5	Demonstrate proficiency in memory management and pointer manipulation in C.	
DETAILED SYLLABUS		
S.No.	**Topic**	**Hours**

	Arrays and Linked Lists
	   1. Array Implementation of Stack
	   2. Array Implementation of Queue
	   3. Singly Linked List: Creation, Insertion, Deletion
	   4. Doubly Linked List Operations
	   5. Circular Linked List Operations
	
	Stack and Queue Applications
	   1. Infix to Postfix Conversion using Stack
	   2. Postfix Expression Evaluation using Stack
	   3. Implement Circular Queue using Array and Linked List
	   4. Palindrome Checker using Stack
	
	Trees
	   1. Binary Tree Creation and Traversals (Inorder, Preorder, Postorder)
	   2. Binary Search Tree (BST): Insertion, Deletion, Search
	   3. Find Height/Depth of a Binary Tree
	   4. Count Leaf Nodes and Non-leaf Nodes in a Tree
	
	Searching and Sorting
	   1. Linear Search and Binary Search
	   2. Bubble Sort, Insertion Sort, Selection Sort
	   3. Quick Sort Implementation
	   4. Merge Sort Implementation
	
	Graphs (Optional for Basic Labs)
	   1. Graph Representation using Adjacency Matrix and List
	   2. Depth-First Search (DFS) and Breadth-First Search (BFS)	

Suggested Readings:

1. Fundamentals of Data Structures in C, By Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Publisher: University Press
2. Data Structures Using C, By Reema Thareja, Publisher: Oxford University Press
3. Data Structures Using C, By Yashavant Kanetkar, Publisher: BPB Publications
4. Data Structures Through C, By G.S. Baluja, Publisher: Dhanpat Rai Publications
5. Data Structures and Algorithm Analysis in C, By Mark Allen Weiss, Publisher: Pearson Education

BCA273: WEB DEVELOPMENT LAB		
Course Outcome (CO)		
CO1	Define the principle of Web page	
CO2	Define the basics in web design	
CO3	Visualize the basic concept of HTML.	
CO4	Recognize the elements of HTML.	
CO5	Develop the concept of web publishing	
DETAILED SYLLABUS		
S.No.	**Topic**	**Hours**
	1. Develop static pages (using only HTML) of an online Book store. The pages should resemble: www.amazon.com The website should consist the following pages. • Home page, • Registration and user Login, • User profile page, • Books catalog, • Shopping cart, • Payment By credit card, • Order confirmation. 2. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript. 3. Design a web page using CSS (Cascading Style Sheets) which includes the following: • Use different font, styles: In the style definition you define how each selector should work (font, color etc.). • Then, in the body of your pages, you refer to these selectors to activate the styles. **4.** Design a web page using CSS (Cascading Style Sheets) which includes the following: • Set a background image for both the page and single elements on the page • Control the repetition of the image with the background-repeat property 5. Design an HTML page with JavaScript that takes a number from one text field in the range 0-999 and display it in other text field in words. If the number is out of range, it should show "out of range" and if it is not a number, it should show "not a number" message in the result box. 6. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font	

size reaches 5Opt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt

7. Develop and demonstrate a HTMLS file that includes JavaScript script that uses functions for the following problems:

    a. Parameter. A string
    Output: The position in the string of the left-most vowel

    b. Parameter: A number
    Output: The number with its digits in the reverse order

8. Develop a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.

9. Develop a PHP program to gerent online electricity bill where user provides the input of previous reading and present reading and prepare an electricity bill using the following conditions.

Units Consumed	Rate
<100	Rs 3/Unit
Between 100 and 200	Its 4/Unit
Between 201 and 300	Its 5/Unit
>301	Rs 6 /Unit

10. Design an HTML form to input the salary details of an employee (Employee name, Basic pay, DA and HRA). Write a PHP script to accept user input data and store it in a text file. Write a PHP script to display the contents of the file.

11. Develop a PHP program to implement a session based counter which counts the number of how time dose the user view the web page for this create a session variable using PHP. Display the session variable using PHP.

12. Create a PHP program to develop a web application which display the result of the student I which users inputs the marks list of the student and connect to a database and retrieve data from a table and show the details in a neat format
    a) Mark list of a student is entered and saved to MySQL table using PHP
    b) Data stored in MySQL table is displayed

Syllabus

BCA 2nd Year
IVth Semester

BCA202: ADVANCE PYTHON PROGRAMMING		
Course Outcome (CO)		
CO1	Understand advanced features of Python like file handling, error handling, and OOP.	
CO2	Develop real-world applications using object-oriented concepts.	
CO3	Use Python for database interaction and basic GUI development.	
CO4	Work with advanced modules like NumPy, Pandas, and Matplotlib for data handling and visualization.	
CO5	Implement mini projects and scripts for automation, data processing, or GUI-based apps.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Advanced Python Basics:** Review of Python basics (data types, loops, functions), Modules and Packages, File Handling (Text, Binary, CSV), Exception Handling (try, except, else, finally), Working with with statement.	8
II	**Object-Oriented Programming:** Classes and Objects, __init__() and __str__() methods, Inheritance and Method Overriding, Encapsulation and Polymorphism, Static and Class Methods.	9
III	GUI and Database Programming: Introduction to Tkinter (Basic GUI: Label, Entry, Button), Event handling in GUI, Connecting Python with MySQL using MySQL.Connector, CRUD Operations (Create, Read, Update, Delete), Form-based simple database applications.	9
IV	**Data Handling and Visualization:** Introduction to NumPy (Arrays, Slicing, Indexing), Introduction to Pandas (Series, DataFrames, Import/Export CSV), Data Cleaning and Filtering, Visualization using Matplotlib (Line, Bar, Pie charts).	8
V	**Advanced Topics and Mini Projects:** Working with JSON and XML, Sending Emails with smtplib, Web Scraping using BeautifulSoup or requests, **Mini Projects:** Student Information System, Weather App using API, Expense Tracker, Data Plotting Dashboard.	8

Suggested Readings:

Reference Books:
1. "Python Programming" by Reema Thareja – Oxford University Press
2. "Learning Python" by Mark Lutz – O'Reilly Media
3. "Python for Everybody" by Dr. Charles R. Severance – Free eBook
4. "Automate the Boring Stuff with Python" by Al Sweigart – No Starch Press

Online Documentation:
1. https://docs.python.org/3/
2. https://pandas.pydata.org/
3. https://matplotlib.org/

BCA204: OOP CONCEPTS USING JAVA		
Course Outcome (CO)		
CO1	Use of OOPs concepts	
CO2	Classify the conditional control statements, array& concept of string.	
CO3	Use of Packages and Interface in java.	
CO4	Develop and understand exception handling, multithreaded applications with synchronization.	
CO5	Design GUI based applications and develop using AWT & Swing.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Features of the Java Language, JVM, JDK, JRE , Platform Independency, Data type, Variables, types of variables, Operators , types of operators **OOPS:** Object, Class, Methods & classes, Inheritance, Polymorphism, Overloading, and Overriding of methods, Encapsulation, Abstraction.	8
II	**Conditional Control Statements:** If statements, if-else, if-else-if statements, break & continue keyword, loops, while loop, do-while loop and for loop. **Arrays:** Concept of array, initialling and accessing array, types of array**. String:** string in java, mutable and immutable string, creating string using String Buffer.	8
III	**Interface:** Introduction, abstract keyword and interface, Multiple inheritances Using interface. **Packages:** Concept of Package, creating package, Importing packages, Child Packages.	8
IV	**Exception Handling:** Exceptions & Errors, Types of Exception, Use of the Try, catch, finally, throw, throws in Exception Handling. In-built and User define Exceptions. **Multi-Threading:** Threads, Needs of Multi-Threaded Programming, How to create your own thread, Thread Life-Cycle, Thread Priorities, Synchronization of Thread.	8
V	**GUI Application Development:** Introduction to AWT, AWT controls Java Applet, Layout Managers, Menus, Images, Graphics, Event Handling, Swing, Containers, Panes, Frames, Dialogue boxes, working with image controls.	8

Text and Reference Books:
1. The Complete Reference Internet, Margaret Levine Young, TMH, 1999.
2. The Complete Reference JAVA 2, Naughton Schildt, TMH, 5th Edition.
3. Programming in JAVA, E. Balagurusamy E, TMH, 3rd Edition, 2006.
4. Java Black book, Steven Helzner, Dreamtech , 2002

BCA206: OPERATING SYSTEMS		
Course Outcome (CO)		
CO1	Define the principle of Web page	
CO2	Define the basics in web design	
CO3	Visualize the basic concept of HTML.	
CO4	Recognize the elements of HTML.	
CO5	Develop the concept of web publishing	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction**: Definition and types of Operating systems, Batch Systems, Multiprogramming, Time Sharing, Parallel, Distributed and Real-Time Systems, Operating System Structure, Operating System Components and Services, System Calls, System Programs, VirtualMachines.	8
II	**Process Management:** Process Concept, Process Scheduling, Cooperating Processes, Threads, Interprocess Communication, CPU Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling and Algorithm evaluation.	9
III	**Process Synchronization and Deadlocks:** The Critical-Section Problem, Synchronization Hardware, Semaphores Classical Problems of Synchronization, Critical Regions, Monitors, Deadlocks-System Model, Characterization, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock, Combined approach to Deadlock Handling.	9
IV	**Memory Management:** Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation with Paging, Virtual Memory, Demand Paging and its performance, Page Replacement Algorithms, Allocation of Frames, Thrashing, Page Size and other considerations, Demand Segmentation.	8
V	**Disk Scheduling and Process Management in UNIX:** File concept, Access methods, Directory Structure, Disk scheduling, UNIX overview, Processes in UNIX, Process Fundamentals, Creating a New Process, Parent Child Process, Connecting Processes with Pipes, Background Process, Managing Multiple Processes, Process Related Commands, Changing Process Priority. Process Scheduling: Scheduling of Processes, Process Daemon, And Process Scheduling Commands.	8

 Suggested Readings:

Reference Books:
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne "Operating System Concepts", 9th Edition, Wiley 2018
2. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", 3rd edition, McGraw Hill Education, 2017
3. Thomas Anderson and Michael Dahlin, "Operating Systems: Principles and Practice", 2014
4. William Stallings, "Operating Systems: Internals and Design Principles", 7e (Old Edition), Pearson Education India, 2013
5. Gary J Nutt, "Operating Systems: A Modern Perspective". 1997.

