

**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT,
KABLANA (JHAJJAR)
An Autonomous Institute (UGC)
Approved by AICTE, New Delhi and Affiliated to MDU, Rohtak
NAAC 'A' GRADE**

**Scheme of Studies and Examination
Bachelor of Computer Applications**

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	1 Practical (P) per week	0.5 Credit
4	2 Practical (Lab) per week	1 Credit

2. RANGE OF CREDIT

A range of credits from 136 to 144 for a student to be eligible to get Under Graduate degree in Computer Application. A student will be eligible to get Under Graduate degree with Honours or Research Program, if he/she completes an additional 48 credits.

3. STRUCTURE OF UNDER GRADUATE PROGRAM (BCA)

Sr. No.	Category	Break up of Credits BCA	BCA (Honours)	BCA (With Research)
1	Discipline-Specific Courses(DSC)-Major Course	76*	116*	104*
2	Minor(MIC)/Minor Vocational(MV)/MIC Vocational(VOC)/Skill Enhancement Courses (SEC)/Internship	37*	45*	45*
3	Multidisciplinary Courses	9*	9*	9*
4	Ability Enhancement Course	8*	8*	8*
5	Value Added Course	6*	6*	6*
6	Research Project/Dissertation	4*	4*	16*
Total Credits		140*	188*	188*

* Minor variations allowed as per need of the respective disciplines.

Students exiting the program after second semester and securing 48 credits including 4 credits of summer internship will be awarded UG Certificate in the relevant Discipline/Subject. Students exiting the program after fourth semester and securing 96 credits including 4 credits of summer internship will be awarded UG Diploma in the relevant Discipline/Subject. Students will be awarded 3-year UG Degree in relevant major Discipline/Subject upon securing 140 credits.

Four credits of internship earned by a student during summer internship after 2nd semester or 4th semester will be counted in 5th semester of a student who pursue 3 year UG Programs without taking exit option.

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Discipline-Specific Courses-Major Course	DSC
2	Minor Vocational	MV
3	MIC Vocational(VOC)	MICV
4	Skill Enhancement Courses	SEC
5	Multidisciplinary Courses	MDC
6	Ability Enhancement Courses	AEC
7	Value Added Courses	VAC
8	Internship	INT
9	Research Project	RP
10	Dissertation	DISS

Revised Scheme of Studies and Examination

BCA – 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration In Hours
				L	T	P			Assessment	End Semester Exam	Practical	Total	
1	Discipline-Specific Courses Major Courses	DSC-BCA-301A	Software Engineering	4	0	0	4	4	30	70	-	100	3
2	Discipline-Specific Courses Major Courses	DSC-BCA-303A	Artificial Intelligence	4	0	0	4	4	30	70	-	100	3
3	Discipline-Specific Courses Major Courses	DSC-BCA-305A	Cloud Computing	3	0	0	3	3	25	50	-	75	3
		LC-BCA-307A	Cloud Computing Lab	0	0	2	1	1	10	-	15	25	3
4	Discipline-Specific Courses Major Courses	DSC-BCA-309A	Object Oriented Analysis and Design using UML	2	0	0	2	2	15	35	-	50	3
		LC-BCA-311A	Object Oriented Analysis and Design using UML Lab	0	0	4	2	2	15	-	35	50	3
5	Major Discipline Relevant Course (Vocational)-Minor Courses	Refer Table XII	-----	3	1	0	4	4	30	70	-	100	3
6	Internship	INT-BCA-317A	-----	0	0	0	0	4	30	-	70	100	
Total Credits								24	185	295	120	600	

Note:

- Four credits of internship earned by a student during summer internship after the 2nd semester or 4th semester will be counted in the 5th semester of a student who pursues a 3-year UG Program without taking exit option.
- After completion of the internship, students need to prepare a comprehensive report highlighting their learning and takeaways during the internship period. The internship duration is 8 weeks during the summer vacation. The Internship Report prepared after completion shall be assessed in the 5th Semester as a compulsory course.

Revised Scheme of Studies and Examination
BCA – 6th Semester
w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration In Hours
				L	T	P			Assessment	End Semester Exam	Practical	Total	
1	Discipline-Specific Courses Major Courses	DSC-BCA-302A	Internet of Things (IoT)	3	0	0	3	3	25	50	-	75	3
		LC-BCA-304A	Internet of Things (IoT) Lab	0	0	2	1	1	10	-	15	25	3
2	Discipline-Specific Courses Major Courses	DSC-BCA-306A	Information and System Security	3	0	0	3	3	25	50	-	75	3
		LC-BCA-308A	Information and System Security Lab	0	0	2	1	1	10	-	15	25	3
3	Discipline-Specific Courses Major Courses	DSC-BCA-310A	Data Warehousing & Mining	3	0	0	3	3	25	50	-	75	3
		LC-BCA-312A	Data Warehousing & Mining Lab	0	0	2	1	1	10	-	15	25	3
4	Discipline-Specific Courses Major Courses	DSC-BCA-314A	Relational Database Management System	2	0	0	2	2	15	35	-	50	3
		LC-BCA-316A	Relational Database Management System Lab	0	0	4	2	2	15	-	35	50	3
5	Major Discipline Relevant Course (Vocational)- Minor Courses	Refer Table XIII	-----	3	1	0	4	4	30	70	-	100	3
6	Project	RP-BCA-322A	Project/Dissertation	0	0	0	0	4	25	-	75	100	3
Total Credits								24	190	255	155	600	

Note: The panel of examiners for assessment of the Project Reports/Dissertation/Research Project/Summer Internship Reports shall be recommended by the Department of Computer Science and Application.

Semester-V

Table No. XII Major Discipline Relevant (Vocational) -Minor Courses

S. No.	Category	Course Code	Course Name
1	Major Discipline Relevant Course (Vocational) - Minor	MICV-307A	Business Policy and Strategy
2		MICV-309A	Computer Networks and Internet
3		LC-MICV-311A	Computer Networks and Internet Lab

Semester-VI

Table No. XIII Major Discipline Relevant (Vocational) -Minor Courses

S. No.	Category	Course Code	Course Name
1	Major Discipline Relevant Course (Vocational) - Minor	MICV-308A	Entrepreneurship Development
2		MICV-310A	Web Development
3		LC-MICV-312A	Web Development Lab

Semester-V

Course Code	DSC-BCA-301A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Software Engineering				
Scheme and Credits	L	T	P	Credits	Semester-V
	4	0	0	4	
Course Objectives	The objectives of this course are • Understand software engineering principles, processes, and methodologies including traditional and agile models for effective development, requirement analysis, design, and testing of software systems. • Apply project management, quality assurance, risk management, and maintenance practices to ensure reliable software delivery, release management, and long-term product sustenance.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall fundamental software engineering concepts, process models, requirements, design, testing, quality, and project management principles.	Level-1 Remember
CO2	Understand and explain key concepts in software processes, requirements, design, testing, quality management, and maintenance.	Level-2 Understand
CO3	Apply software engineering processes, requirements analysis, design, testing, quality assurance, and project planning techniques to develop reliable software systems.	Level-3 Apply
CO4	Analyze software processes, requirements, design, testing, quality, and sustenance practices across development lifecycles to evaluate their effectiveness and suitability.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 2 marks each from all units and remaining 8 questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

The evolving role of software, changing nature of software, layered technology, a process framework,

Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.

UNIT II

Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.

Project planning: Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.

UNIT III

Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.

Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT IV

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.

Release Management: Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring.

Product sustenance: Maintenance, updates, End of life, migration strategies.

Text Books

1. Software Engineering, N.S. Gill, Khanna Publishing House, 2023 (AICTE Recommended Textbook)
2. Software Engineering, Ian Somerville, 9th edition, Pearson education.
3. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

Reference Books

1. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007
2. Software Engineering: Principles and Practice Hans van Vliet

Video Links

Topics	Links
Waterfall Model	https://nptel.ac.in/courses/106101061
Increment Model	https://nptel.ac.in/courses/106105182
Agile Model	https://nptel.ac.in/courses/106105150
Quality Management	https://nptel.ac.in/courses/106105218

Course Code	DSC-BCA-303A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Artificial Intelligence				
Scheme and Credits	L	T	P	Credits	Semester-V
	4	0	0	4	
Course Objectives	The objectives of this course are • Understand AI foundations, intelligent agents, search techniques (uninformed, informed, adversarial, evolutionary), and problem-solving methods. • Apply logical reasoning, uncertainty handling, planning, and explore AI domains like ML, CV, robotics, NLP, expert systems, and ethical issues.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define and recall fundamental concepts of Artificial Intelligence including intelligent agents, search techniques, logical reasoning, planning, uncertainty, AI domains, expert systems, and ethical issues.	Level-1 Remember
CO2	Explain the principles of rational agents, search strategies, knowledge representation, inference, planning, uncertainty handling, AI domains, expert systems, and ethical issues in AI.	Level-2 Understand
CO3	Apply AI techniques such as search algorithms, logical inference, planning, constraint satisfaction, probabilistic reasoning, fuzzy sets, and machine learning to solve problems.	Level-3 Apply
CO4	Analyze AI problems using appropriate agents, search strategies, knowledge representation, inference, planning methods, and evaluate AI applications with ethical considerations.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 2 marks each from all units and remaining 8 questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to AI: What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of Agents.

