University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

Institute of Engineering & Management, New Town Campus

University of Engineering & Management, Jaipur

6th Semester Syllabus for BCA Admission Batch 2023

BCA 2023 Course structure									
SEMESTER 6									
SL NO	**TYPES OF COURSE**	**SUB CODE**	**SUB NAME**	**L**	**T**	**P**	**S**	**TOTAL CONTACT HRS**	**CREDIT POINTS**
THEORY									
1	Computer Science & Application	BCACC601	Advanced Database Management System with PL/SQL	3	1	0	0	4	4
2	Computer Science & Application	BCACL602	Security in Cloud Computing	3	1	0	0	4	4
3	Computer Science & Application	BCACS602	Network Security and Cryptography	3	1	0	0	4	4
4	Computer Science & Application	BCAIR602	Robot Programming and Kinematics	3	1	0	0	4	4
5	Computer Science & Application	BCAMM602	Introduction to 3D Modelling and Augmented Reality	3	1	0	0	4	4
6	Computer Science & Application	BCAQC602	Quantum Information and Computation	3	1	0	0	4	4
7	Computer Science & Application	BCAWP602	Advanced Web Programming Tools	3	1	0	0	4	4
8	Value Added Course	BCAGS601	General Studies & Current Affairs -VI	2	1	0	0	2	2
PRACTICAL									
9	Computer Science & Application	BCACC691	Advanced Database Management System lab	0	0	4	0	4	2
10	Computer Science & Application	BCACC692	Cloud Computing Tools and Applications	0	0	4	0	4	2
11	Computer Science & Application	BCACS692	Network Security and Cryptography lab	0	0	4	0	4	2
12	Computer Science & Application	BCAIR692	Robotics and Automation Lab	0	0	4	0	4	2

13	Computer Science & Application	BCAMM692	3D Modelling and Augmented Reality lab	0	0	4	0	4	2
14	Computer Science & Application	BCAQC692	Quantum Information and Computation Lab	0	0	4	0	4	2
15	Computer Science & Application	BCAWP692	Advanced Web Programming Lab	0	0	4	0	4	2
SESSIONAL									
16	Skill Enhancement	BCAGS681	Competitive Aptitude Training - VI	0	0	0	2	2	2
17	Ability Enhancement	BCAAE681	Major Project	0	0	0	2	4	4
MOOCS/MAR/IFC									
18	Value Added Course	MOOCs	Massive Open Online Course	0	0	0	0	0	0
19	Value Added Course	IFC	Industry and foreign certification	0	0	0	0	0	0
20	Value Added Course	MAR	Mandatory Additional Requirements(MAR)	0	0	0	0	0	0
								24	20

University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus and Lesson Plan for BCA Admission Batch 2023

Subject Name: **Advanced Database Management System with PL/SQL** Credit: 4 Lecture Hours: 48
Subject Code: **BCACC601**

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –
1.Prof. Abriti Paul
2.Prof. Kaustav Nandy

Pre-requisite: Knowledge of basic DBMS knowledge

Relevant Links:

1. **Link for Study Material:**
   https://drive.google.com/drive/u/2/folders/1FHWdvBkw0TNOM_Uuo1fDiTnLa0Yo9hfK

2. **Link for Coursera Course:**
   https://www.coursera.org/programs/iem-faculty-learning-program-rtyr7/specializations/oracle-sql-databases

3. **Link for LinkedIn Learning Course:**
   https://www.linkedin.com/learning/programming-foundations-databases-2/acid-and-transactions-2?u=229219690

4. **Link for NPTEL Course:**
   https://onlinecourses.nptel.ac.in/noc25_cs18/preview

COURSE OBJECTIVES:

1. To gain knowledge of advanced database management ideas.
2. To gain knowledge of concurrency control and recovery management procedures.
3. To gain skill to write database programs using SQL or PL/SQL.

COURSE OUTCOMES:

CO 1: Understand the concept of Database transactions management.
CO 2: Understand the concept of concurrency control techniques and recovery management.
CO 3: Gain idea about distributed DBMS.
CO 4: To gain skill to write PL -SQL.

Module number	Topic	Sub-topics	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
1	QUERY PROCESSING AND OPTIMIZATION	15.1 Overview 15.2 Measures of Query Cost 15.3 Selection Operation 15.4 Sorting 15.5 Join Operation	Chapter 15 –Query Processing in Database Systems Concepts by Henry Korth, 7th Edition, Tata McGraw Hill)	***International Academia:*** Lecture 9: Query Optimization | Database Systems | Electrical Engineering and Computer Science | MIT Open CourseWare	10
		16.1 Overview 16.2 Transformation of Relational Expressions 16.3 Estimating Statistics of Expression Results 16.4 Choice of Evaluation Plans 16.5 Materialized Views	Chapter 16 -Query Optimization in Database Systems Concepts by Henry Korth, 7th Edition, Tata McGraw Hill)		