	BCA218: AI FOR DEVELOPERS	
	Course Outcome (CO)	
CO1	Understand fundamental AI concepts and their applications.	
CO2	Develop and implement machine learning models using Python.	
CO3	Apply AI techniques in natural language processing and computer vision.	
CO4	Integrate AI tools in software development processes.	
CO5	Explore advanced AI applications in real-world scenarios.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	Introduction to Artificial Intelligence: Definition and Scope of AI, History and Evolution of AI, AI vs. Machine Learning vs. Deep Learning, Applications of AI in Software Development, AI Ethics and Responsible AI.	**8**
II	Machine Learning for Developers: Supervised, Unsupervised, and Reinforcement Learning, Data Preprocessing and Feature Engineering, Model Selection and Evaluation Metrics, Popular ML Libraries: Scikit-Learn, TensorFlow, PyTorch, Implementing ML Models in Python.	**8**
III	Natural Language Processing (NLP) and Computer Vision: NLP Basics: Tokenization, Stemming, Lemmatization,	**8**
IV	Sentiment Analysis and Chatbot Development, Image Processing and Feature Extraction, CNNs for Image Recognition (Introduction to OpenCV, TensorFlow), AI-based Object Detection and Face Recognition.	**8**
V	AI in Software Development: AI-powered Code Generation (GitHub Copilot, ChatGPT API), Automated Testing and Debugging using AI, AI in DevOps: CI/CD Automation, Performance Monitoring, AI-based Security: Intrusion Detection and Threat Analysis, AI and Cloud Computing (AWS AI, Azure AI, Google AI).	**8**

Reference Books:

1. "Artificial Intelligence: A Guide for Thinking Humans" – Melanie Mitchell
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" – Aurélien Géron
3. "Deep Learning for Coders with fastai & PyTorch" – Jeremy Howard, Sylvain Gugger
4. "Pattern Recognition and Machine Learning" – Christopher M. Bishop
5. "Artificial Intelligence: A Modern Approach" – Stuart Russell, Peter Norvig

BCA208: ARTIFICIAL INTELLIGENCE AND ML DATA SCIENCE (EL)

	Course Outcome (CO)	
CO1	Define Artificial Intelligence (AI) and recognize its historical development.	
CO2	Identify problems that can be modeled and solved using search algorithms.	
CO3	Develop the ability to perform inference in first-order logic, applying various techniques to derive conclusions from a set of premises.	
CO4	Understand the structure and function of decision trees in machine learning.	
CO5	Describe the key concepts and terminology in pattern recognition, along with an understanding of its applications in various domains.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction:** Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.	8
II	**Introduction to Search:** Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.	8
III	**Knowledge Representation & Reasoning**: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.	8
IV	**Machine Learning**: Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data - EM algorithm, Reinforcement learning.	8
V	**Pattern Recognition**: Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.	8

Reference Books:

1. Artificial Intelligence: Rich and Knight
2. Artificial Intelligence: A Modern Approach: Stuart Russell and Peter Norvig
3. Introduction to Artificial Intelligence: Partick Winston

BCA210: DATA WAREHOUSING AND DATA MINING (EL)		
	Course Outcome (CO)	
CO1	To understand the principles of Data warehousing and Data Mining.	
CO2	To understand the Architecture of a Data Mining system.	
CO3	To perform classification, association, and prediction of data.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Data Warehousing – Introduction and Design:** Overview and Concepts: Data Warehousing Components, Building a Data Warehouse, Data Warehouse Architecture, Infrastructure and Metadata. Data Design and Data Representation: Principles of Dimensional Modelling, Data Extraction, Transformation and Loading, Data Quality, Online Analytical Processing (OLAP)–OLAP and Multidimensional Data Analysis.	8
II	**Data Mining – Pre-processing:** Steps in Data mining process, Data Mining Functionalities, Architecture of a Typical Data Mining Systems, Classification of Data Mining Systems, Knowledge Discovery in Databases (KDD), KDD Process, Data Preprocessing, Data Cleaning, Data Transformation, Data Compression and Dimension Reduction, Principal Component Analysis, Binning Methods.	8
III	**Data Mining Techniques** Association Rule Mining, Classification and Prediction: Efficient and Scalable Frequent Itemset Mining Methods, Mining, Various Kinds of Association Rules, Association Rules, Market Basket Analysis,	8
IV	Apriori Algorithm, Tree Based Algorithms. Classification by Decision Tree Introduction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Lazy Learners, Prediction Techniques, Regression Models.	8
V	**Clustering & Introduction to Web Mining** Data Mining Algorithms: Clustering. Partitioned Algorithms, Hierarchical Algorithms, Density Based, Algorithms, Grid Based Algorithms, Web Content Mining, Web Structure Mining, Web Usage Mining, Spatial Mining, Multimedia Data Mining, Text Mining.	8

Suggested Readings:

1. Prabhu, "Data warehousing- concepts, Techniques, Products and Applications", Prentice Hall of India.
2. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill Edition, Tenth Reprint.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education.

BCA212: DATA COMPRESSION AND MULTIMEDIA SYSTEM (EL)		
Course Outcome (CO)		
CO1	Describe and apply various techniques for text compression and also evaluate performance of the coding techniques.	
CO2	Define the operation of scalar and vector quantizer.	
CO3	Differentiate lossless and lossy image and video compression techniques and standards.	
CO4	Developed understanding of technical aspect of multimedia systems.	
CO5	Contrast the various file formats for audio, video and text media.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Compression Techniques:** Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression. Introduction to Information Theory and Models: Physical models, Probability models, Markov models.	**8**
II	**Huffman Coding Algorithms:** Minimum variance Huffman codes. Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure, Applications of Huffman coding.	**8**
III	**Arithmetic Coding, Scalar and Vector Quantization:** Arithmetic Coding: Coding a sequence, Generating a Binary code, Comparison of Arithmetic and Huffman coding. Dictionary based compression techniques Static Dictionary: Diagram Coding, Adaptive Dictionary, The LZ77, LZ78 and LZW Approach. Concept of Vector Quantization Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo Gray Algorithm. Image compression Techniques	**8**
IV	**Introduction to Multimedia:** Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work, Convergence of Computer, Communication and Entertainment products. Stages of Multimedia Projects, Multimedia software's, presentation tools, Tools for object generations, Video, Sound, Image capturing, Authoring tools.	**8**
V	**Multimedia Building Blocks:** Text, Graphics and Image Data Representations: Popular File Formats, Sound MIDI, Digital Audio, Audio file formats, MIDI under windows environment, Multimedia Network Communications and Applications. Virtual Reality: Intelligent multimedia system, Desktop Virtual Reality (VR). VR operating System.	**8**

Suggested Readings:
Reference Books:
1. Khalid Sayood, "Introduction to Data Compression", Morgan Kaufmann Publishers.
2. David Salomon, "Data Compression: The Complete Reference", Springer.
3. Buford, "Multimedia Systems", Addison Wesley.
4. Sleinreitz, "Multimedia System", Addison Wesley.
5. Fundamentals of Multimedia, Ze-Nian Li and Mark S. Drew School of Computing Science Simon Fraser University, Pearson Education International, ISBN 0-13¬127256-X

BCA280:ADVANCED PYTHON LAB		
Course Outcome (CO)		
CO1	Apply advanced Python concepts such as decorators, generators, and exception handling.	
CO2	Design object-oriented programs using encapsulation, inheritance, and polymorphism.	
CO3	Handle, analyze, and visualize data using Python libraries like pandas and matplotlib.	
CO4	Develop web applications and perform database interactions using Python frameworks.	
CO5	Implement multithreaded applications and network communication using Python.	
CO6	Build end-to-end projects demonstrating real-world problem-solving using Python.	
DETAILED SYLLABUS		
S.No.	**Topic**	**Hours**
	Advanced Python Concepts 1. Implement a program using decorators and generators. 2. Program to demonstrate file handling (read, write, append in text and binary files). 3. Implement exception handling with custom exceptions. **Object-Oriented Programming** 1. Create classes with inheritance, polymorphism, and encapsulation. 2. Use of abstract classes and interfaces via abc module. **Data Handling and Visualization** 1. Read/write CSV and Excel files using pandas. 2. Data visualization using matplotlib and seaborn. 3. Implement basic data analysis: descriptive stats, filtering, and grouping. **Web and Database Applications** 1. Create a simple Flask web application with HTML templates. 2. Implement database CRUD operations using sqlite3 or SQLAlchemy. **Multithreading and Networking** 1. Demonstrate multithreading with thread synchronization. 2. Build a simple TCP/UDP client-server chat application using socket. 3. Implement a web scraper using BeautifulSoup or Scrapy. 4. Create a GUI application using tkinter or PyQt. 5. Mini-project: Choose any domain (e.g., data analysis, automation, web) to build a complete Python application.	

Suggested Readings:

1. "Learning Python" by Mark Lutz – O'Reilly Media.
2. "Fluent Python" by Luciano Ramalho – O'Reilly Media.
3. "Python Cookbook" by David Beazley and Brian K. Jones – O'Reilly Media.
4. "Python for Data Analysis" by Wes McKinney – O'Reilly Media.
5. "Automate the Boring Stuff with Python" by Al Sweigart – No Starch Press.
6. "Core Python Programming" by Wesley J. Chun – Prentice Hall.
7. Online Documentation: Python Official Docs

BCA282:OOP USING JAVA LAB		
Course Outcome (CO)		
CO1	Understand the basics of object-oriented programming using JAVA.	
CO2	Apply the concept of classes, Java, JDK Components and develop Simple Java Programs.	
CO3	Develop Simple Java Programs using inheritance and Exception handling.	
CO4	Develop Multi-threading Programming and Interfaces.	
CO5	Develop GUI applications using Applet classes, Swing components and Event handling programs.	
DETAILED SYLLABUS		
S.No.	**Topic**	**Hours**
1	Program to define a structure of a basic JAVA program	
2	Program to define the data types, variable, operators, arrays and control structures.	
3	Program to define class and constructors. Demonstrate constructors.	
4	Program to define class, methods and objects. Demonstrate method overloading.	
5	Program to define inheritance and show method overriding.	
6	Program to demonstrate Packages.	
7	Program to demonstrate Exception Handling.	
8	Program to demonstrate Multithreading.	
9	Program to demonstrate I/O operations.	
10	Program to demonstrate Network Programming.	
11	Program to demonstrate Applet structure and event handling.	
12	Program to demonstrate Layout managers.	
13	WAP to demonstrate data types available in java	
14	WAP to design a simple calculator using switch case statement	
15	WAP to print all prime numbers between 1 to	
16	WAP to implement linear search in 1D array.	
17	WAP to implement bubble sort in 1 D array.	
18	WAP to multiply 2 matrices in java.	
19	WAP to implement recursion function in java.	
20	WAP to demonstrate some in-built functions on Strings	
21	WAP to demonstrate concept of Class, Object, and methods in java.	
22	WAP to demonstrate method overloading in java.	
23	WAP to demonstrate inheritance in java.	
24	WAP to demonstrate multiple inheritance using interface.	
25	WAP to demonstrate method over riding in java	
26	WAP to demonstrate exception handling in java	
27	WAP to demonstrate multi-threading in java.	