Knowledge-Based Agents: Introduction to Knowledge-Based Agents, The Wumpus World as an Example World. Problem-solving: Problem-solving agents.

UNIT II

Advanced Search Techniques: Uninformed Search: DFS, BFS, Iterative Deepening Search.

Informed Search: Best First Search, A* search, AO* search.

Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning. Constraints and Constraint Satisfaction Problems(CSPs), Backtracking search for CSP.

Evolutionary Search Techniques: Introduction to evolutionary algorithms, Genetic algorithms, Applications of evolutionary search in AI.

UNIT III

Logical Reasoning and Uncertainty Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting.

Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems.

Introduction to Planning: Blocks World problem, Strips.

Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning,

Introduction to Fuzzy set theory: Introduction to fuzzy logic, Crisp sets vs Fuzzy sets, Definition of fuzzy set, Membership function, Types of membership functions, Properties of fuzzy sets, Support, core, height of fuzzy set, α -cut (alpha cut) concept.

UNIT IV

Domains in AI: Introduction to Machine Learning, Computer Vision, Robotics, Natural Language Processing, Deep Neural Networks, and their Applications.

Expert Systems: The architecture and role of expert systems include two case studies.

Legal and Ethical Issues: Concerns related to AI.

Text Books:

1. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
2. Nilsson Nils J, Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.
3. Dan W Patterson, Introduction to Artificial Intelligence & Expert Systems, PHI Learning 2010.
4. Rajiv Chopra, Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024.

Reference Books:

1. M.C. Trivedi, Introduction to AI and Machine Learning, Khanna Book Publishing Company, 2024.
2. Russell, S. and Norvig, P., "Artificial Intelligence - A Modern Approach", 3rd edition, Prentice Hall
3. Van Hirtum, A. & Kolski, C. (2020). Constraint Satisfaction Problems: Algorithms and Applications. Springer
4. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing Company, 2024.

Video Links

Topics	Links
Introduction to AI	https://nptel.ac.in/courses/106102220
Knowledge-Based Agents	https://nptel.ac.in/courses/106105077
Advanced Search Techniques	https://nptel.ac.in/courses/106105079
Logical Reasoning and Uncertainty Logic	https://nptel.ac.in/courses/106106140
Introduction to Fuzzy set theory	https://nptel.ac.in/courses/111102130

Course Code	DSC-BCA-305A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Cloud Computing				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are • Understand cloud fundamentals, architecture, characteristics, deployment/service models (SaaS/IaaS/PaaS), virtualization (hypervisors, types), and comparisons with cluster/grid computing. • Evaluate cloud vendors (AWS, Azure, Google App Engine), service management (SLAs, load balancing), security challenges, and applications like big data analytics.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Remember and define the fundamentals, characteristics, deployment and service models of cloud computing, virtualization concepts, major cloud vendors, and basic cloud service management and security principles.	Level-1 Remember
CO2	Explain cloud computing fundamentals, models, virtualization, vendors, service management, and security across its architecture, deployment, and service layers.	Level-2 Understand
CO3	Apply cloud computing architectures, service models, virtualization techniques, and vendor platforms to deploy secure, scalable solutions addressing SLAs and security challenges.	Level-3 Apply
CO4	Analyze cloud architectures, service models, virtualization techniques, vendor platforms, and security mechanisms across deployment scenarios.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Cloud Computing Fundamentals: Cloud Computing definition, Characteristics of Cloud Computing, Cloud Computing Benefits and Limitations, Cloud Architecture; Cloud computing vs. Cluster computing vs. Grid computing; Applications: Technologies and Process required when deploying Web services.

UNIT II

Cloud Computing Model and Services: Cloud Computing Deployment model, Cloud Computing service models.

Introduction to Cloud Services: SaaS, IaaS, PaaS; Storage As a Service, Communication As a Service; Cloud-based big data/real time analytics, Understanding SOA; Improving Performance through Load Balancing.

UNIT III

Virtualization: Virtualization Basics: Objectives, Benefits of Virtualization, Emulation, Virtualization for Enterprise, VMware, Server Virtualization, Data Storage Virtualization, hypervisors, types of hypervisors, distributed management of virtual infrastructures.

UNIT IV

Cloud vendors and Service Management & Security: Amazon cloud, AWS Overview, Installation of AWS, Google app engine, azure cloud, Sales force.

Service Management in Cloud Computing: Service Level Agreements (SLAs), Comparing Scaling Hardware: Traditional vs. Cloud, Security Concepts: Cloud security challenges

TEXT/REFERENCE BOOKS:

1. Cloud Computing: A Practical Approach by Anthony T. Velte Toby J. Velte, Robert Elsenpeter, the McGraw-Hill.
2. Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more. by Dr. Kris Jamsa.
3. Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'ReillyMedia Inc.
4. Cloud Computing Bible, Barrie Sosinsky, Wiley-India.
5. Cloud Computing: Principles and Paradigms, Editors: RajkumarBuyya, James Broberg, Andrzej M. Goscinski, and Wile.
6. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
7. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India.

Video Links

Topics	Links
Introduction to AI	https://nptel.ac.in/courses/106102220
Knowledge-Based Agents	https://nptel.ac.in/courses/106105077
Advanced Search Techniques	https://nptel.ac.in/courses/106105079
Logical Reasoning and Uncertainty Logic	https://nptel.ac.in/courses/106106140
Introduction to Fuzzy set theory	https://nptel.ac.in/courses/111102130

Course Code	LC-BCA-307A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Cloud Computing Lab				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives	The objectives of this course are • To understand cloud computing fundamentals, deployment models, and service models through hands-on experiments. • To perform practical implementation of cloud services, virtualization, and web service deployment using cloud platforms. • To analyze cloud architecture, load balancing, and virtualization techniques for efficient system design.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply cloud computing concepts to use SaaS, PaaS, IaaS, virtualization, and deploy basic cloud services.	Level-3 Apply
CO2	Analyze cloud architecture, deployment models, service models, and virtualization techniques.	Level-4 Analyze
CO3	Evaluate different cloud platforms, load balancing methods, and cloud services for suitable applications.	Level-5 Evaluate
CO4	Create and deploy virtual machines, web services, and simple applications on cloud platforms.	Level-6 Create

Exp. No.	Experiments
1	Study different Cloud Computing characteristics (On-demand, scalability, elasticity) and prepare comparison table.
2	Compare Cloud vs Grid vs Cluster computing with examples.
3	Create a diagram showing Cloud Architecture (Front-end, Back-end, Internet, Services).
4	Study benefits and limitations of Cloud Computing and prepare case study.
5	Deploy a simple web service using any free cloud platform (AWS / Azure / Google Cloud / Replit).
6	Study Cloud Deployment Models (Public, Private, Hybrid, Community) with real examples.
7	Compare Service Models (IaaS, PaaS, SaaS) with practical examples.
8	Create account on SaaS application (Google Docs / Office 365) and demonstrate usage.
9	Demonstrate Storage as a Service using Google Drive / OneDrive.
10	Demonstrate Communication as a Service using Google Meet / Zoom.
11	Study Cloud-based Big Data analytics using Google Colab.
12	Implement Load Balancing concept using round-robin example.
13	Install VirtualBox / VMware and create virtual machine.
14	Install operating system in virtual machine.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	DSC-BCA-309A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Object Oriented Analysis and Design using UML				
Scheme and Credits	L	T	P	Credits	Semester-V
	2	0	0	2	
Course Objectives	The objectives of this course are to • To understand the fundamentals of web development using the .NET framework, including its architecture, execution model, and development tools such as IIS, SQL Server, and Visual Studio. • To develop proficiency in object-oriented programming concepts such as classes, inheritance, polymorphism, interfaces, and exception handling using C#. • To design and implement Windows-based applications with user interfaces and database connectivity using ADO.NET for data access and manipulation.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts of UML, object-oriented modeling, state and interaction modeling, and system analysis and design including principles, elements, relationships, diagrams, and architectural aspects.	Level-1 Remember
CO2	Explain the concepts of UML, object-oriented modeling, class and state modeling, interaction modeling, and system analysis and design including principles, relationships, diagrams, and architectural considerations.	Level-2 Understand
CO3	Apply UML techniques, object-oriented modeling concepts, state and interaction models, and system analysis and design methods to develop models, diagrams, and solutions for real-world systems.	Level-3 Apply
CO4	Analyze UML models, object-oriented designs, state and interaction behaviors, and system architectures to evaluate system requirements, subsystem organization, concurrency, and design strategies.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 marks each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT – I

UML: Principles of modeling, UML Things – Structural, Behavioral, Grouping, Annotational. Relationships in UML – Dependency, Association, Generalization, Realization. Overview of diagrams in UML – Class diagram, Object diagram, Use-Case diagram, Sequence diagram, Collaboration diagram, State chart diagram, Activity diagram, Component diagram, Deployment diagram. UML Semantic Rules – Names, Scope, Visibility, Integrity, Execution. Mechanisms in the UML – Specifications, Adornments, Common Divisions, Extensibility Mechanisms.

UNIT – II

Modeling as a Design Technique: Abstraction, Encapsulation, Modularity, Hierarchy, Typing, Concurrency, Persistence of objects. Purpose of modeling, Class Model – Object & Class, Links & Associations, Generalization & Inheritance, Association Ends - Multiplicity, Role names, Ordering, Qualification, Aggregation, Link attributes & Link class, Abstract class, Metadata, Constraints.