2	TRANSACTION MANAGEMENT	17.1 Transaction Concept 17.2 A Simple Transaction Model 17.3 Storage Structure 17.4 Transaction Atomicity and Durability 17.5 Transaction Isolation 17.6 Serializability 17.7 Transaction Isolation and Atomicity 17.8 Transaction Isolation Levels 17.9 Implementation of Isolation Levels 17.10 Transactions as SQL Statements	Chapter 17 -Transactions in o Database Systems Concepts by Henry Korth, 7th Edition, Tata McGraw Hill)	***International Academia:*** Lecture 10: Transactions and Locking | Database Systems | Electrical Engineering and Computer Science | MIT OpenCourseWare	10
		18.1 Lock-Based Protocols 18.2 Deadlock Handling 18.3 Multiple Granularity 18.4 Insert Operations, Delete Operations, and Predicate Reads 18.5 Timestamp-Based Protocols	Chapter 18- Concurrency Control in Database Systems Concepts by Henry Korth, 7th Edition, Tata McGraw Hill)		
		19.1 Failure Classification 19.2 Storage 19.3 Recovery and Atomicity 19.4 Recovery Algorithm	Chapter 19 Recovery System in Database Systems Concepts by Henry Korth, 7th Edition, Tata McGraw Hill)		
3	PARALLEL AND DISTRIBUTED DATABASES	20.1 Overview 20.2 Centralized Database Systems 20.3 Server System Architectures 20.4 Parallel Systems 20.5 Distributed Systems	Chapter 20 Database-System Architectures in Database System Concept by Henry Korth, 7th Edition, (Tata McGraw Hill)	***International Academia:*** Lecture 17: Parallel Databases | Database Systems | Electrical Engineering and Computer Science | MIT OpenCourseWare	10

4	PL/SQL	1. Advantage of PL/SQL 2. The Generic PL/SQL Block 3. The PL/SQL Execution Environment 4.PL/SQL 5. Control Structure 6. PL/SQL Transaction 7.Cursor 8. Triggers 9. Store Procedures and Packages	Chapter 15 Introduction to PL/SQL in SQL,PL/SQL The Programming Language of Oracle by Bayross, Ivan	***International Academia:*** 1. PL/SQL Optimization and Tuning (oracle.com)	10

Module 1: QUERY PROCESSING AND OPTIMIZATION

3rd Year [Sec A, Sec B, Sec C, Sec D --- 1. Prof Abriti Paul. 2. Prof. Kaustav Nandy]

Working Days	Lesson Plan Description
Day 1	Overview of Query Processing ,Measures of Query Cost
Day 2	Selection Operation , Sorting
Day 3	Join Operation
Day 4	Overview of Query Optimization
Day 5	Transformation of Relational Expressions
Day 6	Estimating Statistics of Expression Results
Day 7	Choice of Evaluation Plans
Day 8	Materialized Views
Day 9	Exercise Problems Discussion
Day 10	Choice of Evaluation Plans

Module 2: TRANSACTION MANAGEMENT

3rd Year [Sec A, Sec B, Sec C, Sec D --- 1. Prof Abriti Paul. 2. Prof. Kaustav Nandy]

Working Days	Lesson Plan Description
Day 11	Transaction Concept ,A Simple Transaction Model , Storage Structure, Transaction Atomicity and Durability, Transaction Isolation
Day 12	Serializability ,Transaction Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels,
Day 13	Transactions as SQL Statements
Day 14	Lock-Based Protocols , Deadlock Handling
Day 15	Multiple Granularity ,Insert Operations, Delete Operations, and Predicate Reads
Day 16	Timestamp-Based Protocols,
Day 17	Failure Classification
Day 18	Validation-Based Protocols
Day 19	Validation-Based Protocols
Day 20	Storage

Module 3: PARALLEL AND DISTRIBUTED DATABASES

3rd Year [Sec A, Sec B, Sec C, Sec D --- 1. Prof Abriti Paul. 2. Prof. Kaustav Nandy]

Working Days	Lesson Plan Description
Day 21	Overview
Day 22	Centralized Database Systems
Day 23	Server System Architecture
Day 24	Transaction Server Architecture
Day 25	Parallel Systems
Day 26	Shared Memory and Share Memory Architecture
Day 27	Cache Coherency
Day 28	Distributed Systems
Day 29	Transaction Processing in Parallel and Distributed System
Day 30	Cloud Services

Module 4: PL/SQL

3rd Year [Sec A, Sec B, Sec C, Sec D --- 1. Prof Abriti Paul. 2. Prof. Kaustav Nandy]

Working Days	Lesson Plan Description
Day 31	SQL v/s PL/SQL
Day 32	Advantage of PL/SQL
Day 33	The Generic PL/SQL Block
Day 34	The PL/SQL Execution Environment
Day 35	Language construct of PL/SQL
Day 36	Variables, Basic and Composite Data type, Conditions looping
Day 37	TYPE and % ROWTYPE
Day 38	Control Structure
Day 39	PL/SQL Transaction
Day 40	Cursor
Day 41	Triggers
Day 42	PL/SQL Procedures
Day 43	Oracle Packages
Day 44	Assignment for Module 1 and Module 2
Day 45	Assignment for Module 3 and Module 4
Day 46	Revision and Previous year Question Discussion
Day 47	Review and Problem Solving for Module 1 and Module 2
Day 48	Review and Problem Solving for Module 3 and Module 4

TEXTBOOK: DATABASE SYSTEM CONCEPTS, SEVENTH EDITION by Abraham Silberschatz, Henry F. Korth, S. Sudarshan
Sql, pl/sql the programming language of oracle by Bayross, Ivan

REFERENCE BOOKS: Advanced Database Management System by Rini Chakrabarti, Shilbhadra Dasgupta, and Subhash K. Shinde.

