

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented for 2026-30 and 2027-31 Batch
Department of Computer Applications

Class: F.Y. BCA

Semester: I

		Teaching Scheme				Evaluation Scheme					
Course Code	Course	L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max	Min for Passing	Max	Min for Passing	
BC1231	Mathematics Foundations for Computer Science – I	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC1251	Problem Solving Techniques	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC1271	Computer Architecture	3	-	-	3	ISE	20	40	40	---	---
						UT-1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC1291	Problem Solving Techniques Lab	-	-	4	2	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
BC143	Computer Architecture Lab	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
BC1331	General English - I	1	1	-	2	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC1351	Indian Knowledge Systems	2	-	-	2	ISE	50	40	40	---	---
						ESE	50	40		---	---
BC1371	Environmental Science and Sustainability	2	-	-	2	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
	Additional Course - Indian or Foreign Language Other than Mother Tongue and English (0-0-2) [optional course] *	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
	Total	14	01	08	19						
	Total Contact Hours	23									

ISE = In Semester Evaluation, UT-I = Unit Test, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/Week : 23

Total Credits : 19





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Department of Computer Applications

Foreign Language

German-I	BC1391
Japanese-I	BC1411



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Department of Computer Applications

Class: F.Y. BCA

Semester: II

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max	Min for Passing	Max	Min for Passing	
BC1221	Mathematics Foundations for Computer Science – II	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC1241	Data Structures	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC1261	Operating Systems	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC1281	Object-Oriented Programming Using Java	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC1301	Web Technologies	1	-	2	2	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
BC1321	Data Structures Lab	-	-	4	2	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
BC1361	Object-Oriented Programming Using Java Lab	-	-	4	2	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
BC1381	Indian Constitution	2	-	-	2	ISE	20	40	40	---	---
						UT 1	15				
						UT 2	15				
						ESE	50				
	Additional Course - Indian or Foreign Language Other than Mother Tongue and English (0-0-2) [optional course] *	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
	Total	14	00	14	21						
	Total Contact Hours	28									

ISE = In Semester Evaluation, UT-I = Unit Test, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/Week : 28

Total Credits : 21





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Foreign Language

German-II	BC1401
Japanese-II	BC1421





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Department of Computer Applications

Class: S.Y. BCA

Semester: III

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme					
							Max	Min for Passing	Max	Min for Passing	
BC2231	Probability and Statistics	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC2251	Database Management Systems	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC2271	Python Programming	2	-	-	2	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC2291	Database Management Systems Lab	-	-	4	2	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
BC2311	Python Programming Lab	-	-	4	2	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
BC2331	Software Engineering	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC241	Server-Side Scripting Using PHP	1	-	2	2	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC2371	Yoga/Sports/NCC/ NSS/ Disaster Management	-	-	4	2	ISE	---	---	---	100	50
BC2391	Mini Project	-	-	2	1	ISE	---	---	---	100	50
	Total	12	00	16	20						
	Total Contact Hours	28									

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Total Contact Hours/Week : 28

Total Credits : 20



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Class: S.Y. BCA

Semester: IV

Course code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max	Min for Passing	Max	Min for Passing	
BC2221	Entrepreneurship and Start-up Ecosystem	1	1	-	2	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC2241	Computer Networks	2	-	-	2	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC2261	Design and Analysis of Algorithms	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC2281	Artificial Intelligence	3	-	-	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
	Professional Elective – 1	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC2361	Computer Networks Lab	-	-	4	2	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
BC2381	Artificial Intelligence Lab	-	-	4	2	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
BC2401	Design Thinking and Innovation	1	1	-	2	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
BC2421	MOOCs**	-	-	-	1	ISE	---	---	---	100	50
	Total	12	02	10	20						
	Total Contact Hours	24									

Professional Elective – 1

Specialization	Course Code	Course
Data Science	BC2301	Statistical Methods for Data Science
Artificial intelligence and Machine Learning	BC2321	Feature Engineering
Information and Cyber Security	BC2341	Fundamentals of Information Security

ISE = In Semester Evaluation, UT-I = Unit Test, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/Week : 24

Total Credits : 20

Note:** MOOC Course certification marks will be carried out for the credits



Class: T.Y. BCA

Semester: V

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max	Min for Passing	Max	Min for Passing	
BC325	Android Application Development	2	-	-	2	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50	40	---	---	
BC3031	Cloud Computing	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50	40	---	---	
	Professional Elective – 2	2	0	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50	40	---	---	
	Professional Elective – 3	2	0	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50	40	---	---	
BC327	Android Application Development Lab	-	-	4	2	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
BC3191	Soft Skills	-	-	2	1	ISE	---	---	---	50	50
						ESE	---	---	---	50	50
BC3211	Quantitative Techniques	1	1	-	2	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50	40	---	---	
BC3231	Capstone Project	-	-	8	4	ISE	---	---	---	100	50
	Total	09	01	20	20						
	Total Contact Hours	30									

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Total Contact Hours/Week : 30

Total Credits : 20





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Curriculum Structure and Evaluation Scheme

To be implemented for 2026-30 and 2027-31 Batch

Department of Computer Applications

Professional Elective – 2

Specialization	Course Code	Course
Data Science	BC329	Data Analytics and Visualization
Artificial Intelligence and Machine Learning	BC3071	Machine Learning
Information and Cyber Security	BC3091	Network Security

Professional Elective – 3

Specialization	Course Code	Course
Data Science	BC331	Introduction to Data Science
Artificial Intelligence and Machine Learning	BC3131	Digital Image Processing
Information and Cyber Security	BC3151	Cryptography and Secure Communication





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Department of Computer Applications

Choice based Internship Model

Model I: Industry Internship (II)

Class: T.Y. BCA

Semester: VI

		Teaching Scheme				Evaluation Scheme					
Course Code	Course	L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max.	Min. for passing	Max.	Min. for passing	
BC3021	Financial Management (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
BC3041	Principles of Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
BC3061	Industry Internship & Project	-	-	-	16	ISE	---	----		50	50
						ESE	---	---		50	50
	Total	04	00	00	20						

ISE = In Semester Evaluation, ESE = End Semester Exam

Total Contact Hours/Week : 04

Total Credits : 20

Note:

1. Weekly Contact hours are not mentioned as students are expected to regularly be in an outside research organization for 20 weeks. However, students need to report to institute mentors as and when required.
2. For online courses, lecture videos of each unit will be made available to the students through the college platform. For each unit, there will be separate assignments. Students need to submit all assignments within the specified time.

Weightage: 25% weightage for unit-wise assignments + 75% weightage for final exam. The final exam will be held at a college campus.





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Choice based Internship Model

Model II: Entrepreneurial Internship (EI)

Class: T.Y. BCA

Semester: VI

Course Code	Course	Teaching Scheme			Credits	Scheme	Evaluation Scheme				
		L	T	P			Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max	Min. for passing
BC3081	Project Management (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
BC3101	Commercial Aspects of a Project (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
BC3121	Entrepreneurial Internship	-	-	-	16	ISE	---	---	---	50	50
						ESE				50	50
		04	00	00	20						

ISE = In Semester Evaluation, ESE = End Semester Exam

Total Contact Hours/Week : 04

Total Credits : 20

Note:

- Weekly Contact hours are not mentioned as students are expected to be in an outside research organization regularly for 20 weeks. However, students need to report to institute mentors as and when required.
- For online courses, lecture videos of each unit will be made available to the students through the college platform. For each unit, there will be separate assignments. Students need to submit all assignments within the specified time.
Weightage: 25% weightage for unit-wise assignments + 75% weightage for final exam. The final exam will be held at a college campus.
- A one-week Entrepreneurship Development Program (EDP) will be conducted after completion of 5th semester and before commencement of 6th semester.



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BCA with Honours

Class: Final Year BCA (Honours)

Semester: VII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max	Min for Passing	Max	Min for Passing	
BC4011	Parallel Computing	3	-	2	4	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BC4031	Open Elective – I	-	-	-	3	---	---	---	---	---	---
	Professional Elective – 4	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
	Professional Elective – 5	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
	Professional Elective – 6	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BCH4211	Major Work-I	-	-	8	4	ISE	---	---	---	100	50
	Total	09	00	16	20						
	Total Contact Hours	25									

ISE = In Semester Evaluation, UT-I = Unit Test, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/Week : 25

Total Credits : 20

Open Elective Courses Will be decided by BoS





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Open Elective – I

Open Elective – I of 3 Credits	BCOE4XX	Will be decided by the Board of Studies
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Open Elective Courses will be decided by Board of Studies and an appropriate Course Code will be allotted.

Professional Elective – 4

Specialization	Course Code	Course
Data Science	BC4051	Time Series Analysis
Artificial intelligence and Machine Learning	BC4071	Deep Learning for Computer Vision
Information and Cyber Security	BC4091	Ethical Hacking and Penetration Testing

Professional Elective – 5

Specialization	Course Code	Course
Data Science	BC4111	Data Mining
Artificial intelligence and Machine Learning	BC4131	Predictive Analysis
Information and Cyber Security	BC4151	Blockchain Technology

Professional Elective – 6

Specialization	Course Code	Course
Data Science	BC4171	Advanced Data Visualization
Artificial intelligence and Machine Learning	BC4191	Explainable AI
Information and Cyber Security	BC4211	Web Application Security





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BCA

(with Honours)





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Department of Computer Applications

BCA with Honours

Class: Final Year BCA (Honours)

Semester: VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min for Passing		Max	Min for Passing
	Open Elective – II	-	-	-	2	---	---	---	---	---	---
	Professional Elective – 7	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
	Professional Elective – 8	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BCH4141	Major Project - II	-	-	24	12	ISE	---	---	---	100	50
						ESE	---	---	---	100	50
	Total	04	00	28	20						
	Total Contact Hours	32									

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Total Contact Hours/Week : 32

Total Credits : 20

Open Elective Courses will be decided by BoS





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Open Elective – II

Open Elective – II of 2 Credits	BCOE4XX	Will be decided by the Board of Studies
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Professional Elective Courses will be decided by Board of Studies and an appropriate Course Code will be allotted.