UNIT – III

State Modeling: Event, State, Activity, Action, Transitions & Conditions, State diagrams, Nested state diagrams, signal generalization, concurrency, relationships between class and state models.

Interaction Modeling: use case models, use case relationships, sequence models, procedural sequence models, activity models, special constructs for activity models.

UNIT – IV

System Analysis & design: System development stages, system conception, analysis, domain class model, domain state model, iterating the analysis. class model, application.

System Design: estimating performance, make a reuse plan, organize the system into subsystem, identifying concurrency, allocating subsystems to processors and tasks, management of data stores, handling global resources, choosing software control strategies, handling boundary conditions, setting trade-off priorities, selecting an architect style.

Suggested Readings:

1. Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Pearson Education.
2. M. Blaha, J. Rumbaugh, Object-Oriented Modeling and Design with UML, Pearson Education.
3. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Pearson education.
4. Satzinger, Jackson, Burd, Object-Oriented Analysis & Design with the Unified Process, Thomson.
5. Grady Booch, Object Oriented Analysis & Design, Addison Wesley.
6. Timothy C. Lethbridge, Robert Laganier, Object Oriented Software Engineering,

Useful Video links:

Topics	Links
Introduction to UML	https://nptel.ac.in/courses/106105224
Modeling as a Design Technique	https://youtu.be/c6mLMnXT54E?si=jMxaHT-aGcRBSH9E
State Modeling	https://youtu.be/_f6z7YfgszQ?si=wi4JAJMhRVlZVsn9
System Analysis & design	https://nptel.ac.in/courses/106108102

Course Code	LC-BCA-311A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Object Oriented Analysis and Design using UML Lab				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	4	2	
Course Objectives	The objectives of this course are to • To understand the fundamental concepts of UML and apply different UML diagrams for modeling software systems. • To develop class, state, and interaction models using object-oriented design concepts such as abstraction, inheritance, association, and aggregation. • To perform system analysis and design by creating domain models, identifying subsystems, and applying UML techniques for real-world applications.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply UML techniques to develop class, use case, sequence, activity, state, component, and deployment diagrams.	Level-3 Apply
CO2	Analyze system requirements by identifying objects, relationships, states, interactions, and subsystems using UML models.	Level-4 Analyze
CO3	Evaluate UML design models and architectural styles for suitable software solutions.	Level-5 Evaluate
CO4	Create complete system analysis and design models using domain class, interaction, state, and subsystem diagrams.	Level-6 Create

Exp. No.	Experiments
1	Study different UML Things: Structural, Behavioral, Grouping, Annotational with examples.
2	Draw UML Relationships (Dependency, Association, Generalization, Realization).
3	Draw Class Diagram for Library Management System.
4	Draw Object Diagram for Student Information System.
5	Draw Use Case Diagram for Online Shopping System.
6	Draw Sequence Diagram for ATM Withdrawal.
7	Draw Collaboration Diagram for Online Banking System.
8	Draw State Chart Diagram for Order Processing System.

9	Draw Activity Diagram for Student Admission Process.
10	Draw Component Diagram and Deployment Diagram for Web Application.
11	Create Class Model showing Object, Class and Associations.
12	Draw diagram showing Generalization and Inheritance.
13	Draw Aggregation and Composition example.
14	Implement Multiplicity, Role names and Association Ends in class diagram.
15	Create diagram using Abstract Class and Constraints.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	MICV- 307A				
Category	Major Discipline Relevant Course (Vocational) – Minor				
Course Title	Business Policy and Strategy				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	1	0	4	
Course Objectives	The objectives of this course are to • To understand the foundational concepts, processes, and significance of business policy and strategic management. • To understand various strategy types and their application at the corporate, business, and functional levels. • To understand the implementation aspects of strategy, including structural, behavioral, and functional dimensions. • To understand techniques for evaluating and controlling strategies, including McKinsey’s 7S Framework.				
Assessment	30 Marks				
End Semester Examination	70Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the framework of business policy and strategic management, including strategic intent, environmental and organizational appraisal, types of strategies, implementation methods, evaluation, and control techniques.	Level-1 Remember
CO2	Explain the framework of strategic management, including strategic intent, environmental and organizational appraisal, strategy types, implementation, and control.	Level-2 Understand
CO3	Apply strategic tools and models such as SWOT, PEST, Porter's Five Forces, BCG Matrix, GE 9-cell Matrix, McKinsey's 7s Framework to formulate strategies, implement them through resource and structural planning, and evaluate their effectiveness using control techniques.	Level-3 Apply
CO4	Analyze the internal and external environment, strategic alternatives at corporate, business, and functional levels, as well as implementation challenges related to structure, culture, leadership, and ethics, and apply strategic control systems.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

UNIT – I

Introduction to Business Policy and Strategic Management:- Definition, Concept, Objective and Significance, The levels at which strategy operates, Strategic Management Process, strategic intent: Vision, Mission, Business definition, Goals, and Objectives.

Environment Appraisal:- Concept and Environmental Sector; PEST Analysis, Organizational Appraisal: Concepts and Capability Factors; Porter's Value Chain Model, SWOT Analysis as a Tool for assessing Organizational Capabilities and Environment Opportunities.

UNIT – II

Type of Strategies:- Corporate Level (Concept of Grand Strategies), Business Level, and Functional Level, Guidelines for Crafting Successful Business Strategies. Strategy Analysis and Choice: Corporate Level Strategy Analysis: BCG Matrix and GE 9 cell Matrix, Business Level Strategy Analysis: Life Cycle Analysis, Porter's Five Forces of Industry Analysis, Strategic Choice, and Process of Strategic Choice.

UNIT – III

Strategy Implementation:- Interrelation Between Strategy Formulation and Implementation, Aspects of Strategy Implementation, An overview of Project, Procedural Implementation, Resource Allocation, Structural Implementation. Behavioural Implementation: An overview of: Leadership, Corporate Culture, Corporate Politics and Use of Power, Personal Values and Business Ethics, Functional /Operational Implementation.

UNIT – IV

Strategy Evaluation and Control:- An Overview of Strategic Evaluation and Control, Techniques for Strategic Evaluation and Control, Role of Organizational Systems in Evaluation, McKinsey's 7s Framework.

Suggested Readings:

- Business Policy and Strategic Management by Azhar Kazmi, Tata McGraw-Hill, New Delhi.
- Strategic Management and Business Policy by Wheelen and Hunger, Pearson Education.
- Strategic Management by Chandrasekharan, Oxford University Press.
- Crafting and Executing Strategy: The Quest for Competitive Advantage by A. Thompson Jr., A. J. Strickland III, and J. E. Gamble, Tata McGraw-Hill.
- Strategic Management: Concepts and Cases by Fred R. David, Pearson Education.
- Strategic Management: Competitiveness and Globalization by M. A. Hitt, R. D. Ireland, and R. E. Hoskisson, Thomson Asia Pvt. Ltd.
- Strategic Management: Strategy Formulation and Implementation by J. A. Pearce II and R. B. Robinson Jr., AITBS Publishers and Distributors, Delhi.
- Management Policy and Strategic Management: Concepts, Skills and Practices by R. M. Srivastava, Himalayan Publishing House.
- Managing in a Time of Great Change by Peter F. Drucker, Truman Talley Books / Plume, Penguin Group.

Useful Video links:

Topics	Links
Strategic Management Process	https://nptel.ac.in/courses/110108047
Environment Appraisal	https://nptel.ac.in/courses/110107509
Corporate Level and Business Level Strategies	https://nptel.ac.in/courses/110105161
Strategy Implementation	https://nptel.ac.in/courses/122105024
Case Study	https://nptel.ac.in/courses/122105024
McKinsey's 7s Framework	https://nptel.ac.in/courses/110108161

Course Code	MICV-309A				
Category	Major Discipline Relevant Course (Vocational) - Minor				
Course Title	Computer Networks and Internet				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the fundamental concepts of computer networks, data communication components, network models (OSI & TCP/IP), and transmission media. • To explain and analyze the functions of Data Link, Network, Transport, and Application layers, including framing, error and flow control, MAC protocols, IP addressing, routing techniques, and protocols such as TCP, UDP, DNS, HTTP, FTP, and SMTP. • To explore and evaluate the structure of the Internet and World Wide Web, along with network security concepts, cryptographic techniques, and emerging technologies such as wireless networks, IoT, and cloud computing.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of computer networks, models, and transmission media.	Level-1 Remember
CO2	Explain networking layers, protocols, and communication techniques.	Level-2 Understand
CO3	Apply networking concepts to analyze routing, error control, and internet services.	Level-3 Apply
CO4	Analyze network security issues and evaluate modern networking technologies.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Computer Networks: Definition and importance of computer networks, Data communication concepts, Components, data flow, transmission modes, Types of networks(LAN, MAN, WAN, PAN),Network topologies, Bus, Star, Ring, Mesh, Hybrid ,OSI Reference Model, Layers, functions, and services ,TCP/IP Model, Architecture and comparison with OSI model, Transmission media, Guided (Twisted Pair, Coaxial, Optical Fiber) and Unguided (Radio waves, Microwave, Satellite)

UNIT – II

Data Link and Network Layer: Data Link Layer Functions and services, Framing techniques: Character count, byte stuffing, bit stuffing, Error detection and correction: Parity, CRC, Hamming Code, Flow

control protocols: Stop-and-Wait, Sliding Window, Medium Access Control: ALOHA, CSMA/CD, CSMA/CA

