

Faculty of Science & Technology
Savitribai Phule Pune University
Pune



Syllabus for
Second Year
Bachelor of Computer Applications
(2019 Course)
(with effect from A.Y. 2020-21)

Savitribai Phule University of Pune
Second Year of Bachelor of Computer Applications (2019 Course)
(with effect from June 2020 - 21)

Semester 3

Course Code	Course	Teaching Scheme Hours			Examination Scheme and Marks			Credit	
		Theory	Tutorial	Practical	CE	End-Sem	Total	TH	PR
BCA231	Data Structures	05	--	--	30	70	100	04	--
BCA232	Database Management Systems – II	05	--	--	30	70	100	04	--
BCA233	Computer Networks	05	--	--	30	70	100	04	--
BCA234	Data Structures Laboratory	--	--	04*	15	35	050	--	02
BCA235	Database Management Systems - II Laboratory	--	--	04*	15	35	050	--	02
BCA236	Computer Networks and Web Programming Laboratory	02 ^{\$}	--	04*	15 [#]	35 [^]	050	--	02
	Environmental Science-I	02	--	--	15	35	050	02	---
	Language Communication – I	02	--	--	15	35	050	02	---
Total Credits								16	06
Total		21	--	12	165	385	550	22	

*Laboratory session of 4 hours 20 minutes duration to be conducted for each batch of 12 students per week

\$ Theory lectures will be conducted for the whole class at a time

Continuous assessment will be carried out based on performance in both lab and theory sessions

^ End semester practical exam will be conducted based on assignments carried out during lab sessions only

Savitribai Phule University of Pune Second Year Computer Applications (2019 Course) (with effect from June 2020 - 21)									
<u>Semester 4</u>									
Course Code	Course	Teaching Scheme Hours / Week			Examination Scheme and Marks			Credit	
		Theory	Tutorial	Practical	CE	End-Sem	Total	TH	PR
BCA241	Object Oriented Programming and C++	05	--	--	30	70	100	04	--
BCA242	Web Technology	05	--	--	30	70	100	04	--
BCA243	Software Engineering	05	--	--	30	70	100	04	--
BCA244	C++ Programming Laboratory	--	--	04*	15	35	050	--	02
BCA245	Web Technology Laboratory	--	--	04*	15	35	050	--	02
BCA246	Python Programming Laboratory	02 ^{\$}	--	04*	15 [#]	35 [^]	050	--	02
	Environmental Science-II	02	--	--	15	35	050	02	---
	Language Communication – II	02	--	--	15	35	050	02	---
Total Credits								16	06
Total		21	--	12	165	385	550	22	

*Laboratory session of 4 hours 20 minutes duration to be conducted for each batch of 12 students per week

\$ Theory lectures will be conducted for the whole class at a time

Continuous assessment will be carried out based on performance in both lab and theory sessions

^ End semester practical exam will be conducted based on assignments carried out during lab sessions only