28	WAP to read, write, append data in files.	
29	WAP to demonstrate database connectivity using JDBC.	
30	WAP to create a Swing Application with JDBC CO4	
31	WAP to design a Menu using Swing in Java.	

Syllabus

BCA 3rd Year
Vth Semester

BCA301: MACHINE LEARNING

	Course Outcome (CO)	
CO1	Develop and apply classification algorithms to classify multivariate data.	
CO2	Apply learning algorithms for finding relationships between data variables.	
CO3	Develop and apply reinforcement learning algorithms for learning to control complex systems.	
CO4	Discuss the Scientific reports on computational machine learning methods, results and conclusions.	
CO5	Implement the clustering algorithms to real time problems.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**BASICS**: Learning Problems, Perspectives and Issues, Concept Learning, Find-S, Version Spaces and Candidate Eliminations, Inductive bias.	8
II	**DECISION TREE & NEURAL NETWORKS**: Decision Tree Learning - Introduction, Decision tree representation, appropriate problems, ID3 algorithm. Neural Network Representation Problems, Perceptions Multilayer Networks and Back Propagation Algorithms,	9
III	**BAYESIAN AND COMPUTATIONAL LEARNING:** Bayes Theorem, Concept Learning Maximum, Likelihood Minimum Description Length, Principle Bayes Optimal Classifier, Gibbs Algorithm, Naïve, Bayes Classifier, Bayesian Belief Network, EM Algorithm, Probability Learning.	10
IV	**INSTANT BASED LEARNING:** K- Nearest Neighbour Learning, Locally weighted Regression Radial, Bases Functions, Case Based Learning.	9
V	**CLUSTERING**: Overview- Types of clustering, Types of clusters, K-Means, Agglomerative Hierarchical, Clustering, Density-Based Clustering, Graph-Based Clustering, Cluster evaluation.	9

Suggested Readings:

1. S. Shalev-Shwartz, S.Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014.
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning", MIT Press, 2nd Edition, 2018.
3. Duda, Richard, Peter Hart, and David Stork, "Pattern Classification," 2nd Edition, John Wiley & Sons, Hoboken, 2000.
4. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.

BCA303: DIGITAL ELECTRONICS		
Course Outcome (CO)		
CO1	Examine the structure of various number systems and its application in digital design.	
CO2	Classify the fundamental concepts and techniques used in digital electronics.	
CO3	Ability to understand, analyze and design various combinational and sequential circuits.	
CO4	Describe the memory management techniques	
DETAILEDSYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Number systems** : Binary number system, Octal & Hexa-decimal number system, Conversion of Number System, r' s & (r-1)'s complement, Arithmetic operation on Binary numbers, Codes-ASCII, EBCDIC codes, Gray code, Excess-3 & BCD Code, Weighted Binary Codes, non-weighted Codes, Error Detecting Codes, Error Correcting Codes, Alphanumeric Codes.	**8**
II	**Logic Gates**: AND, OR, NOT GATES and their Truth tables, NOR, NAND & XOR gates, Boolean Operations: AND, OR, Inversion, Boolean algebra, Basic Boolean Law's, Demorgan's theorem, Minimization techniques: K -Map, Sum of Product & Product of Sum combinational circuit design, Gray to binary code conversion circuits, binary to Gray code conversion circuit.	**8**
III	**Combinational circuits**: Multiplexers, Demultiplexers, Decoders, 5x32 Decoders & Encoders, seven segment decoder, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Full Adder to Full Subtractor, Implementation of Boolean expression through Decoder and Multiplexer. NAND AND NOR implementation of Adder and Subtractor.	**8**
IV	**Memory Organization**: Memory Hierarchy, Main Memory: RAM & ROM chips, Memory Address Map, Auxiliary memory: Magnetic Disks, Magnetic Tape, Associative Memory, Cache memory, Virtual Memory, Introduction to memory management hardware.	**8**
V	**I/O Interface**: I/O bus and interface modules, Asynchronous data transfer: Strobe control, Hand Shaking, Modes of transfer: Programmed I/O, Interrupt initiated I/O, DMA, Interrupts & Interrupt handling, Direct Memory access: DMA Controller and DMA Transfer.	**8**
Suggested Readings:		

1. Mano Morris, Digital Logic, Prentice Hall of India.
2. Stallings, Computer Organization, Prentice Hall of India.
3. Mano M., Computer System Architecture, Prentice Hall of India.
4. Tannenbaum, Structured Computer Organization, Prentice Hall of India.
5. Hayes John P., Computer Organization, McGraw Hill.
6. Digital Electronics (TMH) 1998 : Malvino and Leach

BCA305: COMPUTER ARCHITECTURE		
Course Outcome (CO)		
CO1	Identify various components of computer and their interconnection	
CO2	Identify basic components and design of the CPU: the ALU and control unit	
CO3	Compare and select various Memory devices as per requirement.	
CO4	Compare various types of IO mapping techniques	
CO5	Critique the performance issues of cache memory and virtual memory	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**UNIT - I: STRUCTURE OF COMPUTERS:** Computer types, Functional units, Basic operational concepts, VonNeumann Architecture, Bus Structures, Software, Performance, Multiprocessors and Multicomputer, Data representation, Fixed and Floating point, Error detection and correction codes. COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication and Division algorithms, Floating-point Arithmetic Operations, Decimal arithmetic operations.	**8**
II	**UNIT - II: BASIC COMPUTER ORGANIZATION AND DESIGN**: Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt. Central processing unit: Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC	**9**
III	**UNIT - III: REGISTER TRANSFER AND MICRO-OPERATIONS**: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logic shift unit. MICRO-PROGRAMMED CONTROL: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.	**9**
IV	**UNIT - IV**: MEMORY SYSTEM: Memory Hierarchy, Semiconductor Memories, RAM(Random Access Memory), Read Only Memory (ROM), Types of ROM, Cache Memory, Performance considerations, Virtual memory, Paging, Secondary Storage, RAID.	**8**
V	**UNIT – V INPUT OUTPUT**: I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA. MULTIPROCESSORS: Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence.	**8**

Suggested Readings:

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky (2002), Computer Organization, 5th edition, McGraw Hill, New Delhi, India.
2. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy
3. Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,
4. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill

BCA307: MOBILE APPLICATION DEVELOPMENT		
Course Outcome (CO)		
CO1	Understand mobile application development fundamentals and platforms.	
CO2	Design and develop user-friendly mobile applications using Android/iOS.	
CO3	Work with UI/UX design, multimedia, and databases in mobile applications.	
CO4	Integrate networking, sensors, and third-party APIs.	
CO5	Deploy, test, and publish mobile applications on app stores	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Mobile Application Development:** Evolution of mobile computing, Mobile platforms: Android, iOS, Hybrid frameworks (React Native, Flutter), Mobile app development process and architecture, Setting up the development environment (Android Studio, Xcode), Basic programming concepts (Java/Kotlin for Android, Swift for iOS)	**8**
II	**User Interface (UI) and User Experience (UX) Design:** UI components: Views, Layouts, Widgets, Menus, Activity lifecycle and navigation, Event handling and touch gestures, Material design principles and themes, Fragments and multi-screen support, Introduction to responsive UI with Jetpack Compose (Android)	**8**
III	**Data Handling and Storage:** Shared Preferences and SQLite database, Room Database (Android) and Core Data (iOS), File handling and internal/external storage, Working with Web APIs (RESTful APIs, JSON, Retrofit, Volley), Firebase Realtime Database and Cloud Firestore	**8**
IV	**Advanced Features and Integration:** Working with sensors (GPS, accelerometer, gyroscope), Multimedia handling (camera, audio, video), Networking and Bluetooth communication, Notifications and background tasks (WorkManager, Services), Third-party API integration (Google Maps, Payment Gateway, Social Media)	**8**
V	**Deployment, Testing, and Security:** App testing strategies (Unit Testing, UI Testing, Espresso), App security: Permissions, Secure Data Storage, Encryption, Performance optimization techniques, Publishing apps on Google Play Store and Apple App Store, Introduction to DevOps for mobile applications (CI/CD pipelines)	**8**

Suggested Readings:

1. **"Android Programming: The Big Nerd Ranch Guide"** – Bill Phillips, Chris Stewart
2. **"Professional Android"** – Reto Meier
3. **"iOS Programming: The Big Nerd Ranch Guide"** – Christian Keur, Aaron Hillegass
4. **"Kotlin for Android Developers"** – Antonio Leiva
5. **"Flutter for Beginners"** – Alessandro Biessek

BCA309: SOCIAL MEDIA ANALYTICS (EL)		
	Course Outcome (CO)	
CO1	To define concept of social media and social media analytics.	
CO2	Understand Network fundaments, models and making connections.	
CO3	To understand the web analytics tools and techniques.	
CO4	To understand the Facebook Analytics & Network analysis.	
CO5	To know about the Applications in Advertising and Game Analytics.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Social Media Analytics (SMA):** Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas.	8
II	**Network fundamentals and models:** The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization. **Making connections:** Link analysis. Random graphs and network evolution. Social Contexts: Affiliation and identity.	8
III	**Web analytics tools and techniques:** Click stream analysis, A/B testing, online surveys, Use of Google Analytics; Web crawling and Indexing; Natural Language Processing Techniques for Micro-text Analysis. **LinkedIn Analytics:** An overview of LinkedIn, Benefits of LinkedIn Network, Building connections of LinkedIn, Using LinkedIn for analytics.	8
IV	**Facebook Analytics:** Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB, Use of Facebook Business Manager; Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc.	8
V	Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification. Applications in Advertising and Game Analytics (Use of tools like Unity30 / PyCharm). Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration.	8

Reference Books:

1. Mathew Ganis, Avinash Koihrkar , Social Media Analytics , IBM Press , 2015 / 1st.
2. Jim Sterne, Social Media Metrics, Wiley ,Latest.
3. Oliver Blanchard ,Social Media ROI ,Que Publishing ,Latest.
4. Marshall Sponder, Gorah F. Khan ,Digital Analytics for Marketing ,Routledge ,2017 / 1st.
5. Tracy L. Tuten, Michael R. Solomon ,Social Media Marketing ,Sage ,2018 / 3rd.
6. Gohar F. Khan ,Creating Value With Social Media Analytics ,CreateSpace Independent, Publishing ,2018.