Professional Elective – 7

Specialization	Course Code	Course
Data Science	BC4021	Cloud Computing for Data Analytics
Artificial intelligence and Machine Learning	BC4041	Reinforcement Learning
Information and Cyber Security	BC4061	Cyber Forensics and Incident Response

Professional Elective – 8

Specialization	Course Code	Course
Data Science	BC4081	Data Security & Privacy
Artificial intelligence and Machine Learning	BC4101	Security Aspects of Machine Learning
Information and Cyber Security	BC4121	Cloud Security





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BCA

(Honours with Research)





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Class: Final Year BCA (Honours with Research)

Semester: VII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)		
							Max	Min for Passing	Max	Min for Passing	
BCR4011	Research Methodology and IPR	4	-	-	4	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
	Open Elective – I	-	-	-	3	---	---	---	---	---	---
	Professional Elective – 4	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
	Professional Elective – 5	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
	Professional Elective – 6	2	-	2	3	ISE	20	40	40	---	---
						UT 1	15			---	---
						UT 2	15			---	---
						ESE	50			40	---
BCH4211	Research Work Phase-I	-	-	8	4	ISE	---	---	---	100	50
	Total	10	00	14	20						
	Total Contact Hours	24									

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Total Contact Hours/Week : 24

Total Credits : 20

Open Elective Courses Will be decided by BoS





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Open Elective – I

Open Elective – I of 3 Credits	BCOE4XX	Will be decided by the Board of Studies
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Professional Elective Courses Will be decided by Board of Studies and an appropriate Course Code will be allotted.

Professional Elective – 4

Specialization	Course Code	Course
Data Science	BC4051	Time Series Analysis
Artificial intelligence and Machine Learning	BC4071	Deep Learning for Computer Vision
Information and Cyber Security	BC4091	Ethical Hacking and Penetration Testing

Professional Elective – 5

Specialization	Course Code	Course
Data Science	BC4111	Data Mining
Artificial intelligence and Machine Learning	BC4131	Predictive Analysis
Information and Cyber Security	BC4151	Blockchain Technology

Professional Elective – 6

Specialization	Course Code	Course
Data Science	BC4171	Advanced Data Visualization
Artificial intelligence and Machine Learning	BC4191	Explainable AI
Information and Cyber Security	BC4211	Web Application Security





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BCA Honours with Research

Class: Final Year BCA (Honours with Research)

Semester: VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min for Passing		Max	Min for Passing
BCR4021	Research Work Phase-II	-	-	-	20	ISE				100	50
					ESE				100	50	
	Total	00	00	00	20						

ISE = In Semester Evaluation, ESE = End Semester Exam

Total Credits : 20

List of online platforms for MOOC courses - Open Elective

- 1) NPTEL
 - 2) Swayam
 - 3) Coursera
 - 4) Udemy
 - 5) Nasscom
 - 6) Eduskills
 - 7) Oracle Academy
 - 8) EDX
 - 9) FutureLearn
 - 10) IBM SkillsBuild
 - 11) Infosys Springboard
 - 12) Google Digital Garage
 - 13) AWS Academy
 - 14) Cisco Networking Academy
 - 15) IBM SkillsBuild
 - 16) Microsoft Learn
- etc.





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC1231	Course Name: Mathematics Foundations for Computer Science – I	3	-	-	3

Course Description:

This course introduces the mathematical foundations essential for computer science, covering set theory, relations, and functions with applications in computing. It explores counting principles and recurrence relations to model and solve computational problems. Students learn fundamental concepts of graph theory, including special graphs, trees, and planar graphs. Matrix algebra is presented with emphasis on solving linear systems and its role in data representation. The course also covers basic graph algorithms used in networking and optimization. Practical applications in databases, programming, and network analysis reinforce the link between mathematics and computer science.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Apply sets, functions, matrix algebra, and discrete structures to solve computer science problems.
2. Analyze computer science problems using appropriate mathematical models and techniques.
3. Assess the role of mathematical principles in providing concise abstractions of computer science problems.
4. Design efficient solutions for computational problems using mathematical reasoning.
5. Evaluate graph-theoretic algorithms, recurrence relations, and matrix-based methods for solving real-world computing and network-related problems.

Prerequisite:

Basic high school mathematics and logical reasoning.

Course Content

Unit No	Description	Hrs
1	Set Theory, Relations, and Functions: Set Theory: Sets, set operations and their properties, subset, Venn diagrams, Cartesian products. Relations: Relations on a set, properties of relations, representation using matrices and digraphs, types of	06





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	relations, equivalence relations and partitions, closures of relations, Warshall's algorithm. Functions: Properties (domain, range), composition of functions, surjective, injective, bijective functions, inverse functions. Special Functions in Computer Science: Exponential, logarithmic, polynomial, ceiling, and floor functions.	
2	Counting Principles and Recurrence Relations: Counting Principles: Basics of counting, pigeonhole principle, permutations, combinations, binomial coefficients, binomial theorem. Recurrence Relations: Introduction, modelling examples (Fibonacci numbers, Tower of Hanoi), solving linear recurrence relations with constant coefficients using characteristic equation method.	06
3	Graph Theory Fundamentals: Basic Concepts: Terminologies of graphs, connected and disconnected graphs, subgraphs, paths, and cycles. Special Graphs: Complete graphs, digraphs, weighted graphs, Eulerian and Hamiltonian graphs. Trees: Properties, spanning trees, planar graphs, basic results.	06
4	Matrix Algebra: Matrix Basics: Types of matrices, operations (addition, subtraction, multiplication), determinants. Special Matrices: Symmetric, skew-symmetric, orthogonal matrices. Applications: Rank, inverse, solving systems of linear equations, eigenvalues and eigenvectors, Cayley-Hamilton theorem.	06
5	Advanced Graph Algorithms: Representation of graphs (adjacency matrix, adjacency list). BFS (Breadth First Search) and DFS (Depth First Search) traversals. Minimum spanning trees (Prim's and Kruskal's algorithms). Shortest path algorithms (Dijkstra's and Floyd-Warshall). Applications of graph algorithms in computer science.	06
6	Applications and Problem-Solving in Discrete Mathematics: Applications of set theory, relations, and functions in databases, programming, and network theory. Applications of counting principles in combinatorial problems. Graph theory applications in communication networks, circuit design, and social networks. Real-world problem-solving using matrix algebra.	06





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References -

Text Books:

- Reena Garg, Engineering Mathematics, Khanna Book Publishing Company.
- Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company.
- B. Kolman, R. Busby, and S. Ross, Discrete Mathematical Structures.
- Narsingh Deo, Graph Theory with Application to Engineering and Computer Science, Prentice Hall of India.
- A. R. Vasishtha and A. K. Vasishtha, Matrices, Krishna Prakashan.

Reference Books:

- Ralph P. Grimaldi and B. V. Ramana, Discrete and Combinatorial Mathematics: An Applied Introduction, Pearson Education.
- Kenneth H. Rosen and Kamala Krithivasan, Discrete Mathematics and Its Applications, McGraw Hill.
- Douglas B. West, Introduction to Graph Theory, Pearson Education.

Web Links and Video Lectures:

- <https://nptel.ac.in/courses/106103205>
- <https://nptel.ac.in/courses/111101115>





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC1251	Course Name: Problem Solving Techniques	3	-	-	3

Course Description:

This course introduces fundamental problem-solving methods, structured programming concepts, and data representation techniques essential for computer applications. Students learn to apply C language constructs for selection, iteration, modular programming, arrays, strings, and basic algorithms. The course emphasizes solving numerical and statistical problems, implementing search and sort techniques, and performing matrix operations. Practical exercises reinforce coding skills, debugging methods, and the use of good programming practices to develop efficient and reliable programs.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Apply problem-solving concepts, structured programming principles, and data representation methods in computer systems.
2. Develop C programs using selection, iteration, modular programming, arrays, and strings.
3. Solve computational problems involving numbers, sequences, and statistical calculations using appropriate algorithms.
4. Develop efficient C programs using appropriate algorithms, debugging methods, and coding best practices.
5. Implement modular programming techniques using functions, arrays, strings, recursion, and pointers to develop structured solutions for computational problems.

Prerequisite:

Basic knowledge of mathematics, logical reasoning, and fundamental computer operations.

Course Content

Unit No	Description	Hrs
1	Problem Solving Fundamentals: Problems and problem instances, generalization and special cases, types and classification of computational problems, problem analysis, solution approaches, algorithm development, algorithm analysis (efficiency, correctness), role of data structures in problem solving, problem-solving steps (understand, plan, execute, review), breaking problems into	06





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	subproblems, input/output specification, input validation, pre- and post-conditions.	
2	Structured Programming Concepts: Sequence, selection (if, if-else), and repetition (for, while, do-while) statements; control structure stacking and nesting; types of repetition (entry-controlled, exit-controlled, counter-controlled, definite, indefinite, sentinel-controlled); pseudocode and flowcharts; definition and characteristics of algorithms; standard algorithm format; iteration and nesting problems (patterns, sequences, progressions, Taylor series approximations).	06
3	Data Representation and Introduction to C: Different kinds of real-world data and their representation in computer memory; integer representation (signed magnitude, 1's complement, 2's complement), real numbers (IEEE 754 floating point), characters (ASCII, Unicode). C language basics: history, features, generations of programming languages, typed vs typeless languages, structure of an empty C program, input/output in C (scanf, printf), assignment, operators (arithmetic, relational, logical), control structures in C, data types, translating pseudocode to C, incremental compilation and testing, good coding practices.	06
4	Number-Based Problem Solving in C: Problems on numbers: digit extraction, palindrome, prime numbers, prime factors, amicable numbers, perfect numbers, Armstrong numbers, factorial, base conversion; statistics (max, min, sum, average) using sentinel-controlled repetition. C language: else-if ladder, switch-case, increment/decrement operators, break and continue statements.	06
5	Modular Programming and Array Processing: Modular programming concepts, top-down and bottom-up approaches, recursion. Array operations: reading/writing elements, finding maximum, minimum, sum, average, median, and mode; searching (sequential and binary search), sorting (any one algorithm), matrix operations, Pointer basics	06
6	Functions, Strings, and Advanced C Features: Function definition and declaration (prototype), role of return statement, one-dimensional and two-dimensional arrays, string handling functions, other operators, operator precedence and associativity, debugging techniques.	06





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References -

Text Books:

- Venkatesh and Nagaraju Y., Practical C Programming for Problem Solving, Khanna Book Publishing Company.
- AICTE, Programming for Problem Solving (with Lab Manual), Khanna Book Publishing Company.
- Harvey Deitel and Paul Deitel, C How to Program, Pearson India.
- R. G. Dromey, How to Solve It by Computer.