CO- PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	**3**	**2**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
CO2:	**3**	**3**	**3**	**0**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	**1**
CO3:	**3**	**2**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**0**	**0**	**1**
CO4:	**3**	**2**	**2**	**2**	**3**	**1**	**1**	**0**	**0**	**1**	**1**	**1**

3: Strong correlation 2: Medium correlation 1: Weak correlation

PSO	PSO Description
PSO1	**Technical Knowledge and Problem-Solving:** Apply fundamental concepts of computer applications, programming languages, data structures, algorithms, and database management to analyses and solve computational problems effectively.
PSO2	**Software Design and Development:** Demonstrate the ability to design, develop, test, and deploy software solutions by utilizing modern tools, technologies, and logical programming skills for real-world applications across domains such as web, mobile, and enterprise systems.
PSO3	**Professional Skills and Ethics:** Exhibit effective communication, teamwork, leadership, and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1		Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
Mid Term 2		Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
End Semester Examination		Attempt 10 out of 15 questions; Each question carries 2 marks (2 × 10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5 × 6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10 × 5)	**100**

Examination Rules & Regulations:
https://iemcollegemy.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?eQn40

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus and Lesson Plan for BCA Admission Batch 2023

Subject Name: **Security in Cloud Computing** Credit: 4 Lecture Hours: 40
Subject Code: **BCACL602**

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –

1. Jayanta Paul
2. Piyali Bhanja

Pre-requisite: Basic Networking, Operating Systems, Linux, Intro Cryptography (helpful), Cloud basics

Relevant Links:

1. **Link for Study Material:**
   Security in Cloud Computing

2. **Link for NPTEL Course:**
   https://nptel.ac.in/courses/106105167

3. **Link for Coursera Course:**
   https://www.coursera.org/programs/iem-faculty-learning-program-rtyr7/browse?query=Security%20in%20Cloud%20Computing&sortBy=BEST_MATCH&source=search

4. **Link for LinkedIn Learning Course:**
   https://www.linkedin.com/learning/search?keywords=Security%20in%20Cloud%20Computing

COURSE OBJECTIVES:

1. **Explain cloud threat models, attack surfaces, and the shared responsibility model.**
2. **Design secure architectures for IaaS/PaaS/SaaS across single- and multi-cloud.**
3. **Apply IAM, key management, encryption, and network segmentation in practice.**
4. **Map controls to compliance standards and conduct incident response in the cloud.**

COURSE OUTCOMES:

CO1 (Understand/Analyze): Explain cloud security principles, threat models, shared responsibility, and risk/governance.
CO2 (Apply): Configure IAM, access policies, encryption, and key management to protect cloud data/services.
CO3 (Create/Apply): Design and harden secure cloud architectures across compute/network/storage and implement monitoring & incident response.
CO4 (Evaluate/Create): Evaluate compliance/privacy requirements, justify trusted/encrypted-compute choices, and plan DR/BCP.

Module No	Topic	Sub Topic	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
Module 1:	**Foundations, Models, Threats & Governance**	Cloud definitions, service & deployment models, essential characteristics, benefits, CIA triad and baseline risks, shared responsibility, governance/SLA basics.	Ch.1 **Cloud Computing Fundamentals** (definition, essential characteristics, influences). Ch.2 **Cloud Computing Architecture** (SPI model; deployment models; benefits). Ch.4 **Cloud Computing Risk Issues** (CIA triad; privacy/compliance; threats). ***Book:*** *Cloud Security: A Comprehensive Guide to Secure Cloud Computing - Krutz, R. L., & Vines, R. D.*	***International Academia:*** https://aws.amazon.com/free/ ***Industry Mapping:*** Aneka	10

Module 2:	**Software Security Fundamentals, IAM & Data Protection**	Security objectives & services; secure cloud software requirements/testing; IAM (identities, authN, authZ, SSO); encryption & key management; secure remote access; business continuity concepts.	Ch.3 **Cloud Computing Software Security Fundamentals** (objectives, services, principles; secure requirements/testing; BCP/DR). Ch.6 **Security Architecture—Identity Mgmt & Access Control** (passwords, tokens, SSO, models). Ch.7 **Life Cycle Issues—Encryption & Key Management; Secure Incident Handling**. ***Book:*** *Cloud Security: A Comprehensive Guide to Secure Cloud Computing - Krutz, R. L., & Vines, R. D.*	***International Academia:*** https://aws.amazon.com/free/ ***Industry Mapping:*** Aneka	10
Module 3:	**Secure Architecture, Virtualization & Operations**	Secure cloud architecture concepts; hardening compute & virtualization (hypervisor/VM baselines), network security (VPC/VNet segmentation, SG/NSG, WAF/DDoS), storage controls, logging/monitoring/telemetry, security analytics and incident response basics.	Ch.6 **Cloud Computing Security Architecture** (trusted computing; secure exec env & comms; micro-architectures; IAM/AC recap). Ch.5 **Security Challenges** (virtualization security management; VM hardening & best practices). Ch.7 **Incident Response & IDS overview** (process, teams, layered security). ***Book:*** *Cloud Security: A Comprehensive Guide to*	***International Academia:*** https://aws.amazon.com/free/ ***Industry Mapping:*** Aneka	10

			Secure Cloud Computing - Krutz, R. L., & Vines, R. D.		
Module 4:	**Compliance, Standards, DR/BCP & Future Directions**	Privacy/compliance frameworks (e.g., PCI DSS, ISO 2700x overview); standards bodies (Jericho Forum, DMTF/OVF, OASIS, OWASP); SLA/security metrics; DR/BCP (RTO/RPO); encryption/key protection refresh; getting started & provider due diligence.	Ch.4 **Privacy & Compliance Risks** (PCI DSS; privacy laws). Ch.7 **Standards & Ecosystem** (Jericho, DMTF/OVF, ISO series, ETSI, OASIS, SNIA, OWASP). Ch.7 **Incident Response layers** and **key management** refresher; BCP linkage. ***Book:*** *Cloud Security: A Comprehensive Guide to Secure Cloud Computing - Krutz, R. L., & Vines, R. D.*	***International Academia:*** https://aws.amazon.com/free/ ***Industry Mapping:*** Aneka	10