Network Layer: Logical addressing: IPv4 and IPv6, Subnetting and Supernetting, Routing algorithms: Distance Vector, Link State, Routing protocols, RIP, OSPF, BGP, Congestion control techniques

UNIT – III

Transport Layer: Functions and services, Connection-oriented vs Connectionless service, TCP vs UDP (features and comparison), Flow control and congestion control in TCP

Application Layer: Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP/HTTPS), File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP), Telnet and SSH

UNIT – IV

Internet fundamentals: Structure, ISP, Internet services, World Wide Web (WWW): Working and architecture, Web browsers and search engines

Network security concepts: Threats, attacks, vulnerabilities, Cryptography basics (Symmetric & Asymmetric encryption), Firewalls and Intrusion Detection Systems

Emerging trends: Wireless networks (Wi-Fi, Bluetooth), Mobile communication (3G, 4G, 5G basics), Internet of Things (IoT), Cloud computing basics

Reference Books

1. **Behrouz A. Forouzan**, Data Communications and Networking, 5th ed., McGraw-Hill Education, 2013.
2. **Andrew S. Tanenbaum** and David J. Wetherall, Computer Networks, 5th ed., Pearson Education, 2010.
3. **James F. Kurose** and Keith W. Ross, Computer Networking: A Top-Down Approach, 8th ed., Pearson Education, 2021.
4. **William Stallings**, Data and Computer Communications, 10th ed., Pearson Education, 2013.
5. **Nader F. Mir**, Computer and Communication Networks, 2nd ed., Pearson Education, 2014.
6. **Douglas E. Comer**, Internetworking with TCP/IP, Vol. 1, 6th ed., Pearson Education, 2014.

Video Links

Topics	Links
Network basics, OSI model, TCP/IP model, Topologies	https://nptel.ac.in/courses/106106091
Framing, Error detection (CRC, Hamming), Flow control, MAC protocols (ALOHA, CSMA/CD), Routing algorithms, IP addressing	https://nptel.ac.in/courses/106105081
TCP vs UDP, Congestion control, DNS, HTTP, FTP, SMTP, Application layer protocols	https://nptel.ac.in/courses/106105183
Internet Technology	https://nptel.ac.in/courses/106105084
Cryptography and Network Security	https://nptel.ac.in/courses/106105031
Wireless Communication	https://nptel.ac.in/courses/108102096
Cloud Computing	https://nptel.ac.in/courses/106105167

Course Code	LC-MICV-311A				
Category	Major Discipline Relevant Course (Vocational) - Minor				
Course Title	Computer Networks and Internet Lab				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives	The objectives of this course are • To apply fundamental networking concepts to design and simulate network topologies, IP addressing, and communication. • To analyze data communication techniques such as framing, error detection, and flow control protocols. • To evaluate and create network applications using client-server programming, protocol analysis, and basic network security configurations.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply networking concepts to implement topologies, IP addressing, and simulations.	Level-3 Apply
CO2	Analyze framing, error detection, and flow control techniques.	Level-4 Analyze
CO3	Evaluate transport and application layer protocols using programming and tools.	Level-5 Evaluate
CO4	Create network solutions using socket programming, routing, and security configurations.	Level-6 Create

EXP. No.	Experiments
1	Study different types of networks (LAN, MAN, WAN, PAN) with real-life examples.
2	Implement basic network topologies (Bus, Star, Ring) using Cisco Packet Tracer.
3	Create and analyze Star topology and test communication between nodes.
4	Compare different transmission media (Twisted Pair, Coaxial, Optical Fiber) using charts or simulation.
5	Study OSI Model layers and map real-world protocols to each layer.
6	Implement framing techniques (Character count / Byte stuffing) using C program.
7	Write a program for error detection techniques using Parity Bit and CRC.
8	Implement Hamming Code for error detection and correction.
9	Simulate flow control protocols: Stop-and-Wait and Sliding Window.
10	Perform IP addressing and subnetting calculations manually.
11	Configure IPv4 addressing and test connectivity using ping command.
12	Study and simulate routing algorithms (Distance Vector, Link State).

13	Compare TCP and UDP using a simple client-server program.
14	Create a basic client-server communication using sockets in C/Python.
15	Study Application layer and security concepts: • DNS lookup using nslookup • HTTP working using browser developer tools • WWW request-response cycle • Basic firewall / packet filtering (simulation)

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	INT-BCA-317A				
Category	Internship				
Course Title	Industry Internship				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	0	4	
Course Objectives	The objectives of this course are to • Develop project planning and management skills for successful technical execution. • Enhance software development, database design, and system integration capabilities. • Apply structured problem-solving methods to resolve complex technical issues. • Improve professional communication skills, both written and verbal. • Understand and apply ethical principles in software engineering practices				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify emerging technologies and interdisciplinary fields for hands-on industrial training.	Level-1 Remember
CO2	Describe report writing and presentation skills in technical and industrial contexts.	Level-2 Understand
CO3	Apply engineering principles to analyze and solve real-world industrial problems.	Level-3 Apply
CO4	Assess ethical standards and tools across diverse technological domains.	Level-4 Analyze
CO5	Evaluate personal performance in communication, teamwork, and technical proficiency.	Level 5: Evaluate
CO6	Design and develop industry-relevant software or hardware systems.	Level 6: Create

Overview:

Internship is a foundational course that introduces students to the research process in computer science and information technology. This course provides students with the necessary skills and knowledge to undertake independent research projects. Students will learn to identify research problems, conduct literature reviews, design research methodologies, collect and analyze data, and present their findings effectively.

The candidates will submit the internship report in the prescribed format designed by the department. The report will be evaluated by an examiner appointed by the Controller of Examination (or a committee constituted by the Director of the Institute) from the approved panel of examiners.

Assessment Framework

Sr. No.	Exam Type	Stage No.	Criteria	Assessment	Marks	Overall Weightage
1	Internal	Stage-I	Assessment by Mentor	Rubric I	30	30%
2.	External / End Semester Exam	Stage-II	Internship Report	Rubric II	40	70%
		Stage-II	Viva-Voce	Rubric III	30	
Total					100	100%

1. Internal Assessment (30 Marks – 30%)

The internal evaluation is carried to monitor student performance, project development and continuous improvement.

Rubric I: Assessment by Mentor					
Parameters/Assessment Levels	Excellent	Good	Average	Poor	Marks
Skills Learned (15 Marks)	15-13: Acquired and effectively applied technical/professional skills independently.	12-10: Good acquisition and application of skills.	09-06: Basic skills acquired with guidance.	05-00: Limited skill development.	
Regularity & Attendance (10 Marks)	10-09: Highly regular, punctual, and committed.	08-07: Generally regular with minor deviations.	06-04: Moderate attendance and punctuality.	03-00: Irregular participation.	
Professional Conduct (05 Marks)	05: Excellent discipline, teamwork, ethics, and communication.	04: Good professional behavior.	03-02: Satisfactory conduct.	03-02: Satisfactory conduct.	
Total Marks					30

2. External Assessment (70 Marks – 70%)

Rubric II: Internship Report (40 Marks)						
Sr. No.	Parameters/Assessment Levels	Excellent	Good	Average	Poor	Marks
1	Organization Profile & Internship Objectives (08 Marks)	08-07: Clearly describes organization, objectives, and scope of work.	06-05: Adequate description.	04-03: Limited details.	02-00: Poor description.	
2	Work Performed & Technical Understanding (10 Marks)	10-09: Excellent understanding and documentation of assigned work.	08-07: Good understanding.	06-04: Basic understanding.	03-00: Limited understanding.	
3	Learning Outcomes & Skill Development (08 Marks)	08-07: Significant learning and skill enhancement demonstrated.	06-05: Good learning outcomes.	04-03: Moderate learning.	02-00: Limited learning.	
4	Problem Solving & Contribution (08 Marks)	08-07: Demonstrates strong analytical and problem-solving ability.	06-05: Good contribution.	04-03: Limited contribution.	02-00: Minimal contribution.	
5	Report Quality & Presentation (06 Marks)	06: Well-structured, professional, and error-free report.	05-04: Good report quality.	03-02: Average presentation.	01-00: Poor report organization.	
Total Marks						40

Rubric III: Viva-Voce (30 Marks)						
Sr. No .	Parameters / Assessment Levels	Excellent	Good	Average	Poor	Marks
1	Understanding of Internship Work (08 Marks)	08-07: Demonstrates excellent understanding of work and processes.	06-05: Good understanding.	04-03: Basic understanding.	02-00: Poor understanding.	
2	Technical Knowledge & Application (08 Marks)	08-07: Strong technical knowledge with practical application.	06-05: Good technical knowledge.	04-03: Moderate knowledge.	02-00: Limited knowledge.	
3	Problem Solving & Learning Experience (06 Marks)	06-05: Clearly explains challenges faced and solutions adopted.	04: Good explanation.	03-02: Basic explanation.	01-00: Unable to explain.	
4	Communication & Professionalism (08 Marks)	08-07: Communicates confidently and professionally.	06-05: Good communication.	04-03: Average communication.	02-00: Poor communication skills..	
Total Marks						30

Semester-VI

Course Code	DSC-BCA-302A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Internet of Things(IoT)				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of Internet of Things (IoT) architecture, communication models, networking protocols, and enabling technologies. • To develop understanding of IoT hardware platforms, sensor interfacing, embedded systems, and cloud-based IoT applications. • To analyze IoT applications, security challenges, and modern IoT solutions for real-world problem solving.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the concepts of IoT architecture, communication protocols, IoT hardware platforms, and IoT applications & security mechanisms.	Level-1 Remember
CO2	Explain IoT networking models, sensor interfacing techniques, cloud platforms, and security challenges in IoT systems.	Level-2 Understand
CO3	Apply IoT protocols, embedded platforms, programming techniques, and cloud services for developing IoT-based applications.	Level-3 Apply
CO4	Analyze IoT architectures, communication technologies, hardware platforms, and security issues for real-world IoT solutions.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Internet of Things:- Characteristics and Features of IoT, Evolution and Scope of IoT, Applications of IoT in various domains, Components of IoT System, IoT Architecture, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Communication Models, IoT Communication APIs, Challenges and Issues in IoT.