Reference Books:

- Brian W. Kernighan and Dennis Ritchie, The C Programming Language, Pearson.
- Jeri Hanly and Elliot Koffman, Problem Solving and Program Design in C, Pearson.





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC1271	Course Name: Computer Architecture	3	-	-	3

Course Description:

This course provides a comprehensive understanding of digital principles, number systems, and logic circuits essential for computer hardware design. It covers combinational and sequential circuits, counters, and registers along with the fundamentals of computer organization and CPU architecture. Students explore instruction formats, addressing modes, and the differences between RISC and CISC architectures. The course also introduces pipeline and vector processing, input-output organization, and modes of data transfer. Memory hierarchy, cache, virtual memory, and memory management hardware are discussed to develop a strong foundation for understanding modern computer systems.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

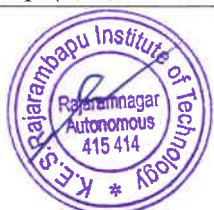
1. Demonstrate an understanding of digital principles, number systems, Boolean logic, and the design of combinational and sequential circuits.
2. Apply computer organization concepts to design, evaluate CPU architecture, instruction formats, addressing modes.
3. Analyze pipeline processing, input-output organization, and different modes of data transfer in computer systems.
4. Analyze memory organization, hierarchy, and management techniques to enhance system performance.
5. Examine combinational and sequential circuits, registers, and counters used in digital computer systems.

Prerequisite:

Basic knowledge of mathematics, logic, and fundamental computer operations before studying this course.

Course Content

Unit No	Description	Hrs
1	Digital Principles and Number Systems: Digital signals, digital logic, digital computers, Von Neumann architecture, Boolean laws and theorems. Karnaugh Map (K-Map): Truth tables to K-Map (2, 3, 4 variables), K-Map simplification, don't	06





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	care conditions, SOP and POS forms. Number systems: Decimal, binary, octal, hexadecimal, number system conversions, binary arithmetic, BCD addition and subtraction, octal and hexadecimal arithmetic. Binary codes: Decimal codes, error-detecting and correcting codes, ASCII, EBCDIC, Excess-3 code, Gray code.	
2	Combinational Logic Circuits: Half adder, full adder, subtractor. Decoders, encoders, multiplexers, demultiplexers.	06
3	Sequential Circuits and Counters: Flip-flops: SR, D, JK, T flip-flops. Registers: 4-bit register with parallel load; bidirectional shift register with parallel load. Counters: 4-bit synchronous binary counter, 4-bit asynchronous binary counter.	06
4	Basic Computer Organization and CPU Design: Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory-reference instructions, input/output interrupt. Complete computer description, design of a basic computer, design of accumulator logic. CPU: Introduction, general register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control. RISC concepts, RISC vs CISC.	06
5	Pipeline, Vector Processing, and I/O Organization: Parallel processing concepts, pipelining, arithmetic pipeline, instruction pipeline, RISC pipeline. I/O organization: Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access (DMA), input-output processor (IOP).	06
6	Memory Organization and Management: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.	06

References -

Text Books:

- Donald P. Leach, Albert Paul Malvino, and Goutam Saha, Digital Principles & Applications, Tata McGraw Hill Education Private Limited.
- M. Morris Mano, Computer System Architecture, Pearson/PHI.

Reference Books:

- William Stallings, Computer Organization and Architecture, Pearson/PHI.
- Andrew S. Tanenbaum, Structured Computer Organization, PHI/Pearson.





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- M. V. Subramanyam, Switching Theory and Logic Design, Laxmi Publications.
- Ikvinderpal Singh, Computer Organization Architecture, Khanna Book Publishing.





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC1291	Course Name: Problem Solving Techniques Lab	-	-	4	2

Course Description:

This course focuses on developing practical problem-solving skills using the C programming language. It introduces students to fundamental programming concepts such as input/output operations, control structures, loops, and decision-making. Learners implement numerical and array-based problems to understand computation, statistics, and base conversions. Modular programming concepts are practiced through function-based and recursive solutions, enabling top-down and bottom-up approaches. Students gain hands-on experience in string manipulation, matrix operations, and searching and sorting techniques. The experiments emphasize translating algorithms and pseudocode into working programs while applying debugging and good coding practices. By completing these exercises, students develop the ability to design, implement, and test programs for both simple and complex computational problems.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

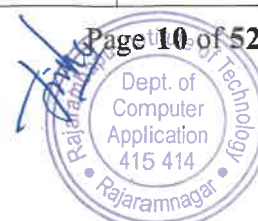
1. Apply problem-solving techniques to implement basic numerical and array-based programs using C.
2. Develop modular programs using functions, recursion, and control structures to solve computational problems.
3. Implement searching, sorting, and matrix operations to process and analyze data effectively.
4. Utilize string handling, debugging, and good coding practices to design and test reliable C programs.
5. Analyze numerical, statistical, and real-world problems to select appropriate programming constructs and develop efficient C-based solutions.

Prerequisite:

Basic knowledge of programming concepts and familiarity with C language syntax.

List of Experiment

Expr. No	Description	Hrs
1	Write a C program to convert a temperature from Celsius to Fahrenheit and vice versa.	02





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2	Write a C program to find the largest, smallest, sum, and average of n numbers using arrays.	02
3	Write a C program to check if a given number is palindrome, prime, Armstrong, perfect, or amicable.	04
4	Implement base conversion for a given number from one base to another ($2 \leq \text{base} \leq 10$).	04
5	Write a C program to display the first n terms of a series (Fibonacci/Tribonacci) using recursion.	04
6	Write a C program to perform sorting on an array (e.g., selection sort, bubble sort, or insertion sort).	04
7	Implement searching in an array using sequential and binary search.	04
8	Write a modular C program to perform matrix operations: addition, subtraction, multiplication.	04
9	Write a C program to compute factorial, GCD, or power of a number using recursion.	04
10	Write a C program to demonstrate string handling functions: length, concatenation, reversal, and comparison.	04
11	Write a C program to implement statistical operations on an array: median, mode, maximum, minimum.	04
12	Write a modular C program using functions to solve a real-world problem (e.g., student grade calculation or BMI).	04

References -

Text Books:

- Venkatesh and Nagaraju Y., Practical C Programming for Problem Solving, Khanna Book Publishing Company.
- AICTE, Programming for Problem Solving (with Lab Manual), Khanna Book Publishing Company.
- Harvey Deitel and Paul Deitel, C How to Program, Pearson India.
- R. G. Dromey, How to Solve It by Computer.

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- Brian W. Kernighan and Dennis Ritchie, The C Programming Language, Pearson.
- Jeri Hanly and Elliot Koffman, Problem Solving and Program Design in C, Pearson.





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC143	Course Name: Computer Architecture Lab	-	-	2	1

Course Description:

This laboratory course provides hands-on experience in digital logic design and sequential/combinational circuit implementation. Students verify the truth tables of basic logic gates and De-Morgan's laws, and explore the concept of universal gates by implementing circuits using only NAND gates. The course also includes design and testing of fundamental digital circuits such as adders, multiplexers, encoders, decoders, flip-flops, shift registers, and 4-bit arithmetic circuits using standard ICs. It helps students develop practical understanding of digital system design and analysis.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Analyze the operation of basic logic gates and Boolean algebra theorems using truth tables.
2. Design combinational circuits such as adders, multiplexers, encoders, and decoders using logic gates.
3. Construct sequential circuits including flip-flops and shift registers using logic gates and standard ICs.
4. Implement arithmetic and data processing circuits such as parallel adders and universal gate-based designs using digital logic concepts.
5. Explain the working principles and applications of combinational and sequential digital circuits used in digital systems.

Prerequisite:

Basic understanding of number systems, Boolean algebra, and logic gates.

List of Experiment

Expr. No	Description	Hrs
1	Verify truth tables of AND, OR, NAND, NOR, XOR, XNOR, NOT, Buffer gates.	02
2	Study and verify implementation of basic gates using only NAND gates.	02
3	Verify De-Morgan's laws for 2 variables using logic gates.	02
4	Design and test SR flip-flop using NAND/NOR gates.	02
5	Verify truth table and operation of JK flip-flop using NAND/NOR gates.	02





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6	Design and implement decoder and encoder using basic logic gates.	02
7	Design and implement 4:1 MUX using logic gates.	02
8	Design and verify half adder and full adder circuits.	02
9	Implement and test 4-bit parallel adder using 7483 IC.	02
10	Design and implement a 4-bit shift register using flip-flops.	02

References -

Text Books:

- Donald P. Leach, Albert Paul Malvino, and Goutam Saha, Digital Principles & Applications, Tata McGraw Hill Education Private Limited.
- M. Morris Mano, Computer System Architecture, Pearson/PHI.

Reference Books:

- William Stallings, Computer Organization and Architecture, Pearson/PHI.
- Andrew S. Tanenbaum, Structured Computer Organization, PHI/Pearson.
- M. V. Subramanyam, Switching Theory and Logic Design, Laxmi Publications.
- Ikvinderpal Singh, Computer Organization Architecture, Khanna Book Publishing.





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC1331	Course Name: General English – I	1	1	-	2

Course Description:

This course enhances students' proficiency in English for academic and professional contexts. It focuses on vocabulary building through word formation, root words, and derivatives, along with developing precise and coherent writing skills. Students learn to identify common grammatical errors, apply correct sentence structures, and organize paragraphs effectively. The course also covers various forms of written communication such as essays, précis, and comprehension. Interactive sessions in the language lab strengthen listening, pronunciation, and speaking skills for workplace communication, interviews, and formal presentations.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Develop vocabulary through word formation, root words, prefixes, suffixes, synonyms, antonyms, and abbreviations.
2. Apply basic writing skills to create coherent, precise, and well-structured sentences and paragraphs.
3. Identify common grammatical errors to improve clarity in writing.
4. Demonstrate effective oral communication skills through listening, pronunciation, workplace conversations, and formal presentations.
5. Apply effective communication strategies in presentations, group discussions, interviews, and workplace interactions.