Module 1: Foundations, Threats & Governance

3rd Year, Sec A (Faculty Name – Jayanta Paul)
3rd Year, Sec B (Faculty Name – Piyali Bhanja)

Working Day	Lesson Plan Description
Day 1	What is cloud? NIST essential characteristics — define & explain 5 traits. *(Ch.1)*
Day 2	Influences on cloud (architectural/technological/operational) — relate to real systems. *(Ch.1)*
Day 3	SPI delivery models (SaaS/PaaS/IaaS) — compare & select for an app. *(Ch.2)*
Day 4	Deployment models (public/private/community/hybrid) — security implications. *(Ch.2)*
Day 5	Alternative models (e.g., Cloud Cube) — interpreting vendor claims. *(Ch.2)*
Day 6	Expected benefits & drivers — tie to governance metrics/KPIs. *(Ch.2)*
Day 7	CIA triad in multi-tenant cloud — apply to risk scenarios. *(Ch.4)*
Day 8	Privacy & compliance risks — PII, principles, triggers. *(Ch.4)*

Day 9	Threats to infra/data/access; CSP vs tenant risks — two-column risk table. *(Ch.4)*
Day 10	SLAs & shared responsibility — accountability vs liability; mini-SLA drafting. *(Ch.2/4)*

Module 2: Identity, Access & Data Protection

3rd Year, Sec A (Faculty Name – Piyali Bhanja)
3rd Year, Sec B (Faculty Name –Jayanta Paul)

Working Day	Lesson Plan Description
Day 11	Security objectives & services — map objectives to controls. *(Ch.3)*
Day 12	Secure cloud software requirements (NFRs) — write/verify. *(Ch.3)*
Day 13	Secure testing (SAST/DAST) + BCP/DR basics — RTO/RPO vocabulary. *(Ch.3)*
Day 14	IAM foundations — identities & credentials (passwords, tokens, SSO). *(Ch.6)*
Day 15	Authorization models (RBAC/ABAC) & least-privilege policy design. *(Ch.6)*
Day 16	Federation & SSO patterns — trust boundaries and flows. *(Ch.6)*
Day 17	Encryption basics — at rest vs in transit; symmetric/asymmetric roles. *(Ch.7)*
Day 18	Key management lifecycle — creation, rotation, escrow, retirement. *(Ch.7)*
Day 19	Secure remote access & IR preview — access patterns; IR steps. *(Ch.7)*
Day 20	**Midterm-1 (Modules 1–2)** — short case + MCQs.

Module 3: Secure Architecture & Operations

3rd Year, Sec A (Faculty Name – Jayanta Paul)
3rd Year, Sec B (Faculty Name – Piyali Bhanja)

Working Day	Lesson Plan Description
Day 21	Architectural considerations — trust zones & control placement. *(Ch.6)*
Day 22	Secure execution & communications — segmentation; encrypted channels; logging hooks. *(Ch.6)*
Day 23	Identity & access in architecture — service accounts, break-glass, privilege elevation. *(Ch.6)*
Day 24	Virtualization risks — hypervisor/VM attack paths & isolation. *(Ch.5)*
Day 25	VM hardening — golden images; patching; config baselines. *(Ch.5)*

Day 26	Network segmentation & perimeter — SGs/ACLs; east-west vs north-south. *(Ch.6)*
Day 27	Monitoring & logging — events, retention, log integrity. *(Ch.7)*
Day 28	Incident response — phases; evidence handling in cloud. *(Ch.7)*
Day 29	Reference secure cloud architecture — layer-wise controls & trade-offs. *(Ch.5/6/7)*
Day 30	**Quiz-2 (Days 21–29)** — short design question.

Module 4: Compliance, Trusted Compute & Continuity

3rd Year, Sec A (Faculty Name –Piyali Bhanja)
3rd Year, Sec B (Faculty Name –Jayanta Paul)

Working Day	Lesson Plan Description
Day 31	Standards & ecosystem — Jericho, DMTF/OVF, ISO 2700x, ETSI, OASIS, OWASP. *(Ch.7)*
Day 32	Compliance primers — PCI DSS relevance; data handling implications. *(Ch.4)*
Day 33	Legal/jurisdictional concerns — cross-border data, vendor accountability. *(Ch.4)*
Day 34	Governance & SLAs — breach notice, audit, deletion, subcontractor, data-location clauses. *(Ch.4/7)*
Day 35	DR/BCP deep-dive — compute RTO/RPO; multi-region strategies; drills. *(Ch.3)*
Day 36	Encryption & keys (ops/retirement) — escrow, rotation schedules, data retirement. *(Ch.7)*
Day 37	Audit readiness & evidence — mapping controls to artefacts. *(Ch.7)*
Day 38	Provider due-diligence & onboarding checklist — avoid lock-in. *(Ch.8)*
Day 39	Capstone presentations — secure design walkthroughs & defenses. *(Ch.5/6/7)*
Day 40	**Midterm-2 / End-term prep** — blueprint review; past paper drill.