Semester III

SEMESTER III		
BCA231: Data Structures		
Teaching Scheme: Theory: 05 Hrs./Week	Credits 04	Examination Scheme: Continuous Evaluation: 30 Marks End-Semester : 70 Marks
Pre-requisite Course: BCA 112 and BCA 122		
Companion Course: BCA234: Data Structures Laboratory		
Course Objectives: <ul style="list-style-type: none"> • To understand algorithms and analysis of algorithms • To learn static and dynamic data structures. 		
Course Outcomes: After successful completion of this course, learner will be able to <ul style="list-style-type: none"> • Apply appropriate data structures for the given problem. • Design an efficient algorithm for the given problem. • Determine the time and space complexity of a given algorithm. 		
Course Contents		
Unit I	Introduction to data structure	06Hrs.
<ul style="list-style-type: none"> • Data types and data objects • Abstract Data Types (ADT) • Data structure • Algorithm analysis: Frequency counts, Space and Time complexity, Asymptotic notation : BigO, Omega (Ω) • Algorithms and its complexity using simple example algorithms 		
Unit II	Arrays	06 Hrs.
<ul style="list-style-type: none"> • Introduction and definition • Matrix representation using arrays: Row and column major, operations on matrices, Sparse Matrix • Sorting techniques with time complexity: Bubble sort, Insertion sort, Merge sort, Quick sort • Searching techniques with time Complexity: Linear search, Binary search 		
Unit III	Linked Lists	12Hrs.
<ul style="list-style-type: none"> • Introduction and Definition • Representation: Static & Dynamic • Types of linked lists: singly, doubly, circular • Operations on link list: create, display, insert, delete, reverse, search, sort, concatenation, Merge • Real world applications of Link list (implementation not expected) 		
Unit IV	Stacks and Queues	12Hrs.
<ul style="list-style-type: none"> • Representation of Stack: Using arrays and Linked Lists • Operations on stack: push, pop • Applications of Stack : Recursion, Infix to postfix, postfix to infix • Representation of Queues : Static & Dynamic 		

- **Operations on queue:** insert, delete
- **Types of queue:** Circular queue and Priority queue
- **Real world Applications of queue (Implementation not expected)**

Unit V	Trees	12 Hrs.
<ul style="list-style-type: none"> • Introduction and Tree terminologies: Definitions: Tree, root, child, leaf, level, height, depth • Binary trees: Types: Rooted, full, complete and skewed. • Representation of Trees: Using arrays and Linked Lists • Types of Traversal: Preorder, Inorder, Postorder, Applications of Binary trees • Binary Search Tree (BST): Introduction and definition 		
Unit VI	Graphs	12 Hrs.
<ul style="list-style-type: none"> • Introduction and Graph terminologies • Representation of a Graph – Adjacency matrix, Adjacency list, Adjacency multi-list • Graph Traversals – DFS, BFS • Applications of graphs - Topological sort 		

Reference Books

1. Fundamentals of Data Structures-Horowitz Sahani (Galgotia)
2. Introduction to Data Structures using C-Ashok Kamthane
3. Data Structures using C-Bandopadhyay &Dey(Pearson)
4. Data Structures using C-By Srivastava BPB Publication

E-Books

- 1)Data Structure Using C – By Balagurusamy
https://books.google.co.in/books?id=nB_ZAgAAQBAJ&printsec=frontcover&dq=data+structures+ebook&hl=en&sa=X&ved=0ahUKEwjNwd_Ki6LpAhXVH7cAHfbrAgkQ6AEIJzAA#v=onepage&q&f=false
- 2) Data Structures and Algorithms - Gavpai
https://books.google.co.in/books?id=Vx_rKhsEr8C&printsec=frontcover&dq=data+structures+ebook&hl=en&sa=X&ved=0ahUKEwjNwd_Ki6LpAhXVH7cAHfbrAgkQ6AEINzAC#v=onepage&q&f=false
- 3) Classic Data Structures – Debasis Samanta
https://books.google.co.in/books?id=law2E-LPScIc&printsec=frontcover&dq=data+structures+ebook&hl=en&sa=X&ved=0ahUKEwjNwd_Ki6LpAhXVH7cAHfbrAgkQ6AEIYTAH#v=onepage&q&f=false

SEMESTER III

BCA232 : Database Management Systems – II**Teaching Scheme:**

Theory: 05 Hrs./Week

Credits

04

Examination Scheme:

Continuous Evaluation: 30 Marks

End-Semester : 70 Marks

Prerequisite Courses: BCA – 124**Companion Course :** BCA235 Database Management Systems-II Laboratory**Course Objectives:**

- To understand advanced SQL features and procedural SQL.
- To study concurrency control and crash recovery techniques.
- To understand need of database security.
- To learn different database system architectures.

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

- Formulate SQL queries using advanced SQL features.
- Perform Database operations using PL/PostgreSQL.
- Compare and contrast different concurrency control and recovery techniques.
- Apply mechanisms for database security.
- Analyze various database system architectures.