Prerequisite:

Basic knowledge of English grammar, vocabulary, and sentence formation before taking this course.

Course Content

Unit No	Description	Hrs
1	Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.	04





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2	Basic Writing Skills: Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely.	04
3	Identifying Common Errors in Writing: Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies.	04
4	Nature and Style of sensible Writing: Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Writing Practices, Comprehension, Précis Writing, Essay Writing.	04
5	Oral Communication (This Module involves interactive practice sessions in Language Lab): Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations	04
6	Professional Communication Skills: Group Discussions: Principles, Techniques, and Practice Sessions, Public Speaking and Extempore Speaking, Professional Etiquette and Interpersonal Communication, Resume Writing and Cover Letter Preparation	04

References -

Text Books:

- Anjana Tiwari, Communication Skills in English (with Lab Manual), Khanna Book Publishing Co.
- Kul Bhushan Kumar, Effective Communication Skills, Khanna Book Publishing.
- Michael Swan, Practical English Usage, Oxford University Press.
- F. T. Wood, Remedial English Grammar, Macmillan.
- William Zinsser, On Writing Well, Harper Resource Book.
- Liz Hamp-Lyons and Ben Heasley, Study Writing, Cambridge University Press.
- Sanjay Kumar and PushpLata, Communication Skills, Oxford University Press.
- CIEFL, Hyderabad, Exercises in Spoken English (Parts I–III), Oxford University Press.





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC1351	Course Name: Indian Knowledge Systems	2	-	-	2

Course Description:

This course offers a comprehensive introduction to Indian Knowledge Systems (IKS), covering foundational texts such as the Four Vedas, Vedāṅga, and Indian philosophical schools including both Vedic (Sāṃkhya, Yoga, Nyaya, Vaiśeṣika, Pūrva-Mīmāṃsā, Vedānta) and non-Vedic traditions (Cārvāka, Buddhist, Jain). It explores key aspects of Indian science and technology, including mathematics, astronomy, linguistics, and phonetics, with emphasis on classical contributions like Panini's Grammar, the decimal system, and the Chandah Sastra. The course delves into Indian arts and crafts (64 Kalas), metallurgy, architecture, and urban planning, alongside humanities perspectives such as Ayurveda, psychology, governance, and management as reflected in texts like the Ramayana and Arthashastra. Students will gain an integrated understanding of IKS' rich heritage and its relevance to contemporary science, technology, and social sciences.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Analyze Indian Knowledge Systems, including Vedas and philosophies.
2. Examine scientific and linguistic concepts in Sanskrit and their modern relevance.
3. Identify contributions of Indian mathematicians and astronomers.
4. Explore Indian views on health, wellness, and governance.
5. Examine the contributions of Indian science, technology, architecture, and traditional knowledge systems to the development of society and civilization.

Prerequisite:

Basic awareness of Indian culture, history, and society.

Course Content

Unit No	Description	Hrs
1	Introduction to Indian Knowledge Systems: Introduction to Indian Knowledge Systems, Objectives and Significance of IKS, Caturdaśa Vidyāsthānam, Four Vedas and Vedāṅgas, Itihāsa: Ramayana and Mahabharata, Nīti Śāstra and Subhāṣitas, Sixty-Four Kalas.	04



2	Indian Philosophy and Knowledge Traditions: Introduction to Indian Philosophy, Vedic and Non-Vedic Schools, Basic Concepts of Nyaya, Yoga, Vedanta, Buddhist and Jain Philosophy, Introduction to Pramāṇa.	04
3	Sanskrit, Mathematics and Astronomy: Panini and Sanskrit Grammar, Sanskrit and Natural Language Processing, Concept of Zero, Decimal Number System, Pingala's Binary System, Contributions of Aryabhata and Brahmagupta, Indian Calendar (Panchanga) and Overview of Jantar Mantar.	04
4	Indian Science, Technology and Architecture: Indian Scientific Heritage, Ancient Metallurgy (Iron, Steel, Zinc), Temple Architecture, Town Planning, Vastu Śāstra, Traditional Engineering Practices	04
5	Health, Psychology and Yoga: Introduction to Ayurveda, Health and Wellness, Food, Sleep and Lifestyle, Yoga as a Way of Life, Triguṇa Concept, Indian Perspective on Mind and Well-being	04
6	Governance, Ethics and Management: Governance in Ramayana, Arthashastra and Kautilya, Principles of Public Administration, Ethics and Leadership in Indian Thought, Relevance of Indian Knowledge Systems in Modern Society	04

References -

Text Books:

- Mahadevan, B., Bhat, Vinayak Rajat, & Nagendra, Pavana R. N., Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning Pvt. Ltd.
- K. Kapur and A. K. Singh (Eds.), Indian Knowledge Systems, Vol. 1, Indian Institute of Advanced Study, Shimla.
- Tatvabodh of Sankaracharya, Central Chinmaya Mission Trust.
- Shantha N. Nair, Echoes of Ancient Indian Wisdom, Hindology Books.
- S. K. Das, The Education System of Ancient Hindus, Gyan Publication House.
- B. L. Gupta, Value and Distribution System in India, Gyan Publication House.
- Reshmi Ramdhoni, Ancient Indian Culture and Civilisation, Star Publication.
- Supriya Lakshmi Mishra, Culture and History of Ancient India (With Special Reference of Sudras).
- Swami Gambirananda (Trans.), Upanishads with the Commentary of Sankaracharya, Advaita Ashrama Publication Department.
- Swami Ranganathananda, The Message of the Upanishads, Bharatiya Vidya Bhavan.



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- Om Prakash, Religion and Society in Ancient India, Bharatiya Vidya Prakashan.
- J. Auboyer, Daily Life in Ancient India from Approximately 200 BC to AD 700, Munshiram Manoharlal Publications.
- D. K. Chakrabarty and Makkhan Lal, History of Ancient India (Set of 5 Volumes), Aryan Books International.
- Girish Nath Jha, Umesh Kumar Singh, and Diwakar Mishra, Science and Technology in Ancient Indian Texts, DK Print World Limited.
- Swami B. B. Vishnu, Vedic Science and History: Ancient Indian's Contribution to the Modern World, Gosai Publications.
- S. C. Chatterjee, The Nyaya Theory of Knowledge, University of Calcutta Press.
- Surendranath Dasgupta, A History of Indian Philosophy, Motilal Banarsidass.
- Jean L. Mercier, From the Upanishads to Aurobindo, Asian Trading Corporation.
- M. Hiriyanna, Essentials of Indian Philosophy, Diane Publications.
- Robert Ernest Hume (Trans.), The Thirteen Principal Upanishads, Oxford University Press.





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC1371	Course Name: Environmental Science and Sustainability	2	-	-	2

Course Description:

This course introduces the fundamentals of environment, natural resources, and sustainability. It covers ecosystems, biodiversity, and methods of conservation. Students learn about pollution types, climate change, and waste management practices. The course also addresses disaster management, environmental laws, and social issues related to sustainability. Practical examples and case studies help students understand the importance of protecting the environment for present and future generations.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Analyze basic environmental concepts, natural resources, and sustainability.
2. Assess ecosystems, biodiversity, and ways to conserve them.
3. Identify causes and effects of pollution, climate change, and waste problems with possible solutions.
4. Analyze key environmental regulations and social challenges that promote sustainable living.
5. Assess waste management practices and disaster management approaches for reducing environmental and societal risks.

Prerequisite:

Basic knowledge of science, social studies, and current environmental issues before studying this course.

Course Content

Unit No	Description	Hrs
1	Introduction to Environment and Sustainability: Fundamental environmental concepts and their relevance to business operations; components and segments of the environment; man-environment relationship; historical environmental movements. Concept and principles of sustainability; intergenerational and intragenerational equity; importance of public awareness and environmental education.	04





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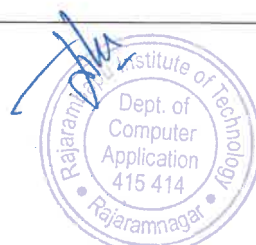
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2	Natural Resources and Sustainable Management: Classification of natural resources; issues related to overutilization; strategies for conservation and sustainable use. Case studies on deforestation, water conservation, energy security, and food security. Best practices in resource management for long-term ecological balance.	04
3	Ecosystems and Biodiversity Conservation: Types of natural ecosystems, their structure, functions, and ecological characteristics. Biodiversity significance, threats, and conservation methods. Concepts of ecosystem resilience, homeostasis, and carrying capacity. In situ and ex situ conservation strategies, nature reserves, and India as a mega diverse nation.	04
4	Environmental Pollution and Climate Change: Types of pollution: air, water, noise, soil, and marine pollution; causes, impacts, and preventive measures. Global environmental issues: climate change, ozone depletion, greenhouse effect, and acid rain. Notable pollution episodes in India; importance of cleaner technologies and sustainable industrial practices.	04
5	Waste and Disaster Management: Solid waste management practices and technologies. Natural and man-made disasters, disaster risk reduction, and the role of businesses in disaster preparedness and recovery. Integration of sustainability principles into disaster management.	04
6	Social Issues, Legislation, and Environmental Governance: Society–environment interactions, sustainable development goals, environmental ethics, and responsible consumption. Key environmental laws: Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981, Environment (Protection) Act 1986. Environmental justice, rights of environmental refugees, resettlement and rehabilitation policies, ecological economics, and population dynamics in India.	04

References -

Text Books:

- M. P. Poonia, Environmental Studies, Khanna Book Publishing Co.
- Erach Bharucha, Textbook of Environmental Studies, Orient Blackswan Private Ltd.
- D. Dave and S. S. Katewa, Text Book of Environmental Studies, Cengage Learning India Pvt. Ltd.





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- R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press.
- G. Tyler Miller and Scott Spoolman, Living in the Environment, Cengage.
- M. Basu and S. J. Xavier Savarimuthu, Fundamentals of Environmental Studies, Cambridge University Press.
- M. G. Roy, Sustainable Development: Environment, Energy and Water Resources, Ane Books.
- K. Pritwani, Sustainability of Business in the Context of Environmental Management, CRC Press.
- Richard T. Wright and Dorothy F. Boorse, Environmental Science: Toward a Sustainable Future, Pearson.