UNIT II

IoT Communication and Networking: Sensors and Actuators, Basics of Embedded Systems, RFID Technology, Wireless Sensor Networks (WSN), Networking Concepts in IoT, IPv4 and IPv6, MQTT Protocol, CoAP Protocol, ZigBee Technology, Bluetooth and Bluetooth Low Energy (BLE), Wi-Fi for IoT, Data Communication in IoT, Cloud Connectivity in IoT, Machine-to-Machine (M2M) Communication.

UNIT III

IoT Hardware and Software Platforms: Introduction to Arduino Platform, Raspberry Pi Platform, NodeMCU and ESP8266, Interfacing Sensors with Arduino, IoT Programming Basics, Python Programming for IoT, Embedded C Basics, Data Acquisition Techniques, IoT Middleware, Cloud Platforms for IoT, ThingSpeak Application, Blynk Application, Data Storage and Processing in IoT.

UNIT IV

IoT Applications and Security:-Smart Home Systems, Smart City Applications, Smart Agriculture, Healthcare Applications of IoT, Industrial Internet of Things (IIoT), Wearable Devices, IoT Data Analytics, Security Challenges in IoT, Privacy Issues in IoT, IoT Security Techniques, Future Trends in IoT, Case Studies of IoT Applications.

Text Books

1. **Internet of Things: A Hands-On Approach**, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
2. **Internet of Things**, Samuel Greengard, MIT Press, 2015.
3. **Learning Internet of Things**, Peter Waher, Packt Publishing, 2015.
4. **Fundamentals of Internet of Things**, Sudip Misra, Anandarup Mukherjee and Arijit Roy, Cambridge University Press, 2019.

Reference Books

1. **Internet of Things: Principles and Paradigms**, Rajkumar Buyya and Amir Vahid Dastjerdi, Morgan Kaufmann, 2016.
2. **Designing the Internet of Things**, Adrian McEwen and Hakim Cassimally, Wiley Publications, 2014.
3. **Building the Internet of Things**, Maciej Kranz, Wiley Publications, 2016.

Video Links

Topics	Links
Introduction to Internet of Things	https://nptel.ac.in/courses/106104242
Sensors and Actuators	https://nptel.ac.in/courses/108108123
Arduino Platform	https://youtu.be/CFL3E0or2HU?si=LLcq9fQkt0tnglo2
IoT Applications	https://nptel.ac.in/courses/108108123

Course Code	LC-BCA-304A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Internet of Things(IoT) Lab				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	2	1	
Course Objectives	The objectives of this course are • To provide practical knowledge of IoT architecture, communication protocols, sensors, actuators, and embedded platforms used in IoT systems. • To develop skills for analyzing IoT communication, cloud connectivity, real-time data acquisition, and security challenges in IoT applications. • To design and implement IoT-based real-world applications using modern hardware, software, and cloud technologies.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply IoT architecture, communication models, sensors, actuators, and embedded platforms for basic IoT applications.	Level-3 Apply
CO2	Analyze IoT device interfacing, wireless communication, cloud connectivity, and real-time sensor data in IoT systems.	Level-4 Analyze
CO3	Evaluate IoT network performance, security challenges, and authentication mechanisms for secure IoT communication.	Level-5 Evaluate
CO4	Design IoT-based real-world solutions using appropriate hardware, software, cloud platforms, and communication technologies.	Level-6 Create

Exp. No.	Experiments
1	Study IoT architecture, components, and communication models.
2	Examine IoT sensors, actuators, and embedded system platforms.
3	Demonstrate LED and push button interfacing using Arduino board.
4	Implement temperature and humidity sensor interfacing with Arduino.
5	Implement ultrasonic sensor for distance measurement application.
6	Demonstrate RFID based identification and tracking system.
7	Implement serial communication between Arduino and computer system.
8	Configure NodeMCU/ESP8266 for Wi-Fi based IoT connectivity.
9	Develop a simple IoT application using Raspberry Pi platform.
10	Implement MQTT protocol for IoT device communication.
11	Implement Bluetooth/BLE based wireless communication system.
12	Develop cloud-based sensor monitoring using ThingSpeak platform.
13	Analyze real-time sensor data acquired from multiple IoT devices.
14	Analyze communication performance and connectivity issues in IoT networks.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	DSC-BCA-306A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Information and System Security				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of information security principles, cryptographic techniques, system security, and network security mechanisms. • To develop understanding of authentication methods, access control techniques, web security vulnerabilities, and cyber security threats in modern information systems. • To analyze and implement security solutions for protecting information systems, networks, databases, and web applications against cyber attacks and vulnerabilities.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of information security, cryptography, system security, access control, web security, and cyber security threats.	Level-1 Remember
CO2	Explain encryption techniques, authentication methods, security mechanisms, malware protection, and web security vulnerabilities in information systems.	Level-2 Understand
CO3	Apply cryptographic algorithms, firewall and IDS techniques, authentication mechanisms, and security tools for securing information systems and networks.	Level-3 Apply
CO4	Analyze security attacks, system vulnerabilities, cyber threats, web application risks, and emerging trends in information and system security.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Information and System Security: Introduction to Information Security, Need and Goals of Security, Security Attacks and Threats, Security Services and Mechanisms, Principles of Information Security, Confidentiality, Integrity and Availability (CIA Triad), Authentication and Authorization, Security Policies and Models, Risk Management and Risk Analysis, Cyber Security Fundamentals, Types of Cyber Crimes, Ethical Hacking Concepts, Vulnerabilities and Threat Assessment.

UNIT II

Cryptography and Network Security: Introduction to Cryptography, Plain Text and Cipher Text, Encryption and Decryption Techniques, Classical Encryption Techniques, Symmetric Key Cryptography, Asymmetric Key Cryptography, Public Key Infrastructure (PKI), Data Encryption Standard (DES), Advanced Encryption Standard (AES), RSA Algorithm, Hash Functions, Digital Signatures, Key Management, Network Security Concepts, Firewalls, Virtual Private Networks (VPN), Intrusion Detection System (IDS), Intrusion Prevention System (IPS), Secure Socket Layer (SSL) and Transport Layer Security (TLS).

UNIT III

System Security and Access Control: Operating System Security, Database Security, File System Security, Access Control Mechanisms, Authentication Techniques, Password Management, Biometrics, Malware and Malicious Software, Viruses, Worms, Trojans, Spyware and Ransomware, System Vulnerability Assessment, Security Auditing, Security Monitoring, Backup and Recovery Mechanisms, Security in Distributed Systems, Cloud Security Fundamentals, Mobile and Wireless Security Issues.

UNIT IV

Web Security and Emerging Trends: Web Security Concepts, Web Application Vulnerabilities, SQL Injection, Cross Site Scripting (XSS), Session Hijacking, Phishing and Social Engineering Attacks, E-mail Security, Secure Electronic Transactions, Digital Certificates, Cyber Forensics, Incident Response and Disaster Recovery, Security Standards and Policies, Legal and Ethical Issues in Information Security, IoT Security, Blockchain Security Basics, Emerging Trends in Cyber and Information Security.

Text Books

1. Principles of Information Security, Michael E. Whitman and Herbert J. Mattord, Cengage Learning, 2022.
2. Cryptography and Network Security, William Stallings, Pearson Education, 2023.
3. Fundamentals of Information Systems Security, David Kim and Michael G. Solomon, Jones & Bartlett Learning, 2021.
4. Computer Security: Principles and Practice, William Stallings and Lawrie Brown, Pearson Education, 2018.

Reference Books

1. Managing Information System Security, Gurpreet Dhillon, Palgrave Macmillan, 1997.
2. Security of Computer Based Information Systems, V. P. Lane, Palgrave Macmillan, 1985.
3. Network Security Essentials: Applications and Standards, William Stallings, Pearson Education, 2017.
4. Information Security Handbook, John M. D. Hunter, Springer, 2001.
5. Cyber Security Essentials, James Graham, Richard Howard and Ryan Olson, CRC Press, 2016.