Course Contents

Unit I	Relational Database Design	12 Hrs
1.1. PL/Postgre SQL: Language structure 1.2. Controlling the program flow, conditional statements, loops 1.3. Views 1.4. Functions 1.5. Handling errors and exceptions 1.6. Cursors 1.7. Triggers		
Unit II	Transaction Concepts	10 Hrs
2.1 Transaction, properties of transaction, states of transactions 2.2 Concurrent execution of transactions and conflicting operations 2.3 Schedules, types of schedules, concept of serializability, precedence graph for serializability		
Unit III	Concurrency Control	12Hrs
3.1 Ensuring serializability by locks, different lock modes 3.2 2PL and its variations 3.3 Multiple Granularity locking protocol 3.4 Basic timestamp method for concurrency, Thomas Write Rule 3.5 Locks with multiple granularity, dynamic database concurrency (Phantom Problem) 3.6 Timestamps versus locking 3.7 Optimistic concurrency control algorithm, multi version concurrency control 3.8 Deadlock handling methods - 3.8.1 Detection and Recovery (Wait for graph). 3.8.2 Prevention algorithms (Wound-wait, Wait-die) 3.8.3 Deadlock recovery techniques (Selection of Victim, Starvation, Rollback)		
Unit IV	Crash Recovery	10 Hrs

- 4.1 Transaction Failure classification
- 4.2 Recovery concepts
- 4.3 Checkpoints
- 4.4 Recovery with concurrent transactions (Rollback, checkpoints, commit)
- 4.5 Log base recovery techniques (Deferred and Immediate update)
- 4.6 Buffer Management
- 4.7 Database backup and recovery from catastrophic failures
- 4.8 Shadow paging

Unit V**Database Security****08 Hrs**

- 5.1 Introduction to database security concepts
- 5.2 Methods for database security
- 5.3 Discretionary access control method
- 5.4 Mandatory access control and role based access control for multilevel security
- 5.5 Use of views in security enforcement
- 5.6 Overview of encryption technique for security
- 5.7 Statistical database security

Unit VI**Database System Architectures****08 Hrs**

- 6.1 Centralized and Client – Server Architectures
- 6.2 Server System Architectures
- 6.3 Introduction to Parallel Systems
- 6.4 Introduction to Distributed Systems
- 6.5 Introduction to Object Based Databases

Books:

1. Database System Concepts – Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 6th edition- McGraw-Hill
2. Fundamentals of Database Systems- Ramez Elmasri, Shamkant B. Navathe, 6th edition– Pearson.
3. Database Management Systems -Raghu Ramakrishnan, Johannes Gehrke, 3rd edition, Tata McGraw Hill
4. Introduction to Database Management System- Bipin Desai, 3rd edition, Galgotia Publication
5. An Introduction to Database Systems - C.J. Date, 7th edition, Addison-Wesley
6. Practical PostgreSQL- Joshua D. Drake, John C Worsley, O'Reilly Publications

E-Books

1) Fundamentals of Relational Database Management System –

S. Sumathi S. Esakkirajan

<https://books.google.co.in/books?id=RjnNA0GW0wsC&printsec=frontcover&dq=Relational+Database+Management+System+ebook&hl=en&sa=X&ved=0ahUKEwi3ubfgkKLpAhXWxzgGHY2oCv8Q6AEIKjAA#v=onepage&q=Relational%20Database%20Management%20System%20ebook&f=false>

2) Introduction to Database Management System – Dr. Satinder Bal Gupta, Aditya Mittal

<https://books.google.co.in/books?id=NGISs8YFs3EC&printsec=frontcover&dq=Relational+Database+Management+System+ebook&hl=en&sa=X&ved=0ahUKEwi3ubfgkKLpAhXWxzgGHY2oCv8Q6AEINDAB#v=onepage&q&f=false>