BCA311: BIG DATA ANALYTICS (EL)		
Course Outcome (CO)		
CO1	Define the Big Data and its analytics in the real world	
CO2	Contrast the Big Data framework like Hadoop and NOSQL to efficiently store and process Big Data to generate analytics	
CO3	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm	
CO4	Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence.	8
II	Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharing, master-slave replication, peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8
III	Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.	8
IV	MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.	8
V	Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Hive, data types and file formats, Hive QL data definition, Hive QL data manipulation, Hive QL queries.	8

Suggested Readings:
1. Seema Acharya, Subhashini Chellappan, "Big Data Analytics", 1st Edition, Wiley, 2015.
2. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions".
3. Chris Eaton, Dirk Deroos et. al., "Understanding Big data", Indian Edition, McGraw Hill, 4.Tom White, "HADOOP: The definitive Guide", 3rd Edition, O Reilly, 2012.

BCA313: NATURAL LANGUAGE PROCESSING (EL)		
Course Outcome (CO)		
CO1	Understand the fundamental concepts and applications of Speech and NLP.	
CO2	Apply syntactic and parsing techniques to analyze sentence structures.	
CO3	Perform semantic and pragmatic analysis on natural language data.	
CO4	Demonstrate knowledge of speech signal processing and recognition systems.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Natural Language Processing (NLP):** Basics of NLP: Definition, scope, applications. NLP tasks: Tokenization, stemming, lemmatization. Language models: N-gram models, smoothing techniques. Part-of-Speech (POS) tagging: Rule-based, stochastic, HMM-based methods. Morphology and syntax: Word structure, sentence structure.	8
II	**Syntax and Parsing Techniques:** Context-Free Grammars (CFG). Parsing algorithms: Top-down, bottom-up, CYK, Earley parser. Dependency parsing. Feature structures and unification. Probabilistic CFG (PCFG).	8
III	**Semantics and Pragmatics:** Semantic analysis: Meaning representation (First-order logic, semantic roles). Lexical semantics: Word sense disambiguation (WSD), thesauri (WordNet). Pragmatics: Discourse analysis, co-reference resolution. Ambiguity resolution. Dialogue systems and Natural Language Generation (NLG).	8
IV	**Speech Processing:** Introduction to speech signals: Phonetics, phonology. Speech production and perception. Speech signal processing: Sampling, feature extraction (MFCC, LPC). Speech recognition: Acoustic modeling, language modeling, Hidden Markov Models (HMM), ASR systems. Text-to-Speech (TTS) synthesis.	8
V	**Applications and Advanced Topics:** Information Retrieval (IR), Question Answering (QA). Sentiment Analysis, Text Classification. Machine Translation (MT): Statistical MT, Neural MT. Recent trends: Deep Learning in NLP, Transformers, BERT, GPT. NLP tools: NLTK, SpaCy, Stanford NLP.	8

Suggested Readings:

1. Daniel Jurafsky & James H. Martin, Speech and Language Processing, 3rd Edition (Draft), Pearson Education.
2. Christopher D. Manning, Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press.
3. Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python, O'Reilly Media.
4. Lawrence Rabiner and Biing-Hwang Juang, Fundamentals of Speech Recognition, Prentice Hall.

BCA371: DIGITAL ELECTRONICS LAB		
Course Outcome (CO)		
CO1	Understand and implement basic logic gates and Boolean algebra simplification.	
CO2	Design combinational circuits like adders, subtractors, multiplexers, etc.	
CO3	Design and analyze sequential circuits including flip-flops and counters.	
CO4	Utilize simulation tools for design and verification of digital circuits.	
CO5	Demonstrate practical skills in handling digital ICs and designing real-time circuits.	
DETAILED SYLLABUS		
S.No.	**Topic**	**Hours**
	1. **Verification of Basic Gates** - Implement AND, OR, NOT, NAND, NOR, XOR, XNOR using ICs and truth tables. 2. **Implementation of Boolean Expressions** - Simplify expressions using Karnaugh Maps and implement circuits. 3. **Half Adder and Full Adder / Subtractor** - Design and implement using logic gates. 4. **4-bit Binary Adder using IC 7483** - Understand and use parallel adders. 5. **Multiplexer and Demultiplexer** - Implement 4:1 MUX and 1:4 DEMUX using ICs or gates. 6. **Decoder and Encoder Circuits** - Realize 3:8 decoder and 8:3 encoder. 7. **BCD to 7-Segment Display Decoder** - Interfacing BCD to 7-segment display using IC 7447. 8. **Flip-Flops (SR, JK, D, T)** - Design and verify flip-flop behavior using ICs. 9. **Shift Registers (SIPO, PISO, SISO, PIPO)** - Design and implementation using IC 7495 or similar. 10. **Asynchronous Counters** 2-bit/3-bit ripple counters using T Flip-Flops. 11. **Synchronous Counters** 3-bit up/down counters using JK Flip-Flops. 12. **Ring Counter and Johnson Counter** - Implementation and analysis. 13. **Universal Shift Register** - Implement 4-bit register with control on shift directions. 14. **Simulation-Based Experiments (Optional)** - Design and simulate circuits using Logisim or Proteus.	

Suggested Readings:

1. "Morris Mano – Digital Logic and Computer Design, Pearson Education.
2. R.P. Jain – Modern Digital Electronics, Tata McGraw-Hill.
3. Thomas L. Floyd – Digital Fundamentals, Pearson Education.
4. Anand Kumar – Fundamentals of Digital Circuits, PHI Learning.
5. Charles Roth & Larry Kinney – Fundamentals of Logic Design, Cengage Learning.

BCA373: MOBILE APPLICATION DEVELOPMENT LAB		
Course Outcome (CO)		
CO1	Understand principles and best practices of mobile application development using flutter framework	
CO2	Develop cross-platform (iOS and Android) mobile application development using the Flutter framework	
CO3	Explore concepts such as stateful and stateless widgets; material design; themes; assets; text input; gestures; retrieving local and real-time data	
CO4	Employ best practices for developing mobile applications	
CO5	Develop multimedia applications in Android	
DETAILED SYLLABUS		
S.No.	**Topic**	**Hours**
	Installation of Dart ID: • Installation of Dart IDE and Writing Dart Program **Simple App Design:** • Create a Pizza Order Program **Simple App Design:** • Create a Small Overtime Payment Program **Create Flutter App:** • Create a Simple Flutter App **Develop Restaurant Menu:** • Create a Restaurant Menu **Develop App with Navigation:** • Navigation and Routing a Pizza Store App **Develop Flutter App with features:** • Create a Flutter App using BottomNavigatorBar Navigation Technique **Develop E-AppCommerce:** • Creating a Hotel Reservation App **Create User Profile Interface:** • Create a User Profile Interface using Firebase	

Suggested Readings:

1. Subhash Chandra Shukla, "Flutter zero to hero edition - 2023", Splendid Coder
2. Marco L. Napoli, Beginning Flutter", Wrox publication
3. Livre Books, "Flutter A Complete Book For Mobile App Development", Livre Books

BCA375: (INTERNSHIP)/ MINI PROJECT LAB	
Course Outcome (CO)	
CO1	Identify project/research problems; understand information and grasp meaning; translate knowledge into new context; use information, methods, concepts, and theories of fundamental topics in computer science in new situations (Knowledge, Comprehension);
CO2	Apply computer science principles and practices to a real-world problem; demonstrate in-depth knowledge in the area of the project they have undertaken; solve problems using required knowledge and skills; implement and test solutions/algorithms (Application and Evaluation);
CO3	Identify potential solutions/algorithms for the project problem; see patterns and modularize the problem, recognize hidden meanings and identify components, show proficiency in software engineering principles (Analysis);
CO4	Apply a software development methodology currently practiced in industry to produce software system in a rigorous and systematic way using different software life cycle phases (specification, architecture, design, implementation, validation, documentation) (Synthesis);
CO5	Show evidence (group collaboration, regular meetings, email communications, significant knowledge and skills contributions, etc.) of working productively as an individual and in a team on a project that produces a significant software product (Team Work);
CO6	Show evidence of competency in oral and written communications skills through oral presentations (project presentation, department seminar or conferences, client interactions), technical reports and/or published research papers in conferences and/or journals (Communications);
CO7	Use modern techniques, skills and tools necessary for computer science practices relevant to the project they undertake; use techniques in recent research papers to solve problems (Lifelong Learning).
DETAILED SYLLABUS	

Sr. N	Topic	Hours
	LAB: Besides completing the subject/Lab assignments, the students will be required to complete one mini project as follows: **MINI-PROJECT in VB, VC++ or Java under Linux(UNIX)/Windows** **In addition to completing Mini-Project, the students will be doing the exercises** provided by the respective teachers in their class rooms. The individual	

	teachers who are teaching the courses will be responsible for completing their respective lab assignments.	
	Some of the representative areas/problems may include the following:	
	Developing Window Based Applications using recent technologies using .NET Platform or Java Technologies like Java Servlet, Java Beans, COM, CORBA etc.	
	Students should learn languages such as PROLOG or LISP to solve the Laboratory exercises.	
	An expert system shell such as IITM rule be used to create a small expert system for, say, troubleshooting moped, VCR etc. Some suggested experiments are : Tour of India, Stable marriage problem, Game playing (such as bridge), coin change problem etc.	

Suggested Readings:

1. Robert Lafore, "Object Oriented Programming in C++", Pearson
2. R. Brown, "Visual Basic .NET – Your Visual Blueprint for Building Versatile Programs on the .NET Framework", Wiley Publishing, Inc.
3. Ivan Bayross, "Oracle", BPB
4. E.N. Mackay, "Developing user Interfaces for Windows", WP Publishers & Distributors Pvt. Ltd.