Video Links

Topics	Links
Types of Cyber Crimes	https://www.youtube.com/watch?v=HWr4-mWWvjw
Cryptography	https://www.youtube.com/watch?v=iTVyKbDCJrA&list=PLgMDNELGJ1CbdGLyn7OrVAP-IKg-0q2U2
Operating System Security	https://www.youtube.com/watch?v=LBSttNg-q84&list=PLyqSpQzTE6M-at1naX10LV_n5WqRgYlBU&index=2
Cross Site Scripting (XSS)	https://www.youtube.com/watch?v=6fuKefq9KBo

Course Code	LC-BCA-308A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Information and System Security Lab				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	2	1	
Course Objectives	The objectives of this course are • To develop practical knowledge of cryptographic techniques, authentication methods, firewall configuration, and network security mechanisms for protecting information systems. • To analyze system vulnerabilities, malware attacks, web security threats, and cyber security issues using modern security tools and techniques. • To design and implement secure information systems and web applications using appropriate security protocols, access control methods, and cyber security practices.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply cryptographic techniques, authentication methods, firewall configurations, and security tools for securing information systems and networks.	Level-3 Apply
CO2	Analyze system vulnerabilities, malware behavior, web security threats, and network security issues in information systems.	Level-4 Analyze
CO3	Evaluate security mechanisms, access control techniques, cyber security policies, and protection methods for secure computing environments.	Level-5 Evaluate
CO4	Design and develop secure information systems and web security applications using appropriate security tools, protocols, and security techniques.	Level-6 Create

Exp. No.	Experiment
1	Study of information security principles, security attacks, and security services.
2	Demonstrate implementation of classical encryption and decryption techniques.
3	Implement Caesar Cipher and Playfair Cipher algorithms.
4	Implement DES and AES encryption algorithms for secure communication.
5	Implement RSA algorithm for public key cryptography.
6	Demonstrate generation and verification of digital signatures.
7	Configure user authentication and password management techniques in operating systems.
8	Implement access control mechanisms for system security.
9	Configure and analyze firewall rules for network protection.
10	Demonstrate Intrusion Detection System (IDS) and Intrusion Prevention System (IPS).
11	Perform vulnerability assessment using security analysis tools.

12	Implement backup and recovery mechanisms for system security.
13	Demonstrate secure communication using SSL/TLS protocols.
14	Analyze malware behavior and system vulnerabilities in information systems.
15	Analyze web application security threats such as SQL Injection and Cross Site Scripting (XSS).

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	DSC-BCA-310A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Data Warehousing & Mining				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of data warehousing architecture, OLAP operations, data preprocessing techniques, and data mining concepts. • To develop understanding of association rule mining, classification, clustering techniques, and data analysis using modern data mining tools. • To analyze and apply data warehousing and data mining techniques for knowledge discovery and decision-making in real-world applications.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of data warehousing, data preprocessing, association rule mining, classification, clustering, and data mining tools.	Level-1 Remember
CO2	Explain data warehouse architecture, OLAP operations, preprocessing techniques, classification methods, clustering techniques, and WEKA tool functionalities.	Level-2 Understand
CO3	Apply data preprocessing methods, association rule mining algorithms, classification techniques, clustering methods, and WEKA tool for data analysis.	Level-3 Apply
CO4	Analyze data warehouse models, frequent pattern mining techniques, classification performance, clustering results, and real-world data mining applications.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Data Warehousing and Data Mining: Introduction to Data Warehousing, Need and Applications of Data Warehousing, Characteristics of Data Warehouse, Data Warehouse Architecture, Data Warehouse Models, Data Mart, Metadata, OLTP and OLAP Systems, Difference between OLTP and OLAP, Data Warehouse Schema Design – Star Schema, Snowflake Schema and Fact Constellation Schema, Introduction to Data Mining, Knowledge Discovery in Databases (KDD) Process, Data Mining Functionalities, Data Mining System Classification, Issues and Applications of Data Mining.

UNIT II

Data Preprocessing and Data Warehouse Operations: Data Objects and Attribute Types, Statistical Description of Data, Data Cleaning, Data Integration, Data Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation, Data Visualization Techniques, Similarity and Dissimilarity Measures, OLAP Operations – Roll-up, Drill-down, Slice, Dice and Pivot, Data Cube Technology, Data Warehouse Implementation and Maintenance.

UNIT III

Association Rule Mining and Classification: Mining Frequent Patterns, Association and Correlation Analysis, Apriori Algorithm, Frequent Pattern Growth Method, Constraint Based Association Mining, Multilevel and Multidimensional Association Rules, Classification and Prediction, Decision Tree Induction, Bayesian Classification, Rule Based Classification, Support Vector Machines, Classification using Back Propagation, Lazy Learners, Model Evaluation and Accuracy Improvement Techniques.

UNIT IV

Clustering, Web Mining and Data Mining Tools: Cluster Analysis, Partitioning Methods, Hierarchical Clustering Methods, Density Based Clustering Methods, Grid Based Clustering Methods, Constraint Based Clustering, Clustering High Dimensional Data, Outlier Analysis and Outlier Detection Methods, Introduction to Web Mining, Web Content Mining, Web Structure Mining, Web Usage Mining, Introduction to WEKA Tool, WEKA Interface and Datasets, Data Mining using WEKA Tool, Applications of Data Warehousing and Data Mining.

Text Books

1. Data Warehousing Fundamentals, Paulraj Ponniah, Wiley India, 2011.
2. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012.
3. Data Warehousing in the Real World, Sam Anahory and Dennis Murray, Pearson Education, 2008.
4. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education, 2019.

Reference Books

1. Data Mining Techniques, Arun K. Pujari, Universities Press, 2013.
2. Data Warehouse Toolkit, Ralph Kimball and Margy Ross, Wiley India, 2013.
3. Data Mining: Practical Machine Learning Tools and Techniques, Ian H. Witten, Eibe Frank and Mark A. Hall, Morgan Kaufmann, 2016.
4. Fundamentals of Data Warehouses, Matthias Jarke, Morgan Kaufmann Publishers, 2003.
5. Building the Data Warehouse, W. H. Inmon, Wiley India, 2005.

Video Links

Topics	Links
Knowledge Discovery in Databases	https://nptel.ac.in/courses/106105174
Association Rule Mining	https://nptel.ac.in/courses/106106853
Data Objects and Attribute Types	https://nptel.ac.in/courses/110107092
Cluster Analysis	https://nptel.ac.in/courses/110107095

Course Code	LC-BCA-312A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Data Warehousing & Mining Lab				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	2	1	
Course Objectives	The objectives of this course are • To develop practical knowledge of data warehousing architecture, OLAP operations, and data preprocessing techniques for effective data analysis. • To analyze association rule mining, classification, clustering, and outlier detection techniques using modern data mining tools and algorithms. • To design and implement real-world data warehousing and data mining applications for knowledge discovery and decision support systems.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply data warehousing concepts, OLAP operations, preprocessing techniques, association rule mining, classification, and clustering methods using data mining tools.	Level-3 Apply
CO2	Analyze frequent patterns, classification accuracy, clustering performance, and outlier detection techniques for multidimensional datasets.	Level-4 Analyze
CO3	Evaluate association rules, classification models, clustering methods, and data mining results using WEKA and related analytical techniques.	Level-5 Evaluate
CO4	Design and develop real-world data warehousing and data mining applications using appropriate preprocessing, mining, and visualization techniques.	Level-6 Create

Exp. No.	Experiment
1	Study of Data Warehousing architecture and OLTP vs OLAP systems.
2	Create Star Schema and Snowflake Schema for a sample data warehouse.
3	Perform OLAP operations such as Roll-up, Drill-down, Slice, Dice, and Pivot.
4	Implement data cleaning and data transformation techniques on datasets.
5	Perform data integration and data reduction using sample datasets.
6	Demonstrate data discretization and concept hierarchy generation.
7	Implement data visualization techniques for statistical data analysis.
8	Apply similarity and dissimilarity measures on multidimensional datasets.
9	Implement Apriori algorithm for association rule mining.
10	Generate frequent patterns and correlation rules using transactional datasets.

11	Implement Decision Tree classification using WEKA tool.
12	Apply Bayesian Classification and Support Vector Machine (SVM) techniques.
13	Implement clustering techniques using Partitioning and Hierarchical methods.
14	Analyze clustering performance using Density Based and Grid Based clustering methods.
15	Analyze outlier detection methods and classification accuracy improvement techniques.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	DSC-BCA-314A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Relational Database Management System				
Scheme and Credits	L	T	P	Credits	Semester-VI
	2	0	0	2	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of relational database systems, database architecture, data models, and SQL for efficient data management. • To develop understanding of database design, normalization, transaction management, concurrency control, and database security techniques. • To analyze and apply relational database concepts, advanced database technologies, and connectivity mechanisms for real-world database applications.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of database systems, relational models, SQL, normalization, transaction management, distributed databases, and advanced database technologies.	Level-1 Remember
CO2	Explain database architecture, relational algebra, SQL operations, normalization techniques, concurrency control, recovery mechanisms, and database security concepts.	Level-2 Understand
CO3	Apply SQL queries, normalization techniques, transaction management methods, database connectivity, and security mechanisms in relational database systems.	Level-3 Apply
CO4	Analyze database models, query processing, concurrency issues, recovery techniques, distributed database concepts, and emerging trends in database systems.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 marks each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Database Management Systems: Introduction to Database Systems, Characteristics of Database Approach, Database Users and Administrator, Advantages and Applications of DBMS, Database Environment, Data Models, Three Schema Architecture, Database Languages, Database System Architecture, Entity Relationship (ER) Model, ER Diagrams, Attributes and Relationships, Constraints in ER Model, Extended ER Model, Relational Model Concepts, Relational Algebra and Relational Calculus.