3) Database Management System – P.S.Gill

<https://books.google.co.in/books?id=mK4COraJvIIC&printsec=frontcover&dq=Relational+Database+Management+System+ebook&hl=en&sa=X&ved=0ahUKEwi3ubfgkKLpAhXWxzgGHY2oCv8Q6AEITjAE#v=onepage&q&f=false>

4) Database Management System – Monelli Ayyavaraiah, Arapalli Gopi

<https://books.google.co.in/books?id=BaZjDwAAQBAJ&printsec=frontcover&dq=Relational+Database+Management+System+ebook&hl=en&sa=X&ved=0ahUKEwi3ubfgkKLpAhXWxzgGHY2oCv8Q6AEIRTAD#v=onepage&q&f=false>

SEMESTER III

BCA233: Computer Networks

Teaching Scheme: TH: 05 Hours/Week	Credits 04	Examination Scheme: Continuous Evaluation: 30 Marks End-Semester : 70 Marks
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Prerequisite Courses: BCA-111 & BCA-121

Companion Course: BCA – 236 Computer Networks and Web Programming Lab

Course Objectives:

- To understand the fundamental concepts of networking standards, protocols and technologies.
- To study different techniques for framing, error control, flow control and routing.
- To learn role of protocols at various layers in the protocol stacks.
- To develop an understanding of modern network architectures from a design and performance perspective

Course Outcomes: After successful completion of this course, learner will be able to-

- Analyze the requirements for a given organization and select appropriate network architecture, topologies, transmission mediums and technologies.
- Analyze data flow between TCP/IP model using Application, Transport and Network Layer Protocols.
- Illustrate applications of Computer Network.
- Compare and contrast different routing and switching algorithms

Course Contents

Unit I	Introduction to Data Communications Computer Networks	8 Hrs
1.1 Data communications, Characteristics of Data Communication 1.2 Components of Data communication 1.3 Data Representation – Text, Numbers, Images, Audio, Video 1.4 Types of Data flow – Simplex, Half Duplex, Full Duplex 1.5 Computer Networks applications –Business Application, Home Application, Mobile User 1.6 Broadcast and point-to-point networks 1.7 Network Topologies - Bus, Star, Ring, Mesh 1.8 Network Types- LAN, MAN, WAN, PAN, Wireless Networks, Home Networks, internetworks 1.9 Protocols and standards – Definition of a Protocol, Protocol standards: De facto and De jure		
Unit II	Network Models	8 Hrs
2.1. OSI Model – layered architecture, peer-to-peer processes, encapsulation 2.2 TCP/IP Model – layers and Protocol Suite 2.3 Addressing-Physical, Logical, Port addresses, Specific addresses		
Unit III	Physical Layer	10 Hrs

- 3.1 Analog and Digital data, Analog and Digital signals, Digital Signals-Bit rate, Bit length
 3.2 Baseband Transmission, Broadband Transmission
 3.3 Transmission Impairments– Attenuation, Distortion and Noise
 3.4 Data Rate Limits– Noiseless channel: Nyquist’s bit rate, noisy channel : Shannon’s law
 3.4 Performance of the Network Bandwidth, Throughput, Latency (Delay), Bandwidth – Delay Product, Jitters
 3.4 Line Coding Characteristics, Line Coding Schemes–Unipolar -NRZ, Polar-NRZ-I, NRZ-L, RZ, Manchester and Differential Manchester, Problems
 3.5 Transmission Modes, Parallel Transmission and Serial Transmission– Asynchronous and Synchronous and Isochronous
 3.6 Multiplexing FDM and TDM
 3.7 Switching-Circuit Switching, Message Switching and Packet Switching.