Syllabus

BCA 3rd Year
VIth Semester

BCA302: DIGITAL IMAGE PROCESSING		
Course Outcome (CO)		
CO1	Classify the need for image transforms different types of image transforms and their properties.	
CO2	Develop any image processing application.	
CO3	Explain the need for image compression and to learn the spatial and frequency domain techniques of image compression.	
CO4	Discuss the different techniques employed for the enhancement of images.	
DETAILED SYLLABUS		
Unit	Topic	Proposed Lecture
I	**Introduction:** The Origins of Digital Image Processing – Application of Digital Image Processing – Fundamental Steps in Digital Image Processing – Component of Image Processing System FUNDAMENTALS: Image Acquisition Using a Single Sensor – Image Acquisition Using Sensor Arrays	8
II	**Image Sampling and Quantization:** Basic Concepts-Representing Digital Images – Spatial and Grey Level Resolution-Aliasing &more patterns – Zooming and Shrinking Digital Images. BASIC RELATIONSHIPS BETWEEN PIXELS: Neighbors of a Pixel – Adjacency, Connectivity, Regions and Boundaries – Distance Measures, Image Operations on a Pixel Basis	8
III	**Color Image Processing:** Fundamentals-color models: RGB color model-CMY and CMYK color model-HIS model-Color Image smoothing &color Image sharping. IMAGE ENHANCEMENT IN SPATIAL DOMAIN: Gray Level Transformation – Image Negatives – Log Transformations –Piecewise-Linear transformation function-Enhancement Using Arithmetic/Logic Operations – Image Subtraction – Image Averaging	8
IV	**Image Compression:** Fundamentals-Coding Redundancy – Inter pixel Redundancy – Psycho Visual Redundancy – Image Compression Models – The Source Encoder and Decoder – The Channel Encoder and Decoder	8
V	**Image Segmentation:** Detection of Discontinuities Point Detection – Line Detection – Edge Detection. REPRESENTATION OF IMAGES: Chain Codes – Polygonal Approximation –Signatures – Boundary Segments – Skeletons	8
Suggested Readings:		

Text Books:
1. Digital Image Processing‖ – Second Edition – Rafael C.Gonzalez and Richar E.Woods

Reference Books:
1. Anil K.Jain, ―Fundamentals of Digital Image Processing‖, PHI, 1995.
2. Sid Ahme M.A, ―Image Processing‖, McGraw Hill Inc, 1995
3. Gonzalaz R and Wintz P., ―Digital Image Processing‖, Addison Wesley, 2nd Ed, 1987

BCA304: DEEP LEARNING (EL)		
Course Outcome (CO)		
CO1	Understand the fundamentals of deep learning.	
CO2	Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems	
CO3	Illustrate the strength and weaknesses of many popular deep learning approaches.	
CO4	Understanding the working of Convolutional Neural Networks and RNN in decision making.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** What is a Neural Network?, The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures, Rosenblatt‟s Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.	**8**
II	**Multilayer Perceptrons:** Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Back- Propagation Algorithm Perform Better, Back Propagation and Differentiation.	**8**
III	**Regularization for Deep Learning:** Parameter Norm Penalties - L2 Parameter Regularization, Dataset Augmentation, Semi-Supervised Learning. Optimization for Training Deep Models: Challenges in Neural Network Optimization – Ill Conditioning, Local Minima, Plateaus, Saddle Points and Other Flat Regions.	**8**
IV	**Convolution neural networks:** The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Convolutional Networks and the History of Deep Learning.	**8**
V	**Sequence Modeling:** Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to- Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs	**8**

Suggested Readings:

1. Deep Learning by François Chollet (Indian Edition)
2. Deep Learning: A Practitioner's Approach" by Adam Gibson and Josh Patterson (Indian   Edition)
3. Python Deep Learning" by Ivan Vasilev, Daniel Slater, and others (Indian Edition)

BCA306: NEURAL NETWORK (EL)		
Course Outcome (CO)		
CO1	Study the concepts of neural network and some related problems.	
CO2	Develop the knowledge supervised and unsupervised.	
CO3	Study the concepts of architecture of Neural network.	
CO4	Learn the concepts of principle component and SOM.	
CO5	Develop the skills on FUZZY techniques, soft computing and concepts of CVNN, CVBP.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Neural Networks:** Terminology, Neural Network Architecture, Perceptron's, Linear Separability. Perceptron Training Algorithm: Termination Criteria, Choice of Learning Rate, Non-numeric Input. Modifications: Pocket Algorithm.	8
II	**Supervised/Unsupervised Learning:** Prediction Networks, Winner Take-All Networks, Hamming Networks, Max Net, Simple Competitive Learning, Counter Propagation, Neo Cognition. Associative Models: Hopfield Network, Brain-State-on-a-Box Network, Boltzmann Machines.	8
III	**Accelerated Learning BP** Multilayered Network Architecture, Back Propagation Algorithm, Heuristics for Making Algorithm. Accelerated Learning BP: Recursive Least Square, Quick Prop, RPROP Algorithm, Approximation Properties of RBF Networks, Comparison with Multilayer Perceptron.	8
IV	**Recurrent Network:** Temporal Feed-forward Network, Implementation with BP, Self-Organizing Map and SOM Algorithm, Properties of Feature Map and Computer Simulation, Principal Component, Independent Component Analysis, Application to Image and Signal Processing.	8
V	**Complex Valued NN:** Complex Valued BP, Analyticity of Activation Function, Application in 2D Information Processing, Complexity Analysis of Network Models, Soft Computing, NeuroFuzzy-Genetic Algorithm Integration.	8

Reference Books:

1. K. Mehrotra, Mohan, Ranka "Elements of Artificial Neural Networks" Penram International Publishing
2. J.A. Anderson, "An Introduction to Neural Networks", MIT.
3. Hagen Demuth Beale, "Neural Network Design", Cengage Learning.
4. Laurene V. Fausett, "Fundamentals of Neural Networks. Architectures, Algorithms and Applications", Pearson   India.

BCA308: INTRODUCTION TO INTERNET OF THINGS (EL)		
Course Outcome (CO)		
CO1	Classify the fundamentals of IoT, its architecture, and applications.	
CO2	Identify and use IoT hardware, networking components, and communication protocols.	
CO3	Organize the IoT data handling techniques and security challenges.	
CO4	Develop IoT applications using programming and cloud platforms.	
CO5	Evaluate case studies and emerging technologies in IoT.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to IoT :** Definition, Characteristics, and Evolution of IoT, IoT Architecture & Layers, IoT vs. Traditional Embedded Systems, IoT Communication Models & Protocols, IoT Ecosystem and Applications (Smart Homes, Healthcare, Agriculture, Smart Cities, etc.)	**8**
II	**IoT Hardware & Networking:** Sensors, Actuators, and Microcontrollers (Raspberry Pi, Arduino), IoT Communication Technologies: Wi-Fi, Bluetooth, Zigbee, LoRa, NB-IoT, IoT Connectivity: IPv6, MQTT, CoAP, HTTP, Edge Computing and Fog Computing in IoT, Power Management in IoT Devices	**8**
III	**IoT Protocols & Data Handling :** IoT Protocols: MQTT, CoAP, AMQP, HTTP; Cloud Computing for IoT, IoT Data Processing & Storage (Big Data & NoSQL Databases), Security & Privacy Issues in IoT, IoT Middleware and IoT Platforms (AWS IoT, Google IoT Core, Azure IoT)	**8**
IV	**IoT Application Development & Security:** IoT Programming (Python for IoT, Node.js), IoT Operating Systems (Contiki, RIOT, FreeRTOS), Security Challenges in IoT (Threats, Authentication, Cryptography), Blockchain for IoT Security, IoT Testing & Debugging Tools	**8**
V	**Case Studies & Future Trends in IoT:** IoT Applications in Smart Cities, Agriculture, Healthcare, Industry 4.0; AI and Machine Learning for IoT, Digital Twin Technology in IoT, Future Trends in IoT (5G & Beyond, Quantum IoT), Ethical & Social Implications of IoT	**8**

Suggested Readings:

1. "Internet of Things: A Hands-On Approach" – By Arshdeep Bahga & Vijay Madisetti
2. "Internet of Things (IoT): Principles, Paradigms and Applications" – By Rajkumar Buyya & Amir Vahid Dastjerdi
3. "The Internet of Things: Connecting Objects to the Web" – By Hakima Chaouchi
4. "Internet of Things (IoT) with Raspberry Pi and Arduino" – By Rajesh Singh & Anita Gehlot
5. "IoT and Smart Cities: Advances in Green Computing" – By Pradeep Tomar & Gurjit Kaur

BCA651: MAJOR PROJECT LAB		
Course Outcome (CO)		
CO1	To help students develop openness to new ideas in computer science, develop the ability to draw reasonable inferences from observations and learn to formulate and solve new computer science problems using analytical and problem-solving skills;	
CO2	To help students develop the ability to synthesize and integrate information and ideas, develop the ability to think creatively, develop the ability to think holistically and develop the ability to distinguish between facts and opinion;	
CO3	To help students acquire the necessary competences to build a real-life software system by completing different software life cycle phases (like, specification, architecture, design, implementation, validation, documentation, etc);	
CO4	To help students develop the ability to work individually and as part of a team, develop a commitment to accurate work, develop management skills, improve speaking and writing skills, improve the ability to follow directions, instructions and plans, and improve the ability to organize and use time effectively;	
CO5	To help students develop a commitment to personal achievement, the ability to work skillfully, informed understanding of the role of science and technology, a lifelong love of learning, and cultivates a sense of responsibility for one's own behavior and improves self-esteem/self-confidence.	
DETAILED SYLLABUS		
Sr. N	**Topic**	**Hours**
	Course Content This course consists of the development of a realistic application, representative of a typical real-life software system or to carry a research based project in an area related to CS & IT. 1. The students are expected to propose, analyze, design, develop, test and implement a real life software system using recent technologies. 2. In case of a research based project, the students are required to follow a proper research methodology to propose a solution (in terms of a model/ framework/ algorithm, etc) of a research problem related to computer science and IT. 3. The student will deliver oral presentations, progress reports, and a final report. **A.** Depending on the topic of the project and the chosen software development methodology, the following themes may be addressed to some extent: Software development methodologies, static (products) and dynamic aspects (processes);	

Requirement analysis (goals, use cases), software architectures, architectural styles and patterns, model-driven engineering(MDE);

- Programming techniques, software development environments, refactoring;
- Software validation through unit tests, integration tests, functional and structural tests, and code reviews.
- Project management, planning, resource estimation, reporting.
- Version management by using a version management tool.
- Examples of kinds of systems to be developed are distributed systems, client/server systems, web based systems, secure systems, mobile systems, adaptable systems, optimizations of existing systems or data-intensive systems, etc.