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC1391	Course Name: Foreign Language-German-I	-	-	2	1

Course Description:

German language is a structured curriculum created to instruct students in speaking, reading, writing, and gaining an understanding of the language. These classes include vocabulary, grammar, pronunciation, and cultural quirks, and they are designed for students at all skill levels, from absolute beginners to fluent speakers.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Demonstrate familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type.
2. Introduce himself/herself and ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has.
3. Interact in a simple way provided the other person talks slowly and clearly and is prepared to help.
4. Assess development in German language vocabulary by interacting with others.
5. Construct presentation of how to use and scope of German Language.

Prerequisite:

Basic understanding of English Language.

Course Content

Unit No	Description	Hrs
1	Introduction to German Language-I: Introduction of the language, Greetings, to Introduce oneself, speaking about yourself and others, Alphabets and numbers, Listening of Alphabets and numbers, Reading Information about other people and understanding simple information about them, country names and languages, Numbers 1 to 100 and listening of numbers, Personal pronouns and verb conjugation of regular verbs.	03
2	Introduction to German Language-II: Speaking about Hobbies. Conjugation of strong verbs and revision of regular verbs. Learning articles and genders of nouns, Singular / Plural noun forms, Learning weekdays, months and Seasons. Speaking about	03





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	informal appointments. Grammar: yes/no questions. Verb position in normal statements and in questions Learning professions, reading small texts and understanding information about working days, hours and profession.	
3	Demonstrative German Language-III: Learning to name the famous places, buildings in a city, name the modes of transportation. Learning definite/indefinite and negative articles in German to learn to describe the way, Imperative for Pronoun "Sie".	03
4	Demonstrative German Language-IV: Words to speak about food, understanding food items, where one can buy what, quantities and packing of the grocery items. Subject and object of the sentence and introduction of Akkusativ case in German. Conversation between shopkeeper and customer. Understanding of Grammar.	03

References -

Text Books:

- Netzwerk neu A1 (Deutsch als Fremdsprache) Kursbuch, Goyal Publishers and Distributors Private Ltd.
- Netzwerk neu A1 (Deutsch als Fremdsprache) Arbeitsbuch, Goyal Publishers and Distributors Private Ltd.
- Netzwerk neu A1 (Deutsch als Fremdsprache) Testheft, Goyal Publishers and Distributors Private Ltd.





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Class: F.Y. BCA	Semester: I	L	T	P	Credits
Course Code: BC1411	Course Name: Foreign Language-Japanese-I	-	-	2	1

Course Description:

This course is designed to introduce students to the everyday language of Japan. Lessons will be organized around natural conversational topics, leading students from fundamental aspects of grammar to readings in simple texts.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Relate regional languages into Japanese language.
2. Experiment Japanese vocabulary in day-to-day speaking.
3. Develop basic Japanese language skills (listening, speaking, writing, and reading).
4. Introduce himself /herself with others and can ask and answer questions.
5. Apply basic Japanese grammar, particles, numbers, and sentence patterns to communicate in simple everyday situations

Prerequisite:

A student, who is going to enroll for this course, should have following abilities:

- 1) Knowledge of basic grammar of English Language.
- 2) Communicate moderately using English Language.

Course Content

Unit No	Description	Hrs
1	Introduction to Japanese Language-I: Brief history of Japan & Japanese Language, introduction of 3 scripts. Writing Hiragana alphabets & words from あ to ぜ, Writing Hiragana alphabets from た to ぽ and Daily expressions & greetings.	03
2	Introduction to Japanese Language-II: Writing letters from ま to ん and doubling of consonants and compound letters, Katakana alphabets from classroom expressions and Numbers from 1 to 100, Katakana alphabets from タ to ン classroom expressions, Doubling of consonants and compound words in Katakana.	03



3	Demonstrative pronouns in Japanese Language: Uses of demonstrative pronouns これ、それ、あれ , Substitution for a noun, The こ、そ、あ、ど system of demonstrative, Demonstrative pronouns ここ、そこ、あそこ、どこ and their polite forms, Affirmation and negation in simple present tense, Uses of particles から、まで。	03
4	Expressing time in Japanese Language: Multiples of 100, 1000, 10,000. Uses of particles へ、で、と、よ, Uses of interrogative pronouns なん、いつ、なに。	03

References -

Text Books:

- Minna No Nihongo I, 3A Corporation, Japan.
- Nihongo Shoho Vol. I, Japan Foundation, Tokyo.
- Kanji Picture Book Vol. I & II, Japan Foundation.
- Dr. V. N. Kinkar, Sulabh Janani Vyakaran – Part I.
- Genki, The Japan Times.
- Osamu Mizutani and Nobuko Mizutani, Aural Comprehensions in Japanese.
- Osamu Mizutani and Nobuko Mizutani, An Introduction to Modern Japanese.
- Y. Yoshida, Japanese for Today.
- Alphonsa, Japanese Language Patterns.



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Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1221	Course Name: Mathematics Foundations for Computer Science – II	3	-	-	3

Course Description:

This course introduces fundamental concepts of logic, proof techniques, and algebraic structures essential for computer science and mathematics. It covers propositional calculus, methods of proofs, and mathematical induction for problem solving. Students will learn algebraic structures like semigroups, monoids, groups, and cyclic groups with their properties. The course also focuses on numerical methods for solving equations, interpolation, and integration. Optimization techniques such as linear programming and transportation problems are discussed for practical applications. By the end, learners will be equipped with analytical and computational skills to solve real-world problems efficiently.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

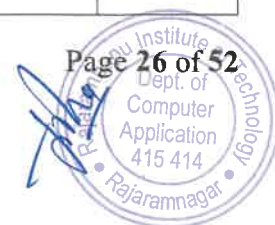
1. Apply logic, proofs, and induction to solve problems.
2. Analyze properties of algebraic structures.
3. Apply numerical methods for problem solving.
4. Solve optimization problems with LP and transportation methods.
5. Analyze logical, numerical, and optimization techniques to model and solve real-world computational and decision-making problems.

Prerequisite:

Basic knowledge of mathematics, algebra, and analytical reasoning.

Course Content

Unit No	Description	Hrs
1	Logic and Propositional Calculus: Propositions, logical operations (basic connectives), compound statements, construction of truth tables, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Form (CNF) and Disjunctive Normal Form (DNF).	06
2	Methods of Proofs and Mathematical Induction: Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, and mathematical induction.	06





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3	Algebraic Structures: Semi-group, monoid, group, subgroup, cyclic group – definitions, properties, and examples.	06
4	Numerical Methods: Equations and Interpolation: Errors in numerical methods – concept and significance. Solution of algebraic and transcendental equations: Bisection method, Newton–Raphson method. Numerical interpolation: Newton's forward interpolation, Newton's backward interpolation, and Lagrange's interpolation formula.	06
5	Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule – formula and problem solving for all topics covered.	06
6	Optimization Techniques: Linear programming: Introduction, LP formulation, graphical method for solving LPs with two variables, special cases in graphical methods, simplex method. Transportation problem: Definition, linear form, North-west corner method, least cost method, Vogel's approximation method (VAM) for feasible solution, MODI method for optimal solution.	06

References -

Text Books:

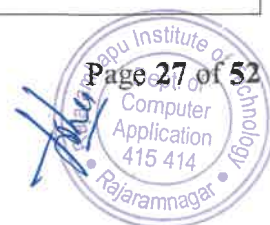
- B. Kolman, R. Busby, and S. Ross, Discrete Mathematical Structures, Pearson Education.
- S. S. Sastry, Introductory Methods of Numerical Analysis, PHI.
- Hamdy A. Taha, Operations Research: An Introduction, Pearson Prentice Hall.
- S. B. Singh, Discrete Structures, Khanna Book Publishing. (AICTE Recommended Textbook).

Reference Books:

- Kenneth H. Rosen and Kamala Krithivasan, Discrete Mathematics and Its Applications, McGraw Hill.
- J. G. Chakravorty and P. R. Ghosh, Linear Programming and Game Theory, Moulik Library.
- J. K. Sharma, Operations Research: Theory and Applications, Macmillan Publishers.

Web Links and Video Lectures:

- <https://nptel.ac.in/courses/111107127>





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- <https://www.math.iitb.ac.in/~siva/si50716/SI507lecturenotes.pdf>





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Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1241	Course Name: Data Structures	3	-	-	3

Course Description:

This course introduces the fundamental concepts of data structures and algorithms, emphasizing their role in efficient problem-solving and program design. It covers the classification, representation, and operations of linear and non-linear data structures, along with algorithm analysis and complexity. Students will learn searching and sorting techniques, manipulation of arrays, linked lists, stacks, queues, and their applications. The course explores recursion and hashing for optimized storage and retrieval. It further introduces trees and graphs, including traversal methods, binary search trees, and AVL trees. Practical implementation of algorithms equips learners with skills to analyze trade-offs between time and space, enhancing their ability to design efficient computational solutions.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

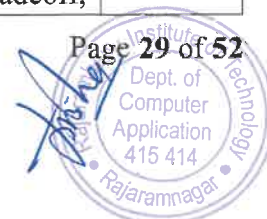
1. Analyze the fundamentals of data structures, algorithms, and their complexity analysis.
2. Apply linear and non-linear data structures such as arrays, linked lists, stacks, queues, trees, and graphs to computational problems.
3. Analyze searching, sorting, recursion, and hashing techniques for efficiency in problem-solving.
4. Design algorithms using appropriate data structures to address real-world applications effectively.
5. Examine the organization and operations of trees, graphs, and hashing techniques for efficient data storage and retrieval.

Prerequisite:

Prior knowledge of basic programming in C, problem-solving concepts, and fundamental mathematics.