TEXT BOOK:

1. **"Krutz, R. L., & Vines, R. D. *Cloud Security: A Comprehensive Guide to Secure Cloud Computing*.", (Module-1, Module- 2, Module-3, Module- 4)**

REFERENCE BOOKS:

1. **Cloud Native Security Cookbook Recipes for a Secure Cloud by Josh Armitage**
2. **Cloud Security and Privacy by Tim Mather, Subra Kumaraswamy, and Shahed Latif Beijing**

CO- PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	0	0	0	1	0	1
CO2	3	3	2	2	2	2	1	0	0	1	0	1
CO3	3	2	3	3	3	2	1	1	1	1	1	1
CO4	3	2	2	2	2	2	1	1	1	1	1	1

PSO	PSO Description
PSO1	**Technical Knowledge and Problem-Solving:** Apply fundamental concepts of computer applications, programming languages, data structures, algorithms, and database management to analyse and solve computational problems effectively.
PSO2	**Software Design and Development:** Demonstrate the ability to design, develop, test, and deploy software solutions by utilizing modern tools, technologies, and logical programming skills for real-world applications across domains such as web, mobile, and enterprise systems.
PSO3	**Professional Skills and Ethics:** Exhibit effective communication, teamwork, leadership, and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1		Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
Mid Term 2		Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
End Semester Examination		Attempt 10 out of 15 questions; Each question carries 2 marks (2 × 10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5 × 6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10 × 5)	**100**

Examination Rules & Regulations:
https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus and Lesson Plan for BCA Admission Batch 2023

Subject Name: **Network Security and Cryptography** Credit: 4 Lecture Hours: 40
Subject Code: **BCACS602**

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –

1. Sucheta Chandra
2. Manjima Saha

Pre-requisite: Knowledge of basic and network security.

Relevant Links:

Link for Study Material: Study Material For Network Security And Cryptpgraphy
Link for Coursera Course: Cryptography, Network Security, and Application Security | Coursera
Link for LinkedIn Learning Course: Learning Cryptography and Network Security Online Class | LinkedIn Learning, formerly Lynda.com
NPTEL Course: Cryptography And Network Security - Course

COURSE OBJECTIVES:

Throughout the course, students will be expected to understand the concept of Network Security and Cryptography by:

1. Developing an overall understanding of defending network security and different attacking layers.
2. To make the student learn different encryption techniques along with hash functions, MAC, digital signatures and their use in various protocols for network security and system security

COURSE OUTCOMES:

CO1: Understand the various concepts of underlying computer network layer security
CO2: Developing an understanding of firewall and digital signatures. Firewall Characteristics, Types of Firewalls, Firewall Location.

CO3: Developing an understanding of cryptography and introductions to different attack models ciphers and encryption standards.
CO4: Acquire the basic knowledge Cryptography.

Module number	Topic	Sub-topics	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
1	**Module 1: Network Security and Firewalls**	Introduction, Security Goals, Attacks, Services and Techniques, Message Integrity, Message Authentication, Entity Authentication and Key Management, Firewall introduction, Packet-Filter Firewall, Proxy Firewall	**Book- Data Communications and Networking, Fourth Edition by Behrouz A. Forouzan Chapter 31,32.4**	***International Standards:*** Network and Computer Security | Electrical Engineering and Computer Science | MIT OpenCourseWare ***Industry Mapping:*** **NMap**	10
2	**Module 2: Internet Security**	Two Modes, Two Security Protocols ,Security Association ,Internet Key Exchange (IKE) ,Virtual Private Networks Architecture, Four Protocols, Email Security, Pretty Good Privacy (PGP,)S/MIME	**Book- Data Communications and Networking, Fourth Edition by Behrouz A. Forouzan Chapter 32**	***International Standards:*** Lecture Notes and Readings | Network and Computer Security | Electrical Engineering and Computer Science | MIT OpenCourseWare ***Industry Mapping:*** **NMap**	10

3	**Module 3: Encryption Techniques**	Classical Encryption techniques, Block Ciphers and Data Encryption Standard, Advanced Encryption Standard	**Book – Cryptography and Network Security By William Stallings .Sixth Edition Chapter 1,2,3**	***International Standards:*** https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/resources/lecture-22-cryptography-encryption/ ***Industry Mapping:*** **Veracrypt**	10
4	**Module 4: Cryptography**	Public key Cryptography and RSA, Other Public Cryptosystems, Crypographic Hash Functions, Digital Signature	**Book – Cryptography and Network Security By William Stallings .Sixth Edition Chapter 8,9,10,11**	***International Standards:*** https://ocw.mit.edu/courses/6-875-cryptography-and-cryptanalysis-spring-2005/ ***Industry Mapping:*** **Veracrypt, DocuSign,SignWell**	10

Learning Resources:

Text Books:			
Name of Author	Title of the Book	**Edition/ISSN/ISBN**	**Name of the Publisher**
Behrouz A. Forouzan.	Data Communications & Networking	5th Edition	Tata McGraw- Hill
William Stallings	Cryptography and Network Security Principles and Practice	ISBN 9789332585225	Pearson
Reference Books:			
Behrouz A. Forouzan.	Introduction to Cryptography Network Security	ISBN 10: 007110223X ISBN 13: 9780071102230	McGraw Hill Higher Education

Module 1: Network Security and Firewalls

3rd Year, Sec C (Faculty Name – Sucheta Chandra, Manjima Saha)

Working Days	Lesson Plan Description
Day 1	Introduction to Network Security
Day 2	Security Goals
Day 3	Attacks
Day 4	Services and Techniques
Day 5	Message Integrity
Day 6	Message Authentication
Day 7	Entity Authentication
Day 8	Key Management
Day 9	Firewall Introduction
Day 10	Packet-Filter Firewall
Day 11	Proxy Firewall