B. Typical process **of research based problems** may include, selection of a research topic followed by an extensive literature survey with an aim to find the research gap. Proposing a solution based on the findings (i.e., research gap) and publishing the research work.

Suggested Readings:

1. Robert Lafore, "Object Oriented Programming in C++", Pearson
2. R. Brown, "Visual Basic .NET – Your Visual Blueprint for Building Versatile Programs on the .NET Framework", Wiley Publishing, Inc.
3. Ivan Bayross, "Oracle", BPB
4. E.N. Mackay, "Developing user Interfaces for Windows", WP Publishers & Distributors Pvt. Ltd.

Syllabus

BCA 4th Year
VIIth Semester

BCA401: DATA MINING		
Course Outcome (CO)		
CO1	To understand the basics of Data mining concepts and their applications with trends.	
CO2	To understand the importance of decision tree, Neural Network and Genetics algorithm.	
CO3	To learn classification-based algorithms and their implementations.	
CO4	To Learn various Data mining Techniques algorithms.	
CO5	Describe Data Mining Association rules measurements and quality of rules.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Data Mining:** Definition and Functionalities of Data Mining. Knowledge representation in Data Bases. Data Mining issues, Data Mining Matrices, Data Mining applications and Trends.	**8**
II	**Data Mining Techniques:** A statistical approach on data mining, similarity measures, Decision Trees, Neural Network, and genetic Algorithm.	**8**
III	**Classification:** Statistical Based Algorithm, Distance Based Algorithm, Decision Based Algorithms.	**8**
IV	**Algorithm:** Clustering Tree Algorithm. Neural Network Algorithm, Rule Based Algorithm, and Combining Techniques: Introduction, Similarity and Distance measures outliers, Hierarchical Algorithm.	**8**
V	**Association Rules:** Introduction. Large Item sets, Parallel and distributed Algorithm, Comparing approaches, Incremental rules, advance association Rules, Measuring the quality of rules	**8**

Suggested Readings:

1. Data Mining Techniques, Arun K Pujari, University Press
2. Data Mining Concepts and Techniques,3rd Edition ,Jiawei Han , Micheline Kamber, Jian Pei.

BCA403: SOFT COMPUTING		
Course Outcome (CO)		
CO1	Classify the knowledge of soft computing concepts and he can apply them for practical applications.	
CO2	Design suitable Neural Network for real time problems.	
CO3	Discuss the appropriately use fuzzy rules and reasoning to develop decision making and expert systems.	
CO4	Formulate the importance of optimization techniques and genetic programming.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Soft Computing, Differences between Soft Computing and Hard Computing, Requirements of Soft Computing, Applications of Soft Computing; Introduction to Artificial Intelligence, Models of Artificial Neural Network, Feed forward artificial neural networks, Perceptron and Multilayer Perceptron neural networks, Radial basis function artificial neural networks, Recurrent neural networks, Modular neural networks.	8
II	**Learning Rules and Various Activation Functions:** Hebbian Learning Rule, Perception Learning Rule, Delta Learning Rule, Widrow, Hoff Learning Rule, Correlation Learning Rule, Winner take All Learning Rule, Associative Memories.	8
III	**Introduction to Fuzzy System:** Fuzzy System, Fuzzy Logic, Fuzzy Sets and Crisp Sets, Evolution of Fuzzy System, Fuzzy Set Operations, Fuzzy to Crisp Conversion, Inference in Fuzzy Logic, Fuzzy Rule Base, Fuzzy Knowledge Base, Fuzzyfication and Defuzzyfication.	
IV	**Genetic Algorithm-I:** Genetic Algorithm, Basic Concept, Working Principle of Genetic Algorithm, Flow Chart of Genetic Algorithm, Genetic Representation (Encoding), Initialization and Selection.	8
V	**Genetic Algorithm-II:** Genetic Representations, (Encoding), Genetic Operators, Mutation, Generational Cycle.	8

Suggested Readings:

Reference Books
1. S. Rajsekaran& G.A. VijayalakshmiPai, "Neural Networks,Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India,2003
2. Anderson, James, "Introduction to Neural Networks", PHI Publication, Delhi, India
3. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press, USA, 2005.
4. Simon Haykin,"Neural Networks and Learning Machines "Prentice Hall of India, 2005, Third Edition.

BCA405: INTRODUCTION TO RESEARCH METHODOLOGY

	Course Outcome (CO)	
CO1	Define the basic framework of research process.	
CO2	Formulate hypotheses or suggested solutions.	
CO3	Use various sources of research design, information for literature review and data collection.	
CO4	Discuss the different sampling techniques	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to Research:** Meaning of Re-search, Retracing the path, Importance of re-search. Philosophies, and the language of research theory building Theoretical background of a research philosophy. The meaning of methodology (structured definition and examples). Understanding research terminologies i.e., Concepts, Constructs, Variables, and Definitions etc.	8
II	**Problems and Hypotheses:** Identifying research problem, State-of-the-Art, The problem definition lifecycle. Meaning/Definition of a hypothesis. Real world examples. Testing and Verification of Hypothesis.	8
III	**Research design:** Experimental and Non-experimental research design. Field research, Survey Research, Survey outcomes. Methods of data collection – Secondary data collection methods, qualitative methods of data collection, and Survey methods of data collection.	8
IV	**Sampling Techniques:** Research Population and Sample. Target Population, Accessible Population. Sampling techniques – The nature of sampling, Probability sampling design. Nonprobability sampling design, Determination of sample size.	8
V	**Data Analysis & Report Generation:** Types of Data Sources, Web Data, Survey Data. Data attributes, Discrete vs. Continuous Data attributes. Mean, Median, Mode; Range, Quartile, Variance, SD, Interquartile Range	8

Suggested Readings:
Text book(s):
1. Bryman, Alan & Bell, Emma (2011). Business Research Methods (Third Edition), Oxford University Press.
2. Kerlinger, F.N., & Lee, H.B. (2000). Foundations of Behavioural Research (Fourth Edition), Harcourt Inc.
3. Rubin, Allen & Babbie, Earl (2009). Essential Research Methods for Social Work, Cengage Learning Inc., USA.

Other References:
1. Chawla, Deepak & Sondhi, Neena (2011). Research methodology: Concepts and cases, Vikas Publishing House Pvt. Ltd. Delhi.
2. Pawar, B.S. (2009). Theory building for hypothesis specification in organizational studies, Response Books, New Delhi.
3. Neuman, W.L. (2008). Social research methods: Qualitative and quantitative approaches, Pearson Education.

BCA407: COMPUTER VISION (EL)		
Course Outcome (CO)		
CO1	Understand the fundamental concepts of image formation, image representation, and perception in computer vision.	
CO2	Apply various image processing techniques for enhancement, segmentation, and feature extraction.	
CO3	Implement feature detection and matching algorithms for object recognition and motion estimation.	
CO4	Design and evaluate computer vision systems using machine learning and deep learning methods.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Computer Vision:** Overview of Computer Vision and Applications, Human vs Computer Vision, Image Formation and Representation, Digital Image Fundamentals: Sampling, Quantization, Resolution. Color Spaces: RGB, HSV, YCbCr, Grayscale. Imaging Devices: Cameras, Sensors, and Image Acquisition, Introduction to OpenCV and Python for CV	**8**
II	**Image Processing Fundamentals:** Image Enhancement Techniques: Histogram Equalization, Filtering (Smoothing, Sharpening), Edge Detection: Sobel, Prewitt, Canny, Laplacian. Thresholding: Global, Adaptive, Otsu's Method. Morphological Operations: Dilation, Erosion, Opening, Closing. Image Segmentation: Region-based, Contour-based, Watershed	**8**
III	**Feature Detection and Matching:** Interest Point Detection: Harris Corner Detector, Shi-Tomasi. Feature Descriptors: SIFT, SURF, ORB. Feature Matching: Brute-Force, FLANN-based Matching, Homography and Image Stitching. Motion Estimation: Optical Flow (Lucas-Kanade, Horn-Schunck)	**8**
IV	**Object Recognition and Tracking:** Template Matching. Object Detection: Viola-Jones, HOG + SVM. Introduction to Convolutional Neural Networks (CNNs), Object Tracking Algorithms: Mean-Shift, CAMShift, Kalman Filter, SORT, Face Detection and Recognition.	**8**
V	**Advanced Topics and Applications:** Deep Learning for Vision: CNN Architectures (AlexNet, VGG, ResNet). Transfer Learning in Computer Vision, Scene Understanding: Image Captioning, Semantic Segmentation (FCN, U-Net). 3D Vision: Stereo Vision, Structure from Motion, Real-world Applications: Autonomous Vehicles, Medical Imaging, Surveillance, AR/VR.	**8**

Suggested Readings:

1. Computer Vision: Algorithms and Applications" by Richard Szeliski, Springer, 2nd Edition, 2022.
2. "Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods, Pearson, 4th Edition, 2018.
3. "Learning OpenCV 4: Computer Vision with Python" by Adrian Kaehler and Gary Bradski, O'Reilly Media, 2nd Edition, 2019.
4. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani, Packt Publishing, 2018.