Course Content

Unit No	Description	Hrs
1	Introduction to Data Structures and Algorithms: Introduction and Overview: Definition, Classification and Operations of Data Structures, Algorithms: Complexity, Time-Space Tradeoff,	06



	Arrays: Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting, Merging.	
2	Searching and Sorting Techniques: Searching: Linear Search and Binary Search, Comparison of Methods, Sorting: Bubble Sort, Selection Sort, and Insertion Sort, Two-Dimensional Arrays: Definition and Representation in Memory, Matrices and Sparse Matrices, Multi-Dimensional Arrays.	06
3	Linked Lists and Hashing: Linked Lists: Definition, Comparison with Arrays, Representation, Types of Linked Lists: Singly, Doubly, Circular, Operations: Traversing, Inserting, Deleting, Searching, Applications: Addition of Polynomials, Hashing and Collision: Hashing, Hash Tables, Types of Hash Functions, Collision Resolution Techniques: Open Addressing, Chaining.	06
4	Stacks and Applications: Stacks: Definition, Representation using Arrays and Linked Lists, Operations on Stacks, Applications of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix to Postfix Expression, Evaluation of Postfix Expression.	06
5	Recursion and Queues: Recursion: Definition, Recursive Notation, Runtime Stack, Applications of Recursion: Factorial, GCD, Fibonacci Series, Towers of Hanoi, Queues: Definition, Representation using Array and Linked List, Types of Queues: Simple Queue, Circular Queue, Double-Ended Queue, Priority Queue, Operations on Queues and Circular Queues using Array and Linked List, Applications of Queues.	06
6	Trees and Graphs: Graphs: Definition, Terminology, Representation, Traversal, Trees: Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree: Inserting, Deleting, Searching, Height Balanced Trees: AVL Trees, Insertion and Deletion in AVL Tree.	06

References -

Text Books:

- R. B. Patel, Expert Data Structures with C, Khanna Book Publishing Company. (AICTE Recommended Textbook)



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- Seymour Lipschutz, Data Structures with C, Schaum's Outlines, Tata McGraw-Hill.
- Yashavant Kanetkar, Data Structures Through C, BPB Publications.

Reference Books:

- Reema Thareja, Data Structures Using C, Oxford University Press.
- Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, Fundamentals of Data Structures in C, Universities Press.





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Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1261	Course Name: Operating Systems	2	-	2	3

Course Description:

This course introduces the fundamental concepts and principles of operating systems, focusing on their evolution, architecture, and services. It explores various types of operating systems, including batch, multiprogramming, time-sharing, parallel, distributed, and real-time systems. Students will study process management, covering process states, multithreading, and CPU scheduling algorithms with performance evaluation. The course emphasizes process synchronization, inter-process communication, and deadlock handling strategies such as prevention, avoidance, detection, and recovery. Memory management techniques including paging, segmentation, fragmentation, and compaction are discussed in detail. Advanced topics include virtual memory management, page replacement strategies, and I/O management with disk scheduling. By the end of the course, learners will gain the ability to analyze and design efficient operating system solutions for modern computing environments.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Analyze the evolution, architecture, services, and various types of operating systems.
2. Apply process management concepts including multithreading, scheduling algorithms, and performance evaluation.
3. Analyze synchronization mechanisms, inter-process communication, and strategies for handling deadlocks.
4. Evaluate memory and I/O management techniques including paging, segmentation, virtual memory, and disk scheduling.
5. Explain operating system structures, system calls, and resource management techniques and their role in efficient system operation.

Prerequisite:

Basic knowledge of computer fundamentals, C programming, and computer organization.



Course Content		
Unit No	Description	Hrs
1	Introduction to Operating Systems: Definition and Evolution of Operating Systems, Objectives and Functions of Operating Systems, Components of Operating Systems Types of Operating Systems: Batch Systems, Multiprogramming Systems, Time-Sharing Systems, Parallel Systems, Distributed Systems Real-Time Systems	04
2	Operating System Structures: Operating System Services, User and Operating System Interface, System Calls and Types of System Calls, System Programs, Operating System Structure: Monolithic Architecture, Layered Architecture, Modular Architecture, Microkernel Architecture, Hybrid Architecture Generations of Operating Systems.	04
3	Process Management: Process Definition, Process States and State Transitions, Process Control Block (PCB), Threads: Concept, Benefits, Types of Threads, Multithreading. Process Scheduling: Definition, Objectives, Preemptive & Non-preemptive Scheduling, Scheduling Algorithms: Priority Scheduling FCFS, SJF, Round Robin (RR), Performance Evaluation of Scheduling Algorithms.	04
4	Process Synchronization and Deadlocks: Process Synchronization: Inter-process Communication, Race Conditions, Critical Section Problem, Mutual Exclusion, Synchronization Mechanisms: Semaphores, Monitors, Deadlocks: System Model, Deadlock Characterization, Deadlock Handling: Prevention, Avoidance (Banker's Algorithm), Detection, Recovery.	04
5	Memory Management: Logical vs. Physical Address Mapping, Swapping, Memory Allocation: MFT, MVT, Fragmentation: Internal & External, Compaction, Paging and Segmentation.	04
6	Virtual Memory and I/O Management: Virtual Memory: Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing, I/O Management: Principles of I/O Hardware, Disk Structure and Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN.	04

It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

List of Experiment		
Expr. No	Description	Hrs
1	Write a C program to simulate FCFS and SJF CPU Scheduling Algorithm.	02
2	Write C program to simulate the Round Robin CPU Scheduling algorithm.	02
3	Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.	02
4	Write a C program to implement the Producer – Consumer problem using semaphores.	02
5	Write a C program to demonstrate Inter-Process Communication using Pipes.	02
6	Write a C program to demonstrate Inter-Process Communication using FIFO (Named Pipe).	02
7	Write a C program to simulate Paging Memory Management Technique.	02
8	Write a C program to simulate Segmentation Memory Management Technique.	02
9	Write a C program to simulate First Fit and Best Fit Memory Allocation Techniques.	02
10	Write a C program to implement FIFO Page Replacement Algorithm and Sequential File Allocation Method.	02

References -

Text Books:

- Ekta Walia, Operating Systems Concepts, Khanna Publishing House. (AICTE Recommended Textbook)
- Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Operating System Principles, Wiley India Private Limited.
- William Stallings, Operating Systems: Internals and Design Principles, Pearson Education.

Reference Books:

- Andrew S. Tanenbaum, Modern Operating Systems, Prentice Hall India.
- Sumitabha Das, UNIX Concepts and Applications, Tata McGraw-Hill.



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Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1281	Course Name: Object-Oriented Programming Using Java	3	-	-	3

Course Description:

This course introduces the fundamentals of Object-Oriented Programming (OOP) with Java, covering its core concepts, benefits, and applications. It explores Java basics including program structure, tokens, operators, control structures, and data types. Students learn to design and implement programs using classes, objects, methods, constructors, and inheritance. The course also covers arrays, strings, wrapper classes, interfaces, polymorphism, and advanced OOP features. Emphasis is placed on packages, exception handling, and modular programming. Advanced topics include multithreading, synchronization, inter-thread communication, and SWING/JavaFX programming. By the end, students gain the ability to build efficient, reusable, and interactive Java applications.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Apply the principles of object-oriented programming to design solutions using classes, objects, methods, and constructors.
2. Implement control structures, arrays, strings, and inheritance concepts for modular and reusable program development.
3. Utilize packages, interfaces, polymorphism, and exception handling to build robust Java applications.
4. Develop multithreaded and interactive programs using synchronization, inter-thread communication, and Swing/JavaFX programming.
5. Analyze Java programming concepts including object-oriented principles, packages, exception handling, and multithreading for developing efficient software applications.

Prerequisite:

Basic knowledge of C/C++ programming with understanding of variables, operators, control structures, and problem-solving concepts.



Course Content		
Unit No	Description	Hrs
1	Introduction to OOP and Java Basics: Fundamentals of Object-Oriented Programming: Concepts, Benefits, Applications, Java Evolution: Features, Differences between Java, C and C++, Java and Internet, Java Environment, Overview of Java Language: Program Structure, Tokens, Statements, Comments, Math functions, JVM, Command Line Arguments, Writing and Implementing Java Programs.	06
2	Data Types, Variables, and Control Structures: Constants, Variables, Data Types, Declaration and Initialization, Symbolic Constants, Type Casting, Operators & Expressions: Arithmetic, Relational, Logical, Assignment, Increment/Decrement, Conditional, Bitwise Operators, Expression Evaluation: Arithmetic Expressions, Operator Precedence & Associativity, Type Conversions, Control Structures: Decision Making, Branching, Looping, Jump and Labelled Loops.	06
3	Classes, Objects and Methods: Defining Classes and Objects, Methods Declaration, Constructors, Method Overloading and Overriding, Introduction to Inheritance.	06
4	Arrays, Strings, and Advanced OOP Concepts: Arrays: 1D and 2D Arrays, Creation and Usage, Strings, Vectors, Wrapper Classes, Enumerated Types, Inheritance in Detail: Extending Classes, Implementing Interfaces, Multiple Inheritance and Polymorphism.	06
5	Packages and Exception Handling: Packages: System Packages, Creating and Accessing Packages, User-defined Packages, Adding Class to a Package, Exception Handling: Keywords (try, catch, throw, throws, finally), Nested try, Multiple catch, Creating User-defined Exceptions.	06
6	Advanced Java Concepts: Multithreading: Thread Creation, Life Cycle of a Thread, Thread Priorities, Synchronization, Inter-thread Communication, Java GUI Programming: Introduction to Graphical User Interface (GUI), Event Handling, Java Swing: Components, Containers, Event Handling. Introduction to JavaFX: Features, Controls, Layouts, and Applications. Developing Simple Interactive GUI Applications using Swing/JavaFX.	06



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References -

Text Books:

- E. Balaguruswamy, Programming with Java: A Primer, McGraw Hill Education.
- Herbert Schildt, Java: The Complete Reference, McGraw-Hill Education.

Reference Books:

- Arunesh Goyal, The Essentials of Java, Khanna Book Publishing Company Private Limited.
- Tanweer Alam, Core Java, Khanna Book Publishing Company Private Limited.
- Y. Daniel Liang, Introduction to Java Programming, Pearson.
- S. Malhotra and S. Choudhary, Programming in Java, Oxford University Press.