Module 2: Internet Security

3rd Year, Sec C (Faculty Name – Sucheta Chandra, Manjima Saha)

Working Days	Lesson Plan Description
Day 12	Two Modes
Day 13	Two Security Protocols
Day 14	Security Association
Day 15	Basics of Internet Key Exchange (IKE)
Day 16	Introduction to Visual Private Networks
Day 17	Virtual Private Networks Architecture
Day 18	Four Protocols
Day 19	Email Security
Day 20	Pretty Good Privacy (PGP)
Day 21	S/MIME

Module 3: Introduction to Cyber Security

3rd Year, Sec C (Faculty Name – Sucheta Chandra, Manjima Saha)

Working Days	Lesson Plan Description
Day 22	Classical Encryption techniques
Day 23	Classical Encryption techniques
Day 24	Classical Encryption techniques
Day 25	Classical Encryption techniques
Day 26	Classical Encryption techniques
Day 27	Block Ciphers and Data Encryption Standard
Day 28	Block Ciphers and Data Encryption Standard
Day 29	Block Ciphers and Data Encryption Standard
Day 30	Block Ciphers and Data Encryption Standard
Day 31	Advanced Encryption Standard

Day 32	Advanced Encryption Standard
Day 33	Advanced Encryption Standard
Day 34	Advanced Encryption Standard
Day 35	Advanced Encryption Standard
Day 36	Public key Cryptography and RSA
Day 37	Public key Cryptography and RSA
Day 38	Public key Cryptography and RSA
Day 39	Public key Cryptography and RSA
Day 40	Other Public Cryptosystems, Crypographic Hash Functions
Day 41	Other Public Cryptosystems, Crypographic Hash Functions
Day 42	Other Public Cryptosystems, Crypographic Hash Functions

Module 4: Information Security Standards

3rd Year, Sec C (Faculty Name – Sucheta Chandra, Manjima Saha)

Working Days	Lesson Plan Description
Day 43	Digital Signature
Day 44	Digital Signature
Day 45	Digital Signature
Day 46	Digital Signature
Day 47	Problem Sums Practice
Day 48	Doubt Clearing Session

TEXTBOOK: **1. Cryptography and Network Security Principles and Practice, William Stallings**

2. Data Communications & Networking, BehrouzA.Forouzan.

REFERENCEBOOKS:

Introduction to Cryptography Network Security BehrouzA.Forouzan.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1		Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
Mid Term 2		Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
End Semester Examination		Attempt 10 out of 15 questions; Each question carries 2 marks (2 × 10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5 × 6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10 × 5)	**100**

Examination Rules & Regulations:
https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**1**	**3**	**1**	**3**	**0**	**0**	**3**	**0**	**1**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**0**	**0**	**2**	**0**	**2**	**2**
CO3	**3**	**3**	**2**	**2**	**3**	**3**	**0**	**3**	**1**	**0**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**0**	**1**	**3**

3: Strong correlation
2: Medium correlation
1: Weak correlation

PSO	PSO Description
PSO1	**Technical Knowledge and Problem-Solving:** Apply fundamental concepts of computer networking, security mechanisms, cryptography, cryptography algorithms to analyse and solve computational problems effectively.
PSO2	**Software Design and Development:** Demonstrate the ability to design, develop, test and deploy cryptography software solutions by utilizing modern tools, technologies, and logical programming skills for real-world applications across domains such as web, mobile, and enterprise systems.
PSO3	**Professional Skills and Ethics:** Exhibit effective communication, teamwork, leadership and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus and Lesson Plan for BCA Admission Batch 2023

Subject Name: **Advanced Web Programming Tools** Credit: 4 Lecture Hours: 40
Subject Code: **BCAWP602**

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –

1. Prof. Pritam Chakraborty

Pre-requisite: Students should have prior knowledge of:

- HTML5, CSS3, and JavaScript (ES5/ES6 basics)
- Basic understanding of client-server architecture
- Fundamentals of database systems (SQL or NoSQL)
- Introductory knowledge of Node.js or any server-side scripting language
- Familiarity with using a code editor (VS Code) and Git version control.

Relevant Links:

1. Link for Study Material:

https://drive.google.com/drive/folders/1cOiUxL4yCIOJanlMnCXVjCoyKnmhnjr5?usp=sharing

2. Link for Coursera Course:

1. https://www.coursera.org/learn/html-css-javascript-for-web-developers
2. https://www.coursera.org/learn/website-coding

3. **https://www.coursera.org/professional-certificates/microsoft-front-end-developer**
4. **https://www.coursera.org/specializations/front-end-development-using-react-specialization**
5. **https://www.coursera.org/learn/developing-backend-apps-with-nodejs-and-express**
6. **https://www.coursera.org/specializations/devops-cloud-and-agile-foundations**
7. **https://www.coursera.org/professional-certificates/microsoft-back-end-developer**

3. Link for LinkedIn Learning Course:

1. **https://www.linkedin.com/learning/html-css-and-javascript-building-the-web/learn-the-web-by-building?u=229219690**
2. **https://www.linkedin.com/learning/building-modern-projects-with-react-24955170/let-s-build-modern-projects-with-react?u=229219690**
3. **https://www.linkedin.com/learning/next-js-creating-and-hosting-a-full-stack-site/create-a-full-stack-site-with-next-js?u=229219690**
4. **https://www.linkedin.com/learning/learning-git-and-github-23011330/welcome?u=229219690**
5. **https://www.linkedin.com/learning/devops-foundations-23454205/the-foundations-of-devops?u=229219690**
6. **https://www.linkedin.com/learning/learning-docker-17236240/get-up-and-running-quick-with-docker?u=229219690**
7. **https://www.linkedin.com/learning/paths/continuous-integration-continuous-delivery-ci-cd-with-jenkins?u=229219690**

COURSE OBJECTIVES:

1. Develop students' understanding of modern full-stack web technologies using React and Next.js**.**
2. Enable learners to design scalable, high-performance, and secure web applications.
3. Provide practical exposure to server-side rendering, APIs, databases, authentication, and DevOps deployment.
4. Introduce students to real-world project workflows, including CI/CD, version control, and containerization.