BCA409: FUNDAMENTALS OF DATA PRIVACY (EL)		
Course Outcome (CO)		
CO1	Explain the fundamental concepts of data privacy and identify privacy threats.	
CO2	Describe data collection practices and the principles of ethical data handling.	
CO3	Apply privacy-enhancing technologies in real-world scenarios.	
CO4	Analyze current trends, challenges, and case studies in data privacy.	
DETAILED SYLLABUS		
Unit	Topic	Proposed Lecture
I	**Introduction to Data Privacy:** Definition and Importance of Data Privacy, Types of Data: Personal, Sensitive, and Anonymized Data, Privacy vs. Security, Historical Context and Evolution of Privacy Laws, Privacy Threats: Data Breaches, Surveillance, Profiling, and Tracking.	8
II	**Data Collection and Usage:** Principles of Data Collection: Consent, Notice, and Purpose Limitation, Data Minimization and Retention Policies, Data Flow and Lifecycle: Collection, Storage, Processing, and Deletion, User Tracking Techniques: Cookies, Web Beacons, and Device Fingerprinting, Behavioral Targeting and Profiling	8
III	**Privacy Regulations and Legal Frameworks:** General Data Protection Regulation (GDPR), California Consumer Privacy Act (CCPA), Health Insurance Portability and Accountability Act (HIPAA), Data Protection Bill (India) – Overview Compliance, Penalties, and Enforcement Mechanisms.	8
IV	**Privacy Enhancing Technologies (PETs):** Data Anonymization and Pseudonymization Techniques, Differential Privacy: Basics and Use Cases, Cryptographic Techniques: Encryption, Homomorphic Encryption, Access Control and Data Masking, Secure Multi-party Computation and Blockchain for Privacy.	8
V	**Emerging Trends and Case Studies:** Privacy in IoT and Mobile Devices, Artificial Intelligence and Data Privacy Challenges, Social Media and Privacy Issues, Case Studies: Facebook-Cambridge Analytica, GDPR Fines, Healthcare Data Breaches, Future of Data Privacy: Challenges and Opportunities.	8

Suggested Readings:

1. Daniel J. Solove, Understanding Privacy, Harvard University Press, 2008.
2. Mike Chapple and David Seidl, Privacy and Data Protection Essentials, Wiley, 2021.
3. Simson Garfinkel and Gene Spafford, Web Security, Privacy and Commerce, O'Reilly Media, 2nd Edition, 2002.
4. Bruce Schneier, Data and Goliath: The Hidden Battles to Collect Your Data and Control Your World, W.W. Norton & Company, 2015.
5. Arvind Narayanan et al., Privacy Technologies and Policy, Springer, 2017.
6. Relevant legislation texts like GDPR, CCPA (available online).

	BCA411: SOFT SKILLS AND INTERPERSONAL COMMUNICATIONS (EL)	
	Course Outcome (CO)	
CO1	Understand and apply various soft skills essential for personal and professional development.	
CO2	Communicate effectively and confidently in diverse scenarios using verbal and non-verbal skills.	
CO3	Demonstrate strong interpersonal skills in teamwork, leadership, and conflict resolution settings.	
CO4	Exhibit professionalism through personal grooming, ethics, and time management.	
CO5	Prepare and present themselves effectively for interviews, group discussions, and workplace communication.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Soft Skills:** Definition and Importance of Soft Skills, Classification of Soft Skills: Personal, Interpersonal, Social. Key Soft Skills: Adaptability, Creativity, Work Ethic, Time Management, Difference between Hard Skills and Soft Skills, Developing a Soft Skill Mindset, Role of Soft Skills in Career and Life Success.	8
II	**Communication Skills:** Verbal and Non-verbal Communication, Barriers to Effective Communication, Listening Skills: Types, Barriers, and Strategies, Writing Skills: Emails, Reports, and Business Correspondence, Public Speaking and Oral Presentation Skills, Communication Etiquette (Phone, Email, Social Media).	8
III	**Interpersonal Communication:** Basics of Interpersonal Communication, Relationship Building: Trust and Respect, Conflict Resolution and Negotiation Skills, Empathy and Emotional Intelligence, Group Discussions and Debates Interview Skills: Preparation and Practice.	8
IV	**Teamwork and Leadership:** Importance of Teamwork in Professional Life, Team Roles and Responsibilities, Leadership Styles and Theories, Motivation and Influencing Skills, Collaboration and Delegation, Problem-solving and Decision-making in Teams.	8
V	**Personality Development and Professionalism:** Self-Awareness and Self-Motivation, Building a Positive Attitude and Confidence, Personal Grooming and Body Language, Stress and Time Management, Professional Ethics and Work Culture Resume Writing and Career Planning.	8

Suggested Readings:

1. Goleman, Daniel – Emotional Intelligence, Bantam Books.
2. Carnegie, Dale – How to Win Friends and Influence People, Simon & Schuster.
3. Rao, M.S. – Soft Skills – Enhancing Employability: Connecting Campus with Corporate, I.K. International Publishing.
4. Meenakshi Raman and Sangeeta Sharma – Technical Communication: Principles and Practice, Oxford University Press.
5. Barun K. Mitra – Personality Development and Soft Skills, Oxford University Press.
6. Ashraf Rizvi – Effective Technical Communication, Tata McGraw-Hill.

BCA471: RESEARCH METHODOLOGY LAB

Course Outcome (CO)		
CO1	Identify and formulate research problems with an understanding of research design.	
CO2	Conduct systematic literature reviews using reliable sources and databases.	
CO3	Apply appropriate methodologies, tools, and techniques for data collection and analysis.	
CO4	Demonstrate academic integrity, ethical considerations, and proper citation practices.	
CO5	Draft high-quality research proposals, papers, and technical reports.	

DETAILED SYLLABUS

Sr. N	Topic	Hours
1	Introduction to Research: Definition, types, and significance of research. Research process: Problem identification, objectives, hypothesis. Research ethics and plagiarism.	
2	Literature Review: Importance and sources of literature. Using digital libraries: IEEE Xplore, Springer, Scopus, Google Scholar. Reference management tools: Mendeley, Zotero, EndNote.	
3	Research Design and Methodology: Qualitative vs Quantitative research. Sampling methods, data collection tools, surveys, experiments. Case studies and simulation methods.	
4	Data Analysis and Tools: Statistical analysis basics: Mean, median, mode, standard deviation. Tools: Excel, SPSS, R, Python (pandas, matplotlib). Interpretation and visualization of data.	
5	Research Documentation and Writing: Research paper structure: Abstract, Introduction, Methodology, Results, Discussion, Conclusion. Technical report writing. Referencing styles: APA, IEEE, MLA.	
6	Research Communication: Preparing presentations and posters. Publishing in journals, conferences. Handling peer review and revision.	

Suggested Readings:

1. C.R. Kothari, Research Methodology: Methods and Techniques, New Age International, 2004.
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, SAGE Publications, 2019.
3. Jonathan Schwabish, Better Data Visualizations, Columbia University Press, 2021.
4. Robert V. Labaree, Research Guides and Academic Databases, USC Libraries.
5. Eliot Freidson, Professional Powers: A Study of the Institutionalization of Formal Knowledge, University of Chicago Press.

BCA473: MINOR PROJECT

	Course Outcome (CO)	
CO1	Identify project/research problems; understand information and grasp meaning; translate knowledge into new context; use information, methods, concepts, and theories of fundamental topics in computer science in new situations (Knowledge, Comprehension);	
CO2	Apply computer science principles and practices to a real-world problem; demonstrate in-depth knowledge in the area of the project they have undertaken; solve problems using required knowledge and skills; implement and test solutions/algorithms (Application and Evaluation);	
CO3	Identify potential solutions/algorithms for the project problem; see patterns and modularize the problem, recognize hidden meanings and identify components, show proficiency in software engineering principles (Analysis);	
CO4	Apply a software development methodology currently practiced in industry to produce software system in a rigorous and systematic way using different software life cycle phases (specification, architecture, design, implementation, validation, documentation) (Synthesis);	
CO5	Show evidence (group collaboration, regular meetings, email communications, significant knowledge and skills contributions, etc.) of working productively as an individual and in a team on a project that produces a significant software product (Team Work);	
CO6	Show evidence of competency in oral and written communications skills through oral presentations (project presentation, department seminar or conferences, client interactions), technical reports and/or published research papers in conferences and/or journals (Communications);	
CO7	Use modern techniques, skills and tools necessary for computer science practices relevant to the project they undertake; use techniques in recent research papers to solve problems (Lifelong Learning).	
DETAILED SYLLABUS		
Sr. N	Topic	Hours
	LAB: Besides completing the subject/Lab assignments, the students will be required to complete one mini project as follows: **MINI-PROJECT in VB, VC++ or Java under Linux(UNIX)/Windows** **In addition to completing Mini-Project, the students will be doing the exercises** provided by the respective teachers in their class rooms. The individual	

teachers who are teaching the courses will be responsible for completing their respective lab assignments.	
Some of the representative areas/problems may include the following:	
Developing Window Based Applications using recent technologies using .NET Platform or Java Technologies like Java Servlet, Java Beans, COM, CORBA etc.	
Students should learn languages such as PROLOG or LISP to solve the Laboratory exercises.	
An expert system shell such as IITM rule be used to create a small expert system for, say, troubleshooting moped, VCR etc. Some suggested experiments are : Tour of India, Stable marriage problem, Game playing (such as bridge), coin change problem etc.	

Suggested Readings:

1. Robert Lafore, "Object Oriented Programming in C++", Pearson
2. R. Brown, "Visual Basic .NET – Your Visual Blueprint for Building Versatile Programs on the .NET Framework", Wiley Publishing, Inc.
3. Ivan Bayross, "Oracle", BPB
4. E.N. Mackay, "Developing user Interfaces for Windows", WP Publishers & Distributors Pvt. Ltd.

Syllabus

BCA 4th Year
VIIIth Semester

BCA402: R PROGRAMMING		
Course Outcome (CO)		
CO1	Understand the fundamentals of R programming and environment setup.	
CO2	Apply various data structures in R for effective data representation and manipulation.	
CO3	Perform data import/export operations and handle real-world data preprocessing.	
CO4	Visualize data effectively using R's powerful graphical capabilities.	
CO5	Conduct statistical analysis and apply basic machine learning techniques in R.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to R Programming:** Introduction to R and RStudio, Installation and Setup of R environment, Basic syntax: Variables, Data Types, Operators, R scripts and R console, Input and Output functions, Control Structures: if, else, switch, for, while, repeat, break, next.	**8**
II	**Data Structures in R:** Vectors, Lists, Matrices, Arrays, Factors and Data Frames, Indexing and Slicing, Functions: Built-in and User-defined, Apply family of functions: apply(), lapply(), sapply(), tapply().	**8**
III	**Data Manipulation and Import/Export:** Data Import: Reading CSV, Excel, Text, JSON, XML files, Data Export: Writing Data to Files, Data Cleaning and Preprocessing, Data Manipulation using dplyr, tidyr, String manipulation with stringr, Date and Time handling with lubridate.	**8**
IV	**Data Visualization in R:** Base plotting functions, Advanced visualization using ggplot2, Bar Charts, Line Charts, Histograms, Scatterplots, Boxplots, Customizing Plots: Titles, Labels, Legends, Themes, Saving plots to files, Introduction to shiny for interactive visualization (optional).	**8**
V	**Statistical Analysis and Applications:** Descriptive Statistics: Mean, Median, Mode, Variance, Standard Deviation, Probability Distributions: Normal, Binomial, Poisson, Hypothesis Testing: t-test, chi-square test, ANOVA, Correlation and Regression Analysis, Introduction to Machine Learning in R: Linear Regression, Clustering (k-means).	**8**

Suggested Readings:

1. "The Art of R Programming" by Norman Matloff, No Starch Press
2. "R for Data Science" by Hadley Wickham and Garrett Grolemund, O'Reilly Media
3. "Hands-On Programming with R" by Garrett Grolemund, O'Reilly Media
4. "Advanced R" by Hadley Wickham, Chapman and Hall/CRC
5. "Beginning R: The Statistical Programming Language" by Mark Gardener, Wiley

CA404: CLOUD COMPUTING (EL)

Course Outcome (CO)		
CO1	Classify the concepts, applications, principles and implementation of cloud computing.	
CO2	Define the Cloud Computing Architecture, Cloud Virtualization, Cloud Programming Models, Cloud security and applications.	
CO3	Explain the theoretical concepts but also strongly focuses on practical skill-based learning.	
CO4	Designing, implementing and managing the issues of cloud computing in their personal as well professional life.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to Cloud Computing:** Overview of Cloud Computing, Evolution of Cloud Computing, Characteristics of Cloud Computing, Types of cloud and its Cloud services, Benefits and challenges of cloud computing, Applications cloud computing, Cloud Storage, Cloud services requirements, Cloud and dynamic infrastructure, Cloud adoption.	8
II	**Cloud Computing Architecture:** Cloud reference model, Platform as service, Software as a service, Infrastructure as service, Cloud deployment models, public clouds, Private clouds, Community cloud, Hybrid clouds, Cloud design and implementation using SOA, security, trust and privacy.	8
III	**Cloud Virtualization Technology:** Overview of Virtualization techniques, Types of Virtualizations, Implementation Levels of Virtualization Structures, Virtualization benefits, Server virtualization, hypervisor management software, virtual infrastructure requirements	8
IV	**Map Reduce:** Introduction to parallel computing, Map-reduce model, Applications of map reduce, Parallel efficiency of Map Reduce, MapReduce infrastructure, Introduction to Security, Cloud Security challenges and Risks, Software-as-a-Service Security Security Monitoring, Security Architecture Design, Data Security, Application Security, Virtual Machine Security, Identity Management and Access Control.	8
V	**Cloud platforms and applications:** Web services, App Engine, Azures Platform, Aneka, Open challenges, Scientific applications, Business and Consumer applications	8

Suggested Readings:

1. Dr. Kumar Saurabh, Cloud Computing
2. Raj Kumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing.

BCA406: STORAGE AREA NETWORK (EL)		
Course Outcome (CO)		
CO1	Classify the fundamentals of SAN, its components, and architecture.	
CO2	Demonstrate the various SAN technologies and communication protocols.	
CO3	Implement SAN management techniques and security best practices.	
CO4	Define the SAN performance and troubleshoot issues in storage networks.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Storage Area Networks:** Overview of Storage Systems, Need for Storage Area Networks (SAN), Types of Storage (DAS, NAS, SAN, Cloud Storage), SAN vs. NAS vs. DAS, SAN Architecture & Components (HBAs, Switches, Storage Arrays)	**8**
II	**SAN Technologies & Protocols:** Fibre Channel (FC) and FC Topologies, iSCSI (Internet Small Computer System Interface), Fibre Channel over Ethernet (FCoE), InfiniBand and NVMe over Fabrics, SAN Zoning and LUN Masking	**8**
III	**SAN Management & Security:** SAN Deployment & Configuration, Storage Virtualization in SAN, Data Deduplication & Compression, SAN Security Threats & Solutions, SAN Backup and Disaster Recovery	**8**
IV	**SAN Performance & Troubleshooting:** SAN Performance Metrics & Monitoring, Bottleneck Identification & Optimization, SAN Troubleshooting Tools & Techniques, Storage Tiering & Load Balancing, Case Studies of Enterprise SAN Implementations	**8**
V	**Emerging Trends in SAN & Cloud Storage:** Software-Defined Storage (SDS), Hyper-Converged Infrastructure (HCI), Cloud Storage & Hybrid Cloud Solutions, AI & Machine Learning in Storage Optimization	**8**

Suggested Readings:

1. "Storage Area Networks" – Meeta Gupta
2. "Data Storage Networking" – Nutan Kumar Panda
3. "Cloud Computing and Storage" – Rashmi Nanda
4. "Storage Networking: Self-Study Guide" – Ramesh Chandra
5. "Storage Networking Fundamentals" – Marc Farley

BCA408: CYBER ANALYTICS (EL)		
Course Outcome (CO)		
CO1	Students after completing this module will be able to understand the basic terminologies related to cyber security and current cyber security threat landscape.	
CO2	After completion of the module, students will have complete understanding of the cyber-attacks that target computers, mobiles and persons.	
CO3	Students after completing this module will be able to understand the legal framework that exist in India for cyber crimes	
CO4	After completing this module, students will understand the aspects related to personal data privacy and security.	
CO5	Students after completing this module will understand the main components of cyber security plan.	

	DETAILED SYLLABUS	
Unit	**Topic**	**Proposed Lecture**
I	Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.	**8**
II	Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.	**8**
III	Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.	**8**
IV	Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies.	**8**
V	Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.	**8**

Suggested Readings:

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security ", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla ,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press.

BCA480: R PROGRAMMING LAB		
Course Outcome (CO)		
CO1	Understand the fundamentals of R programming, including data types and operations.	
CO2	Implement control structures and functions for problem-solving in R.	
CO3	Manipulate and visualize data using built-in and external libraries.	
CO4	Apply statistical techniques and exploratory data analysis using R.	
CO5	Develop data-driven solutions by implementing machine learning models in R.	
DETAILED SYLLABUS		
S.No.	**Topic**	**Hours**
	Basic R Programming: 1. Write a program to print "Hello, R!". 2. Implement basic arithmetic operations in R. 3. Demonstrate the use of variables and data types. **Control Structures:** 1. Write a program using if-else conditions to check whether a number is even or odd. 2. Implement a for loop to print numbers from 1 to 10. 3. Use while loop to generate the Fibonacci series up to a given number. **Functions and Data Structures:** 1. Define a function to calculate the factorial of a number. 2. Implement a function to compute the sum of elements in a vector. 3. Demonstrate list operations by creating and accessing elements of a list. **Data Manipulation using Vectors and Matrices:** 1. Create a vector and perform basic operations (addition, subtraction, sorting, etc.). 2. Implement matrix operations such as addition, multiplication, and transpose. **Data Frames and Data Importing:** 1. Create a data frame with sample student records (Name, Age, Marks). 2. Import a CSV file and perform basic analysis. 3. Filter data based on conditions using subset() and dplyr package. **Data Visualization using ggplot2:** 1. Generate bar plots, histograms, and scatter plots using ggplot2. 2. Create a line graph to visualize trends over time. **Statistical Analysis in R:**	

| | 1. Compute mean, median, and mode for a dataset.
2. Perform correlation and regression analysis.
3. Conduct hypothesis testing using t-test.

Exploratory Data Analysis (EDA):
1. Load a dataset and perform summary statistics.
2. Identify missing values and handle them.
3. Use ggplot2 and dplyr to visualize and explore the dataset.

Machine Learning using R:
1. Implement simple linear regression using R.
2. Build a classification model using decision trees.
3. Perform clustering using k-means algorithm.

Time Series Analysis:
1. Load a time series dataset and visualize trends.
2. Implement ARIMA for time series forecasting. | |

Suggested Readings:

1. R for Data Science – Hadley Wickham & Garrett Grolemund, O'Reilly Media
2. The Art of R Programming – Norman Matloff, No Starch Press
3. Hands-On Programming with R – Garrett Grolemund, O'Reilly Media
4. R in Action – Robert Kabacoff, Manning Publications
5. An Introduction to Statistical Learning with Applications in R – Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani

BCA482: MAJOR PROJECT LAB		
Course Outcome (CO)		
CO1	To help students develop openness to new ideas in computer science, develop the ability to draw reasonable inferences from observations and learn to formulate and solve new computer science problems using analytical and problem-solving skills;	
CO2	To help students develop the ability to synthesize and integrate information and ideas, develop the ability to think creatively, develop the ability to think holistically and develop the ability to distinguish between facts and opinion;	
CO3	To help students acquire the necessary competences to build a real-life software system by completing different software life cycle phases (like, specification, architecture, design, implementation, validation, documentation, etc);	
CO4	To help students develop the ability to work individually and as part of a team, develop a commitment to accurate work, develop management skills, improve speaking and writing skills, improve the ability to follow directions, instructions and plans, and improve the ability to organize and use time effectively;	
CO5	To help students develop a commitment to personal achievement, the ability to work skillfully, informed understanding of the role of science and technology, a lifelong love of learning, and cultivates a sense of responsibility for one's own behavior and improves self-esteem/self-confidence.	
DETAILED SYLLABUS		
Sr. N	**Topic**	**Hours**

	Course Content
	This course consists of the development of a realistic application, representative of a typical real-life software system or to carry a research based project in an area related to CS & IT.
	    4. The students are expected to propose, analyze, design, develop, test and implement a real life software system using recent technologies.
	    5. In case of a research based project, the students are required to follow a proper research methodology to propose a solution (in terms of a model/ framework/ algorithm, etc) of a research problem related to computer science and IT.
	    6. The student will deliver oral presentations, progress reports, and a final report.
	
	  A. Depending on the topic of the project and the chosen software development methodology, the following themes may be addressed to some extent:
	Software development methodologies, static (products) and dynamic aspects (processes);	

Requirement analysis (goals, use cases), software architectures, architectural styles and patterns, model-driven engineering(MDE);

- Programming techniques, software development environments, refactoring;
- Software validation through unit tests, integration tests, functional and structural tests, and code reviews.
- Project management, planning, resource estimation, reporting.
- Version management by using a version management tool.
- Examples of kinds of systems to be developed are distributed systems, client/server systems, web based systems, secure systems, mobile systems, adaptable systems, optimizations of existing systems or data-intensive systems, etc.

B. Typical process **of research based problems** may include, selection of a research topic followed by an extensive literature survey with an aim to find the research gap. Proposing a solution based on the findings (i.e., research gap) and publishing the research work.

Suggested Readings:

5. Robert Lafore, "Object Oriented Programming in C++", Pearson
6. R. Brown, "Visual Basic .NET – Your Visual Blueprint for Building Versatile Programs on the .NET Framework", Wiley Publishing, Inc.
7. Ivan Bayross, "Oracle", BPB
8. E.N. Mackay, "Developing user Interfaces for Windows", WP Publishers & Distributors Pvt. Ltd.