Web Resources:

- <https://www.w3schools.com/java/>.
- <http://www.java2s.com/>.
- https://onlinecourses.nptel.ac.in/noc22_cs47/preview



Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1301	Course Name: Web Technologies	1	-	2	2

Course Description:

This course introduces the fundamentals of web technologies with a focus on HTML, CSS, JavaScript, and Bootstrap for designing responsive and interactive websites. It covers HTML structures, forms, multimedia integration, and navigation design. Students will learn CSS styling, the Bootstrap grid system, and responsive web design techniques. The course explores JavaScript essentials such as DOM manipulation, events, arrays, and form validation for client-side interactivity. Advanced topics include AJAX, XML, JSON, and XHTML for dynamic web applications. Additionally, students gain insights into web hosting, protocols, and server setup for deploying applications.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Build structured web pages using HTML elements, forms, tables, and multimedia components.
2. Design responsive layouts using CSS and Bootstrap classes with grid-based structures.
3. Apply JavaScript for DOM manipulation, event handling, validation, and interactive features.
4. Integrate advanced web technologies such as AJAX, XML, and JSON for dynamic applications and hosting.
5. Analyze web technologies, hosting environments, and client-side scripting techniques for developing responsive and interactive web applications.

Prerequisite:

Basic knowledge of computer fundamentals and internet usage.

Course Content

Unit No	Description	Hrs
1	HTML Fundamentals: Introduction to HTML: History, Objectives, Basic Structure of HTML, Header Tags, Body Tags, Paragraph Tags, Lists in HTML, Introduction to DIV tag, Anchor Tag and Hyperlinking, NAVBAR Design.	02

2	HTML Forms and Multimedia Elements: Tags for Form Creation: FORM, INPUT, TEXTAREA, SELECT, FIELDSET, Creating Tables with TABLE Tag, Inserting Multimedia: IMG, IFRAME, Designing and Styling Forms with HTML.	02
3	CSS and Bootstrap Basics: Introduction to CSS: Types of CSS, Selectors, Responsiveness of a Web Page, Introduction to Bootstrap: Downloading/Linking Bootstrap, Using Bootstrap Classes, Understanding the Bootstrap Grid System, Responsive Web Page Design with CSS and Bootstrap.	02
4	Web Technologies and Hosting: Introduction to WWW: Protocols and Programs, Applications and Development Tools, Web Browsers, DNS, and Web Hosting Providers, Setting up Web Servers on Windows/Linux/Unix, Cloud Web Hosting and Types of Web Hosting.	02
5	JavaScript Essentials: Introduction to JavaScript: Functions and Events, Document Object Model (DOM) Traversing using JavaScript, Output Systems in JavaScript: Alert, Input Box, Console, InnerHTML, Variables and Arrays in JavaScript, Date and String Handling in JavaScript, Manipulating CSS through JavaScript, Form Validation: Required, Length, Pattern Validators.	02
6	Advanced Web Programming Concepts: Advanced JavaScript: Combining HTML, CSS, and JavaScript for Events & Buttons, Browser Control, Introduction to AJAX: Purpose, Advantages, Disadvantages, AJAX-based Web Applications, Alternatives, Introduction to XML: Uses, Key Concepts, DTD & Schemas, XSL, XSLT, Transformations with XSLT, Introduction to XHTML (Extensible HyperText Markup Language), JSON: Keys & Values, Types of Values, Arrays, Objects.	02

It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

List of Experiment		
Expr. No	Description	Hrs
1	Create a class timetable using HTML table tags with proper rows and columns.	02

2	Design a college website containing information about courses, departments, faculty, and library using list tags and hyperlinks.	02
3	Create a webpage using semantic HTML5 layout elements (header, nav, section, article, footer) and navigation links.	02
4	Create a personal resume using HTML with text formatting, lists, hyperlinks, and CSS styling.	02
5	Create a responsive resume using Bootstrap classes and grid system.	02
6	Design the college website using inline, internal, and external CSS together.	02
7	Create a responsive college website suitable for mobile devices using HTML and CSS.	02
8	Create a login page using HTML and JavaScript with input validation using regular expressions.	02
9	Develop JavaScript programs including a simple calculator, use of switch case, five JavaScript events, and built-in JavaScript objects.	02
10	Implement AJAX, XML, and JSON by retrieving data using AJAX, creating XML with DTD and Schema, transforming XML using XSL, and handling JSON data.	02

References -

Text Books:

- Laura Lemay, Mastering HTML, CSS & JavaScript Web Publishing, BPB Publications.
- Thomas A. Powell, The Complete Reference HTML & CSS, McGraw-Hill Education.

Reference Books:

- Silvio Moreto, Bootstrap 4 By Example.
- Tanweer Alam, Web Technologies, Khanna Book Publishing.

Web Resources:

- www.javatpoint.com
- www.w3schools.com
- <https://www.geeksforgeeks.org/web-technology/>



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Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1321	Course Name: Data Structures Lab	-	-	4	2

Course Description:

This course provides hands-on experience with fundamental data structure operations through practical programming. Students will implement array operations including insertion, deletion, searching, sorting, and merging. The course covers matrix manipulations such as addition, subtraction, and multiplication. Learners will design and manipulate linear and non-linear data structures including singly, doubly, and circular linked lists. Stack and queue implementations using arrays and linked lists will be developed along with applications such as expression evaluation and polynomial operations. Recursive techniques will be practiced through problems like factorial, GCD, and Towers of Hanoi. The course also includes implementation and traversal operations in binary search trees. Overall, students will gain strong problem-solving skills and practical coding ability in data structures.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

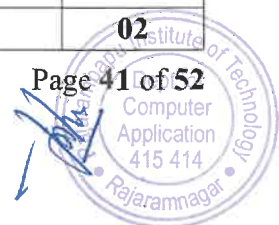
1. Implement basic operations on arrays, matrices, strings using suitable algorithms.
2. Develop linear data structures such as stacks, queues, linked lists.
3. Apply recursion to solve mathematical problems, computational problems.
4. Construct binary search trees to perform insertion, traversal operations.
5. Implement tree-based data structures and their traversal techniques to organize and retrieve data efficiently.

Prerequisite:

Basic knowledge of C programming and fundamental problem-solving skills.

List of Experiment

Expr. No	Description	Hrs
1	Write a program for insertion and deletion operations in an array.	02
2	Write a program to search for an element in an array using Linear Search and Binary Search.	02
3	Write a program to sort an array using Bubble Sort, Selection Sort and Insertion Sort.	02
4	Write a program to merge two arrays.	02





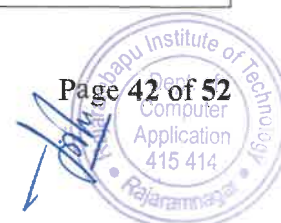
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5	Write a program to add and subtract two matrices.	02
6	Write a program to multiply two matrices.	02
7	Write a program to insert an element into a Singly Linked List: (a) At the beginning (b) At the end (c) At a specified position	02
8	Write a program to delete an element from a Singly Linked List: (a) At the beginning (b) At the end (c) A specified element	02
9	Write a program to perform the following operations in a Doubly Linked List: (a) Create (b) Search for an element	02
10	Write a program to perform the following operations in a Circular Linked List: (a) Create (b) Delete an element from the end	02
11	Write a program to implement stack operations using an array.	02
12	Write a program to implement stack operations using a linked list.	02
13	Write a program to add two polynomials using a linked list.	02
14	Write a program to evaluate a postfix expression using a stack.	02
15	Write a program to perform the following using recursion: (a) Find the factorial of a number (b) Find the GCD of two numbers (c) Solve Towers of Hanoi problem	02
16	Write a program to implement simple queue operations using an array.	02
17	Write a program to implement circular queue operations using an array.	02
18	Write a program to implement circular queue operations using a linked list.	02
19	Write a program to perform the following operations on a binary search tree. (a) Preorder Traversal (b) Inorder Traversal (c) Postorder Traversal	02
20	Write a program to perform insertion operation in a binary search tree.	02

References -

Text Books:

- R. B. Patel, Expert Data Structures with C, Khanna Book Publishing Company.
(AICTE Recommended Textbook)





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- Seymour Lipschutz, Data Structures with C, Schaum's Outlines, Tata McGraw-Hill.
- Yashavant Kanetkar, Data Structures Through C, BPB Publications.

Reference Books:

- Reema Thareja, Data Structures Using C, Oxford University Press.
- Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, Fundamentals of Data Structures in C, Universities Press.





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Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1361	Course Name: Object-Oriented Programming Using Java Lab	-	-	4	2

Course Description:

This course introduces fundamental and advanced concepts of Java programming through practical problem-solving. It covers basic input/output operations, command line arguments, recursion, arrays, strings, and matrix manipulations. Students will learn sorting techniques, palindrome checking, and class design with inheritance, polymorphism, and interfaces. The course emphasizes object-oriented principles by developing programs using classes, objects, packages, and method overriding. Exception handling, custom exceptions, and file handling concepts are practiced to ensure robust programming skills. Real-world applications are demonstrated through programs like student management, employee salary calculation, and banking systems. By the end of the course, learners will be able to design, implement, and test Java applications effectively.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

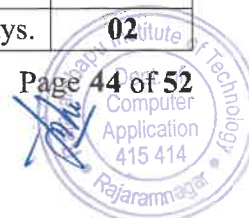
1. Apply Java concepts to solve basic problems using arrays, strings, recursion, and command line arguments.
2. Develop programs using object-oriented principles such as classes, inheritance, polymorphism, and interfaces.
3. Implement exception handling, custom exceptions, and packages to build reliable Java applications.
4. Design Java programs to manage real-world tasks such as student records, salary calculation, and banking operations.
5. Construct Java applications using object-oriented concepts, recursion, exception handling, packages, and interfaces for practical problem-solving.

Prerequisite:

Basic knowledge of C programming and object-oriented programming concepts.