COURSE OUTCOMES:

CO1: Apply advanced HTML, CSS, JavaScript, and TypeScript for responsive and accessible web design.

CO2: Develop client-side applications using React and Next.js with SSR, SSG, and routing features.

CO3: Design and implement RESTful APIs and databases using Node.js, Express, and Next.js API routes.

CO4: Implement authentication, authorization, and real-time features using NextAuth.js and WebSockets. Deploy, test, and optimize full-stack applications using CI/CD, Docker, and cloud services.

Module number	Topic	Sub-topics	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
1	**Advanced Front-End Development**	HTML5: semantic tags, media, forms, custom data attributes. Modern CSS: Flexbox, Grid, responsive design, custom properties, dark/light modes. CSS frameworks and preprocessors: Tailwind CSS, Modern JavaScript (ES6+): arrow functions, promises, async/await, modules. Accessibility (ARIA roles, keyboard navigation) Responsive and mobile-first design patterns	**Chapter 2, Chapter 3, Chapter 4, Chapter 5** **Internet & World Wide Web Paul Deitel Pearson** **Chapter 2, Chapter 3, Chapter 4, Chapter 5, Chapter 6** **Fundamentals of Web Development , Randy Connolly, Ricardo Hoar Pearson**	**International Academia:** https://www.coursera.org/learn/html-css-javascript-for-web-developers https://www.coursera.org/learn/website-coding https://www.coursera.org/professional-certificates/microsoft-front-end-developer	10
2	**React and Next.js Framework**	React essentials: components, hooks, props/state, context. Next.js introduction: pages, layouts, app directory structure. Routing in Next.js: file-based routes, dynamic routes, nested routes. Server-Side Rendering (SSR) vs Static Site Generation (SSG) vs Client-Side Rendering (CSR). Data fetching methods: getStaticProps, getServerSideProps, useEffect, and new fetch API (Next.js 13+). API routes in Next.js (creating backend APIs inside Next).	**Chapter 1, Chapter 3, Chapter 4, Chapter 5, Chapter 6, Chapter 7, Chapter 8** **Advanced Web Development with React, Mehul Mohan, BPB**	https://www.coursera.org/specializations/front-end-development-using-react-specialization https://www.coursera.org/learn/packt-official-next-js-tutorial-code-along-react-web-development-fvs28	10

		Integrating databases using Next.js API routes. Image optimization and SEO with Next.js metadata. PWA features in Next.js apps. State management: Context API / Redux Toolkit			
3	**Back-End Integration & Real-Time Systems**	Node.js runtime, event-driven model, NPM/Yarn. Express.js API routes comparison. RESTful API design principles and documentation. Database integration: SQL, NoSQL (MongoDB) with Mongoose. Authentication and Authorization: JWT, OAuth2, NextAuth.js (integration with Next.js) WebSockets and real-time communication (Socket.IO) File uploads, API rate limiting, and caching.	**Chapter 1, Chapter 2, Chapter 3, Chapter 4, Chapter 5, Chapter 6, Chapter 7, Chapter 8** **NodeJs Guide Book, Dhruti Shah, BPB**	https://www.coursera.org/learn/developing-backend-apps-with-nodejs-and-express https://www.coursera.org/professional-certificates/microsoft-back-end-developer https://www.coursera.org/specializations/restful-microservices-using-node-js-and-express	10
4	**DevOps, Testing, Performance**	DevOps: Implement Version Control and Tracking, Dynamic Developer Environment, Build Once, Deploy Many Frequently Merge Code: Continuous Integration, Software Packaging and Continuous Delivery Automated Testing. Git & GitHub workflow, branching, semantic versioning. Continuous Integration (CI) & Continuous Deployment (CD) using Docker and Jenkins.	**Chapter 1, Chapter 2, Chapter 3, Chapter 4** **Git Repository Management in 30 Days Sumit Jaiswal bpb publishers** **Chapter 1, Chapter 2, Chapter 3, Chapter 4, Chapter 5, Chapter 6** **DevOps Design Pattern**	https://www.coursera.org/specializations/devops-cloud-and-agile-foundations https://www.coursera.org/specializations/master-devops-ci-cd-automation-monitoring https://www.coursera.org/learn/ibm-containers-docker-kubernetes-openshift https://www.coursera.org/projects/cicd-using-jenkins	10

		Docker containerization: multi-stage builds, environment variables, .env configuration. Testing methodologies: Unit testing, component testing (React Testing Library), Analytics and logging for monitoring deployed apps.	**Pradeep Chintale** **bpb publishers** **Chapter 1, Chapter 2, Chapter 3, Chapter 4, Chapter 5, Chapter 6, Chapter 7, Chapter 8** **CI/CD Pipeline with Docker and Jenkins** **Sandeep Rawat** **bpb publsihers**	https://www.coursera.org/learn/getting-started-with-git-and-github https://www.coursera.org/learn/packt-learning-github-actions-for-devops-ci-cd-jb7lj	