UNIT II

Structured Query Language and Database Design: Introduction to SQL, SQL Data Types, DDL Commands, DML Commands, DCL Commands and TCL Commands, Integrity Constraints, Keys and Referential Integrity, SQL Queries, Nested Queries, Join Operations, Aggregate Functions, Views, Sequences, Indexes, Assertions and Triggers, Database Design Process, Functional Dependencies, Normalization Concepts, Normal Forms – 1NF, 2NF, 3NF, BCNF, Multivalued Dependency and Join Dependency.

UNIT III

Transaction Management and Concurrency Control: Transaction Concepts, Properties of Transactions, Transaction States, Concurrent Execution of Transactions, Serializability, Concurrency Control Techniques, Lock Based Protocols, Timestamp Based Protocols, Deadlock Handling Techniques, Database Recovery Techniques, Log Based Recovery, Checkpoints, Shadow Paging, Backup and Recovery Mechanisms, Security and Authorization in Databases, Database Auditing.

UNIT IV

Advanced Database Concepts: Introduction to Distributed Databases, Distributed Database Architecture, Fragmentation and Replication, Client Server Database Architecture, Parallel Databases, Object Oriented Databases, Object Relational Databases, Data Warehousing Concepts, Data Mining Basics, NoSQL Databases, XML Databases, Database Connectivity using ODBC/JDBC, Web Databases, Database Security Issues, Emerging Trends in Database Systems.

Text Books

1. Database System Concepts, Abraham Silberschatz, Henry F. Korth and S. Sudarshan, McGraw Hill Education, 2020.
2. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, Pearson Education, 2017.
3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw Hill Education, 2003.
4. Relational Database Management Systems, N. P. Singh and C. S. Gupta, Abhishek Publications, 2014.

Reference Books

1. An Introduction to Database Systems, C. J. Date, Pearson Education, 2009.
2. Database Systems: A Practical Approach to Design, Implementation and Management, Thomas Connolly and Carolyn Begg, Pearson Education, 2015.
3. Fundamentals of Relational Database Management Systems, S. Sumathi and S. Esakkirajan, Springer, 2007.
4. Database Systems Design, Implementation and Management, Peter Rob and Carlos Coronel, Cengage Learning, 2007.
5. Relational Database Management System, A. D. Mankar, Nirali Prakashan, 2014.

Video Links

Topics	Links
Relational Model Concepts	https://nptel.ac.in/courses/106106093
Structured Query Language	https://nptel.ac.in/courses/106106220
Concurrency Control	https://nptel.ac.in/courses/106104135
Client Server Database Architecture	https://www.youtube.com/watch?v=AAKUqHBuzk4&t=35s

Course Code	LC-BCA-316A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Relational Database Management System Lab				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	4	2	
Course Objectives	The objectives of this course are • To develop practical knowledge of relational database concepts, SQL programming, normalization techniques, and transaction management for database applications. • To analyze database processing, concurrency control, recovery techniques, distributed database concepts, and security mechanisms in relational database systems. • To design and implement real-world relational database applications using appropriate database design, connectivity, and security techniques.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply relational database concepts, SQL commands, normalization techniques, transaction management, and database connectivity for database applications.	Level-3 Apply
CO2	Analyze transaction processing, concurrency control, recovery mechanisms, distributed database concepts, and database security issues.	Level-4 Analyze
CO3	Evaluate database performance, normalization efficiency, query processing methods, and security mechanisms in relational database systems.	Level-5 Evaluate
CO4	Design and develop real-world relational database applications with proper schema design, integrity constraints, security, and connectivity features.	Level-6 Create

Exp. No.	Experiment
1	Study of DBMS architecture, database users, and relational database concepts.
2	Create ER diagrams for real-world database applications.
3	Implement relational schema and perform table creation using SQL commands.
4	Apply DDL commands for database and table management.
5	Apply DML commands for insertion, updation, deletion, and retrieval of records.
6	Implement SQL queries using operators, aggregate functions, and clauses.
7	Implement different types of joins and nested queries in SQL.
8	Create views, indexes, sequences, and triggers in SQL.
9	Apply integrity constraints and referential integrity in relational databases.

10	Perform normalization up to BCNF for database design.
11	Implement transaction management and TCL commands in SQL.
12	Demonstrate concurrency control and locking mechanisms in databases.
13	Implement database connectivity using ODBC/JDBC.
14	Analyze transaction processing, deadlock handling, and recovery mechanisms in database systems.
15	Analyze distributed database concepts, database security issues, and query processing techniques.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	MICV- 308A				
Category	Major Discipline Relevant Course (Vocational) – Minor				
Course Title	Entrepreneurship Development				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	1	0	4	
Course Objectives	The objectives of this course are to • To understand the fundamental concepts, theories, and role of entrepreneurship in economic development. • To develop the ability to identify business opportunities through creative thinking and feasibility analysis. • To equip students with skills to design functional plans including organizational, financial, and operational aspects of a venture. • To understand various sources of finance and legal aspects including Intellectual Property Rights (IPR) relevant to entrepreneurship.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define entrepreneurship concepts, theories, entrepreneurial process, traits of entrepreneurs, business idea generation, feasibility analysis, functional planning, and sources of finance including IPR.	Level-1 Remember
CO2	Explain the entrepreneurial environment in India, factors affecting entrepreneurship, feasibility study components, business planning, organizational structure, financial planning, and funding.	Level-2 Understand
CO3	Apply creative thinking techniques to generate business ideas, conduct feasibility studies, prepare business plans, design organizational structures, and select appropriate funding sources.	Level-3 Apply
CO4	Analyze entrepreneurial opportunities, environmental factors, financial viability, organizational design, and various financing options.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

UNIT – I

Entrepreneurship:- Concept, theories, process, Growth of entrepreneurship environment in India, Traits of successful entrepreneurs; Managerial vs. entrepreneurial approach

UNIT – II

Starting the venture:- Creative thinking, Business idea generation (Business cases on entrepreneurship),

Environmental scanning pertaining to business idea: Feasibility study: Market feasibility, Technical/ Feasibility operations, financial feasibility, Project Report.

UNIT – III

Functional Plans:- Drawing a business plan, selecting organization type for business, Organization structure and Job designs, Designing financial plan: Investment, Incomes and Expenditure, Banking and Accounts, understanding profitability.

UNIT – IV

Sources of Finance:- understanding Financial Framework: Debt Equity Financing, Commercial banks, Venture Capital, Financial institutions supporting entrepreneurs, Angel investors. Understanding IPR: Patents, Trademarks, Copy rights, Trade secrets, Licensing, Franchising.

Suggested Readings:

- Entrepreneurship Development & Small Business Enterprises by Charantimath, Poornima, , Pearson Education.
- Entrepreneurship by Hisrich, Robert D., Michael Peters and Dean Shepherd, Tata McGraw Hill, New Delhi
- Entrepreneurship by Barringer, Brace R., and R. Duane Ireland, Pearson Education.
- Entrepreneurship by Lall, Madhurima, and Shikha Sahai, Excel Books, New Delhi.
- Entrepreneurship by Kuratko, Donand and Richard Hodgetts, Cengage Learning India Pvt. Ltd., New Delhi

Useful Video links:

Topics	Links
Entrepreneurship Concepts & Environment	https://nptel.ac.in/courses/110106141
Starting the Venture & Feasibility Study	https://nptel.ac.in/courses/110106141/lecture-05
Functional Plans & Business Plan	https://nptel.ac.in/courses/110106141/lecture-12
Sources of Finance & IPR	https://nptel.ac.in/courses/110105139

Course Code	MICV-310A				
Category	Major Discipline Relevant Course (Vocational) - Minor				
Course Title	Web Development				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of web technologies, Internet concepts, HTML, CSS, and JavaScript for web page development. • To develop understanding of web page designing, styling techniques, and client-side scripting used in modern websites. • To apply and analyze basic web development concepts for creating simple, responsive, and interactive web pages.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of web technology, HTML, CSS, JavaScript, websites, web pages, and web development tools.	Level-1 Remember
CO2	Explain HTML tags, web page structure, CSS styling techniques, and basic JavaScript concepts used in web development.	Level-2 Understand
CO3	Apply HTML, CSS, and JavaScript techniques to create and design simple web pages and forms.	Level-3 Apply
CO4	Analyze web page structure, styling methods, responsive layouts, and client-side scripting techniques for web applications.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Basics of Web Technology: Introduction to Internet, World Wide Web (WWW), Web Browsers, Web Servers, Websites and Web Pages, Static and Dynamic Websites, URL and Domain Name, Web Hosting Basics, Client Server Architecture, Introduction to Web Development Tools and Editors.

UNIT II

HTML Basics: Introduction to HTML, Structure of HTML Document, Basic HTML Tags, Heading and Paragraph Tags, Text Formatting Tags, Lists in HTML, Hyperlinks, Images, Tables, Frames, Forms and Form Controls, HTML Attributes, Introduction to HTML5.

UNIT III

Advanced HTML and CSS: HTML5 Audio and Video Tags, Semantic Tags, Introduction to CSS, Types of CSS, CSS Selectors, Colors, Backgrounds, Fonts, Borders, Margins and Padding, CSS Box Model, Styling Tables and Forms, Introduction to Responsive Web Pages.

UNIT IV

CSS and JavaScript Basics: CSS Positioning and Layout, Navigation Bar Design using CSS, Introduction to JavaScript, Variables and Data Types, Operators, Conditional Statements, Looping Statements, Functions, Arrays, Event Handling, Form Validation using JavaScript, Introduction to DOM.