List of Experiment

Expr. No	Description	Hrs
1	Write a Java program to demonstrate command line arguments by printing the square of a given number.	02
2	Write a Java program to perform matrix multiplication using 2D arrays.	02





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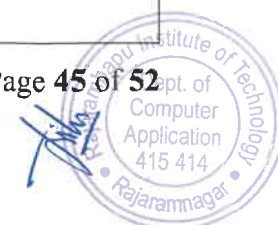
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3	Write a Java program to sort a list of names in ascending order.	02
4	Write a Java program to check whether a given string is a palindrome.	02
5	Write a Java program to implement Fibonacci series and Factorial using recursive and non-recursive methods.	02
6	Write a Java program to read n elements in an array and display them in reverse order.	02
7	Write a Java program demonstrating inheritance using AddSub and MulDiv classes.	02
8	Create a Student class and display details of n students using arrays of objects.	02
9	Write a Java program demonstrating method overriding using Shape and Circle classes.	02
10	Write a Java program demonstrating runtime polymorphism using Employee, Manager, and Programmer classes.	02
11	Write a Java program using an interface Bank implemented by SBI and PNB classes.	02
12	Create a user-defined package and import it into another Java program.	02
13	Write a Java program to count characters, words, and lines in a text file.	02
14	Write a Java program demonstrating divide-by-zero exception handling and multiple catch blocks.	02
15	Write a Java program using a user-defined exception (UnderAge Exception).	02
16	Write a Java program that detects duplicate integers and throws a custom exception.	02
17	Write a Java program to create multiple threads using Thread class and Runnable interface.	02
18	Write a Java program to demonstrate thread synchronization using a shared resource (e.g., Bank Account).	02
19	Write a Java program to demonstrate inter-thread communication using wait(), notify(), and notifyAll().	02
20	Develop a Java Swing/JavaFX GUI application such as Student Information Form or Simple Calculator with event handling.	02

References -

Text Books:

- E. Balaguruswamy, Programming with Java: A Primer, McGraw Hill Education.
- Herbert Schildt, Java: The Complete Reference, McGraw-Hill Education.





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Reference Books:

- Arunesh Goyal, The Essentials of Java, Khanna Book Publishing Company Private Limited.
- Tanweer Alam, Core Java, Khanna Book Publishing Company Private Limited.
- Y. Daniel Liang, Introduction to Java Programming, Pearson.
- S. Malhotra and S. Choudhary, Programming in Java, Oxford University Press.

Web Resources:

- <https://www.w3schools.com/java/>.
- <http://www.java2s.com/>.
- https://onlinecourses.nptel.ac.in/noc22_cs47/preview





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Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1381	Course Name: Indian Constitution	2	-	-	2

Course Description:

This course provides a comprehensive understanding of the Constitution of India, its historical background, and its guiding principles. It covers the Preamble, Fundamental Rights, Duties, and Directive Principles of State Policy, along with their interpretation. The structure and functioning of the Union and State Governments, including the roles of the President, Prime Minister, Governors, and legislatures, are explained in detail. The course introduces the framework of local governance through District Administration, Municipal Corporations, and Panchayati Raj Institutions. It emphasizes the role of the Election Commission of India and State Election Commissions in ensuring free and fair elections. The judicial system, including the Supreme Court, High Courts, and Subordinate Courts, is discussed with a focus on judicial review and Public Interest Litigation (PIL). Additionally, learners gain insights into key constitutional bodies like the Comptroller and Auditor General (CAG), Finance Commission, and UPSC.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Examine the historical development and foundational principles of the Indian Constitution.
2. Identify the structure, powers, and functions of Union and State Governments.
3. Analyze the role of local self-governance, Election Commission, and constitutional bodies.
4. Interpret the functioning of the judiciary and apply the concept of judicial review and PIL.
5. Evaluate the functioning of constitutional bodies, electoral systems, and the judiciary in ensuring democratic governance in India.

Prerequisite:

Basic knowledge of Indian history and civics at the school level.



Course Content		
Unit No	Description	Hrs
1	The Constitution – Introduction: History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its Interpretation, Fundamental Rights and Duties and their Interpretation, Directive Principles of State Policy.	04
2	Union Government: Structure of the Indian Union, The President – Role and Powers, The Prime Minister and the Council of Ministers, Parliament: Lok Sabha and Rajya Sabha.	04
3	State Government: Governor – Role and Powers, The Chief Minister and the Council of Ministers, State Secretariat: Structure and Functions.	04
4	Local Administration: District Administration: Role and Responsibilities, Municipal Corporations: Structure and Functions, Zila Panchayat and Panchayati Raj Institutions.	04
5	Election Commission: Role and Functioning of the Election Commission of India, The Chief Election Commissioner – Powers and Duties, State Election Commission – Structure and Functions.	04
6	Judiciary and Other Constitutional Bodies: The Supreme Court: Structure, Powers, Judicial Review, High Courts and Subordinate Courts, Independence of Judiciary and Public Interest Litigation (PIL), Constitutional Bodies: Comptroller and Auditor General (CAG), Finance Commission, UPSC.	04

References -

Text Books:

- Rajeev Bhargava, Ethics and Politics of the Indian Constitution, Oxford University Press.
- B. L. Fadia, The Constitution of India, Sahitya Bhawan.
- D. D. Basu, Introduction to the Constitution of India, LexisNexis.

Web Resources:

- <https://www.constitution.org/cons/india/const.html>
- <http://www.legislative.gov.in/constitution-of-india>
- <https://www.sci.gov.in/constitution>



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Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1401	Course Name: Additional Course: Foreign Language- German-II	-	-	2	1

Course Description:

This course in German Language introduces students to fundamental grammar, vocabulary, and conversational skills for real-life communication. Learners will explore themes such as professions, food, family, and daily routines while practicing comprehension, invitations, birthdays, and restaurant interactions. Grammar topics include possessive articles, modal verbs (können, wollen, müssen), personal pronouns, separable verbs, prepositions with accusative and dative, and the past tense of haben and sein. Students will also practice telling time, dates, years, and ordinal numbers, along with listening and writing tasks to strengthen understanding. Through role-plays, dialogues, and comprehension exercises, learners will develop confidence in speaking, reading, and writing simple German for personal, social, and professional contexts.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Demonstrate familiar everyday expressions and basic German phrases for simple communication needs.
2. Apply German language skills to introduce oneself and ask and answer questions about personal details such as residence, acquaintances, and possessions.
3. Interact in simple German conversations when communication is slow and clearly articulated.
4. Present the development, usage, and scope of the German language through basic interactions and presentations.
5. Interpret basic German grammar and conversational patterns for communication in everyday situations.

Prerequisite:

1. Knowledge of basic grammar of English Language.
2. Communicate moderately using English Language.



Course Content		
Unit No	Description	Hrs
1	German Language Fundamentals-I: Learning the professions around food and eating. Comprehensions. Understanding and learning of routine activities. To understand the watch timings, Giving information about time, Prepositions and Wh questions related to watch timings.	03
2	German Language Fundamentals-II: Speaking about family and vocabulary related to family, Grammar: Possessive articles in Nominative and akkusativ case, Continuation and exercises of possessive articles, Learning of Modal Verbs: können, wollen, müssen. Telling birthdates and birth year, how to tell years and dates in German. Ordinal numbers, Listening based on ordinal numbers.	03
3	Conversation in German Language-I: To plan something together, speaking about birthday, to understand invitation and to write an invitation, Separable verbs, to order and to pay in restaurant, to speak about own experiences, Vocabulary related to topic Restaurant. Learning, understanding and speaking about ordering and paying in restaurant.	03
4	Conversation in German Language -II: Learning personal pronouns in akkusativ and Preposition für+ akkusativ, Simple past tense of the verbs haben and sein. Vocabulary related to "Contacts", Information and words related to internship and activities related to internship, To understand particular information from the texts and writing it into the points (comprehension). Learning Prepositions with Dative, Articles in Dative, extra exercises and practice., extra exercises and practice for Prepositions with Dativ.	03

References -

Text Books:

- Netzwerk neu A1 (Deutsch als Fremdsprache) Kursbuch, Goyal Publishers and Distributors Private Ltd.
- Netzwerk neu A1 (Deutsch als Fremdsprache) Arbeitsbuch, Goyal Publishers and Distributors Private Ltd.
- Netzwerk neu A1 (Deutsch als Fremdsprache) Testheft, Goyal Publishers and Distributors Private Ltd.

Class: F.Y. BCA	Semester: II	L	T	P	Credits
Course Code: BC1421	Course Name: Foreign Language-Japanese-II	-	-	2	1

Course Description:

This course is designed to introduce students to the everyday language of Japan. Lessons will be organized around natural conversational topics, leading students from fundamental aspects of grammar to readings in simple texts.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Demonstrate an awareness of the relevance of Japanese language to professions and careers.
2. Analyze the cultures and civilizations of Japan, highlighting their historical development and key social aspects.
3. Compare an environment where Japanese is used exclusively.
4. Demonstrate reading and writing skills.
5. Introduce himself/herself with others and can ask and answer questions.

Prerequisite:

Demonstrate knowledge of basic English grammar and communicate effectively in moderate everyday situations using the English language.

Course Content

Unit No	Description	Hrs
1	Introduction to Japanese Language-I: Brief history of Japan & Japanese Language, introduction of 3 scripts, Writing Hiragana alphabets & words from あ to ぜ, Writing Hiragana alphabets from た to ば and Daily expressions & greetings.	03
2	Japanese Language Grammar-II: Expression used to invite someone to something, Expressions used to invite someone to do something, how to say a word or sentence in another language. Different verbs indicating imparting things, information or action, Omission of particles.	03

3	Japanese Language Grammar-III: Introduction of adjective, Forms of adjectives in simple present tense, simple past tense, affirmation & negation, Adverbs of degree.	03
4	Japanese Language Grammar -IV: Modified nouns, Practical Work, Reading/speaking practice. Listening a dialogue and to answer the questions, Conversation.	03

References -

Text Books:

- Minna No Nihongo I, 3A Corporation, Japan.
- Nihongo Shoho Vol. I, Japan Foundation, Tokyo.
- Kanji Picture Book Vol. I & II, Japan Foundation.
- Dr. V. N. Kinkar, Sulabh Janani Vyakaran – Part I.
- Genki, The Japan Times.
- Osamu Mizutani and Nobuko Mizutani, Aural Comprehensions in Japanese.
- Osamu Mizutani and Nobuko Mizutani, An Introduction to Modern Japanese.
- Y. Yoshida, Japanese for Today.
- Alphonsa, Japanese Language Patterns.