Module 1: Advanced Front-End Development

3rd Year, Sec D (Faculty Name – Prof. Pritam Chakraborty)

Working Days	Lesson Plan Description
Day 1	HTML5: semantic tags, media
Day 2	HTML5: semantic tags, media, Forms
Day 3	HTML5: custom data attributes
Day 4	Modern CSS: Flexbox, Grid
Day 5	Modern CSS: custom properties, dark/light modes.
Day 6	CSS frameworks and preprocessors: Tailwind CSS
Day 7	Modern JavaScript (ES6+): arrow functions, promises
Day 8	Async/Await, modules.
Day 9	Async/Await, modules

Day 10	Responsive and mobile-first design patterns

Module 2: React and Next.js Framework

3rd Year, Sec D (Faculty Name – Prof. Pritam Chakraborty)

Working Days	Lesson Plan Description
Day 11	React essentials: components, hooks,
Day 12	props/state, context.
Day 13	Next.js introduction: pages, layouts, app directory structure.
Day 14	Routing in Next.js: file-based routes
Day 15	Dynamic routes, Nested routes.
Day 16	Server-Side Rendering (SSR) vs Static Site Generation (SSG) vs Client-Side Rendering (CSR).
Day 17	Data fetching methods: getStaticProps, getServerSideProps
Day 18	useEffect, and new fetch API (Next.js 13+). API routes in Next.js (creating backend APIs inside Next), Integrating databases using Next.js API routes.
Day 19	Image optimization and SEO with Next.js metadata. PWA features in Next.js apps.
Day 20	State management: Context API / Redux Toolkit

Module 3: Back-End Integration & Real-Time Systems

3rd Year, Sec D (Faculty Name – Prof. Pritam Chakraborty)

Working Days	Lesson Plan Description
Day 21	Node.js runtime, event-driven model, NPM/Yarn.
Day 22	Express.js API routes comparison.
Day 23	RESTful API design principles and documentation
Day 24	Database integration: SQL, NoSQL (MongoDB) with Mongoose

Day 25	Authentication and Authorization: JWT
Day 26	Authentication and Authorization: OAuth2
Day 27	Authentication and Authorization: NextAuth.js (integration with Next.js).
Day 28	Authentication and Authorization: NextAuth.js (integration with Next.js).
Day 29	File uploads, API rate limiting, and caching.
Day 30	File uploads, API rate limiting, and caching.

Module 4: DevOps, Testing, Performance

3rd Year, Sec D (Faculty Name – Prof. Pritam Chakraborty)

Working Days	Lesson Plan Description
Day 31	DevOps: Implement Version Control and Tracking
Day 32	Dynamic Developer Environment, Build Once, Deploy Many
Day 33	Frequently Merge Code: Continuous Integration, Software Packaging
Day 34	Continuous Delivery, Automated Testing.
Day 35	Git & GitHub workflow, branching, semantic versioning.
Day 36	Continuous Integration (CI) & Continuous Deployment (CD) using Docker
Day 37	Continuous Integration (CI) & Continuous Deployment (CD) using Jenkins
Day 38	Docker containerization: multi-stage builds, environment variables, .env configuration.
Day 39	Testing methodologies: Unit testing, component testing (React Testing Library),
Day 40	Analytics and logging for monitoring deployed apps.

TEXTBOOK:

8. Internet & World Wide Web, Paul Deitel, Pearson
9. Fundamentals of Web Development , Randy Connolly, Ricardo Hoar, Pearson
10. Advanced Web Development with React, Mehul Mohan, BPB

REFERENCEBOOKS:

1. NodeJs Guide Book, Dhruti Shah, BPB
2. Git Repository Management in 30 Days, Sumit Jaiswal, BPB publishers
3. DevOps Design Pattern, Pradeep Chintale, BPB publishers
4. CI/CD Pipeline with Docker and Jenkins, Sandeep Rawat, BPB publsihers

CO- PO Mapping:

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	3	2	2	3	1	1	2	1	1	0	2	0
CO2	2	3	3	3	2	1	2	2	2	0	2	0
CO3	3	3	3	3	2	1	2	2	3	0	2	0
CO4.	2	3	3	3	3	1	2	2	3	0	3	0

3: Strong correlation 2: Medium correlation 1: Weak correlation

PSO	PSO Description
PSO1	**Web Application Development:** Ability to design and develop responsive, user-friendly web interfaces using modern front-end technologies like HTML5, CSS3, JavaScript, React, and Next.js.
PSO2	**Full-Stack Software Engineering:** Ability to build secure and scalable full-stack applications using Node.js, Express, Next.js API routes, databases (MongoDB/PostgreSQL), and authentication systems.
PSO3	**DevOps & Deployment Skills:** Ability to implement CI/CD pipelines, use Docker for containerized deployment, and deploy applications on cloud platforms such as Vercel, Netlify, Render, or AWS.

PSO4	**Performance, Testing & Optimization:** Ability to test, monitor, and optimize web applications using tools like Jest, Cypress, Lighthouse, logging systems, and follow best security practices.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1		Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
Mid Term 2		Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
End Semester Examination		Attempt 10 out of 15 questions; Each question carries 2 marks (2 × 10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5 × 6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10 × 5)	**100**

Examination Rules & Regulations:
https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40