Text Books

1. Web Technologies, Uttam K. Roy, Oxford University Press, 2011.
2. HTML and CSS: Design and Build Websites, Jon Duckett, Wiley India, 2017.
3. Web Programming, Chris Bates, Wiley Dreamtech, 2009.
4. Internet and Web Technology, Raj Kamal, Tata McGraw Hill, 2007.

Reference Books

1. Programming the World Wide Web, Robert W. Sebesta, Pearson Education, 2016.
2. Beginning HTML, XHTML, CSS and JavaScript, Jon Duckett, Wiley Publications, 2010.
3. JavaScript: The Complete Reference, Thomas A. Powell and Fritz Schneider, McGraw Hill, 2013.
4. Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, Ivan Bayross, BPB Publications, 2010.
5. Learning Web Design, Jennifer Niederst Robbins, O'Reilly Media, 2018.

Video Links

Topics	Links
Introduction to Internet	https://nptel.ac.in/courses/106105082
World Wide Web (WWW), Web Browsers	https://nptel.ac.in/courses/106105084
HTML	https://www.youtube.com/watch?v=QEtWL4lWIL4&t=984s
CSS	https://www.youtube.com/watch?v=h_RftxdJTzs
Java Script	https://www.youtube.com/watch?v=uUhOEj4z8Fo&t=568s

Course Code	LC-MICV-312A				
Category	Major Discipline Relevant Course (Vocational) - Minor				
Course Title	Web Development Lab				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	2	1	
Course Objectives	The objectives of this course are • To develop practical skills in creating web pages using HTML elements, forms, tables, multimedia, and semantic tags. • To analyze and apply CSS styling, responsive layouts, and JavaScript functionalities for interactive web page design. • To design and develop simple responsive websites using HTML, CSS, and JavaScript technologies.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply HTML, CSS, and JavaScript concepts to create and design basic web pages and forms.	Level-3 Apply
CO2	Analyze web page structures, CSS layouts, responsive design techniques, and client-side scripting functionalities.	Level-4 Analyze
CO3	Evaluate web page design, styling methods, and JavaScript validation techniques for effective web development.	Level-5 Evaluate
CO4	Design and develop responsive and interactive websites using HTML, CSS, and JavaScript technologies.	Level-6 Create

Exp. No.	Experiment
1	Study of Internet, web browsers, web servers, and website structure.
2	Create a simple web page using basic HTML tags.
3	Design a web page using text formatting tags, lists, and hyperlinks.
4	Create web pages using images, tables, and frames in HTML.
5	Design HTML forms using different form controls.
6	Create web pages using HTML5 semantic tags.
7	Implement audio and video embedding in HTML5 web pages.
8	Apply internal, external, and inline CSS in web pages.
9	Design web pages using CSS colors, fonts, borders, margins, and padding.
10	Create responsive web pages using CSS layout and positioning techniques.
11	Design navigation bars and styled forms using CSS.
12	Implement JavaScript variables, operators, and control statements.
13	Develop programs using JavaScript functions and arrays.
14	Design and develop a simple responsive website using HTML, CSS, and JavaScript.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	RP-BCA-322A				
Category	Project				
Course Title	Project				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	0	4	
Course Objectives	The objectives of this course are to • Develop project planning and management skills for successful technical execution. • Enhance software development, database design, and system integration capabilities. • Apply structured problem-solving methods to resolve complex technical issues. • Improve professional communication skills, both written and verbal. • Understand and apply ethical principles in software engineering practices				
Assessment	25 Marks				
End Semester Examination	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify emerging technologies and interdisciplinary fields for hands-on industrial training.	Level-1 Remember
CO2	Describe report writing and presentation skills in technical and industrial contexts.	Level-2 Understand
CO3	Apply engineering principles to analyze and solve real-world industrial problems.	Level-3 Apply
CO4	Assess ethical standards and tools across diverse technological domains.	Level-4 Analyze
CO5	Evaluate personal performance in communication, teamwork, and technical proficiency.	Level 5: Evaluate
CO6	Design and develop industry-relevant software or hardware systems.	Level 6: Create

Overview:

Project is a foundational course that introduces students to the research process in computer science and information technology. This course provides students with the necessary skills and knowledge to undertake independent research projects. Students will learn to identify research problems, conduct literature reviews, design research methodologies, collect and analyze data, and present their findings effectively.

The project evaluation is designed in accordance with Outcome-Based Education (OBE) principles. The assessment is divided into **Internal Assessment (25%)** and **External Assessment (75%)**, ensuring continuous evaluation and comprehensive measurement of student performance across multiple stages.

Project Evaluation Scheme

1. Assessment Framework

Sr. No.	Exam Type	Stage No.	Criteria	Assessment	Marks	Overall Weightage
1	Internal	Stage-I	Project Synopsis	Rubric I	12	Stage I to II = 25%
2		Stage-II	Presentation–I	Rubric II	13	
3	External/End Semester Exam	Stage-III	Project Understanding & Technical Knowledge (20 Marks)	Rubric III	75	Stage III = 75%
			Methodology & Design Approach (20Marks)			
			Implementation Progress & Demonstration (20 Marks)			
			Innovation & Problem Solving (20 Marks)			
			Viva–Voce & Technical Skills(20 Marks)			
Total					100	100%

2. Internal Assessment (25 Marks – 25%)

The internal evaluation is carried out in two progressive stages to monitor student performance, project development, and continuous improvement.

Rubric I: Project Synopsis (Stage-I)					
Parameters/Assessment Levels	Excellent	Good	Average	Poor	Marks
Project Definition & Problem Identification (03 Marks)	03: Problem, objectives and scope are clearly defined.	02: Problem and objectives are adequately defined.	01: Limited clarity in problem definition.	01-00: Problem is unclear or poorly defined.	
Literature Review (03 Marks)	03: Comprehensive review using relevant and credible references.	02: Adequate review with relevant references.	01: Limited review with few references.	00: Inadequate or irrelevant references.	
Technical & Domain Understanding (03 Marks)	03: Demonstrates strong domain and technical understanding.	02: Demonstrates good understanding with minor gaps.	01: Demonstrates basic understanding.	00: Demonstrates poor understanding.	
Impact on Society & Relevance to POs/PSOs (02 Marks)	02: Strong societal/technical relevance with clear alignment.	01: Reasonable relevance and alignment.	0.5: Limited relevance or alignment.	00: No clear relevance or alignment.	
Presentation & Communication (01 Marks)	01: Clear, organized, and professional presentation.	0.75: Satisfactory presentation with acceptable clarity.	0.5: Presentation lacks clarity.	00: Poorly organized presentation.	
Total Marks					12

Rubric II: Presentation -I (Stage-II)						
Sr. No	Parameters/Assessment Levels	Excellent	Good	Average	Poor	Marks
1	Problem Understanding & Planning (03 Marks)	03: Problem, objectives, and planning are clearly defined.	02: Adequate understanding and planning.	01: Limited planning and clarity.	00: Poor understanding and planning.	
2	Design Methodology & Feasibility (03 Marks)	03: Methodology is justified and technically feasible.	02: Methodology is appropriate with acceptable feasibility.	01: Methodology is partially defined.	00: Methodology lacks clarity or feasibility.	
3	Implementation Strategy & Timeline (02 Marks)	02: Implementation plan and timeline are clearly defined.	01: Implementation strategy is satisfactory.	0.5: Limited implementation planning.	00: Implementation strategy is unclear.	
4	Preliminary Progress & Requirement Fulfillment (03 Marks)	03: Significant progress aligned with objectives.	02: Moderate progress toward objectives.	01: Limited progress achieved.	00: Minimal or no progress demonstrated.	
5	Technical Presentation & Communication (02 Marks)	02: Presentation is technically sound and professional.	1.5: Presentation is satisfactory.	01: Presentation lacks clarity.	00: Presentation is ineffective.	
Total Marks						13

External Assessment (75 Marks – 75%)

Rubric III: External/End Semester Exam (Stage-III)						
Sr. No .	Parameters / Assessment Levels	Excellent	Good	Average	Poor	Marks
1	Project Understanding & Technical Knowledge (15 Marks)	15-13: Excellent understanding of concepts, methodology, and technical aspects.	12-10: Good understanding with reasonable clarity.	09-06: Satisfactory understanding with limited clarity.	05-00: Poor understanding of project concepts.	
2	Methodology & Design Approach (15 Marks)	15-13: Methodologies are clearly justified and technically sound.	12-10: Methodology is appropriate with minor refinements needed.	09-06: Methodology is partially defined.	05-00: Methodology lacks clarity.	
3	Implementation Progress & Demonstration (15 Marks)	15-13: Significant implementation progress demonstrated effectively.	12-10: Moderate progress with acceptable demonstration.	09-06: Limited implementation progress.	05-00: Minimal or no implementation progress.	
4	Innovation & Problem Solving (15 Marks)	15-13: Strong innovation and effective problem-solving approach.	12-10: Good innovation with acceptable problem-solving.	09-06: Limited innovation or analytical thinking.	05-00: Lacks innovation and problem-solving approach.	
5	Viva–Voce (15Marks)	15-13: Answers confidently with technical justification.	12-10: Answers most questions satisfactorily.	09-06: Partial responses with basic understanding.	05-00: Unable to answer satisfactorily.	
Total Marks						75