Unit IV	Data Link Layer	10 Hrs
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- 4.1 Framing – Concept, Methods – Character Count, Flag bytes with Byte Stuffing, Starting & ending Flags with Bit Stuffing
 4.2 Error detection code – Hamming Distance, CRC
 4.3 Elementary data link protocols - Simplex stop & wait protocol, Simplex protocol for noisy channel, PPP, HDLC
 4.4 Sliding Window Protocols – 1-bit sliding window protocols, Pipelining – Go-Back N and Selective Repeat
 4.5 Random Access Protocols - ALOHA– pure and slotted, CSMA-1- persistent, p-persistent and non-persistent CSMA/CD, CSMA/CA
 4.6 Controlled Access - Reservation, Polling and Token Passing
 4.7 Channelization – Definitions – FDMA, TDMA and CDMA

Unit V	Network Layer	10 Hrs
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- 5.1 IPv4 addresses: Address space, Notation, Classful addressing, Classless addressing, NAT, Sub netting, Super netting
 5.2 IPv4: Datagram, Fragmentation, checksum, options
 5.3 IPv6 addresses: Structure, address space
 5.4 IPv6: packet format, Extension headers

Unit VI	Transport and Application Layer	12 Hrs
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- 6.1. Process-to-Process Delivery, Multiplexing and De-multiplexing
 6.2. User Datagram Protocol (UDP) - Datagram Format, Checksum, UDP operations, Use of UDP
 6.3. Transmission Control Protocol (TCP) - TCP Services – Process to-Process Communication, Stream Delivery Service, Sending and Receiving Buffers, Segments, Full – Duplex Communication, Connection oriented service, Reliable service
 6.4. TCP Features – Numbering System, Byte Number, Sequence Number, Acknowledgement Number, Flow Control, Error Control, Congestion Control
 6.5 TCP Segment Format
 6.6 TCP Vs UDP
 6.6 Domain Name System (DNS) - Distribution of Name Space, DNS in the Internet
 6.7 E-MAIL - Architecture, User Agent, Message Transfer Agent - SMTP, Web Based Mail
 6.8 WWW – Architecture
 6.9 HTTP - HTTP Transaction

Reference Books:

1. Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill.
2. Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13-212695-3, Pearson

E-Books

1) Computer Networks – Andrew S. Tanenbaum

https://books.google.co.in/books?id=b2HyGSu46lQC&printsec=frontcover&dq=Computer+Networks+ebook&hl=en&sa=X&ved=0ahUKEwj9woKyIKLpAhWIH7cAHR6_BKAQ6AEILjAB#v=onepage&q=Computer%20Networks%20ebook&f=false

2) Computer Networks – Behrouz A. Forouzan and Firouz Mosharrat

https://books.google.co.in/books?id=o8CjAgAAQBAJ&printsec=frontcover&dq=Computer+Networks+ebook&hl=en&sa=X&ved=0ahUKEwj9woKyIKLpAhWIH7cAHR6_BKAQ6AEINzAC#v=onepage&q&f=false

3) Computer Networks – V.S. Bagad and I.A. Dhotre

https://books.google.co.in/books?id=KpOb37EHETcC&printsec=frontcover&dq=Computer+Networks+ebook&hl=en&sa=X&ved=0ahUKEwj9woKyIKLpAhWIH7cAHR6_BKAQ6AEIWjAG#v=onepage&q&f=false

SEMESTER III

BCA234: Data Structures Laboratory

Teaching Scheme: Practical: 04 Hrs./Week/Batch	Credits 02	Examination Scheme: Continuous Evaluation: 15Marks End-Semester: 35Marks
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Prerequisite Courses: BCA – 116 and BCA – 126

Companion Course: BCA- 231: Data Structures

Course Objectives:

- To understand algorithms and analysis of algorithms
- To learn static and dynamic data structures.

Course Outcomes:

After successful completion of this course, learner will be able to

- Apply appropriate data structures for the given problem.
- Design an efficient algorithm for the given problem and implement it using C Programming.
- Determine the time and space complexity of a given algorithm.

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference, one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Assignment No	Topics for the Assignments	Number of sessions
1	Non-Recursive Sorting Techniques 1. Bubble Sort 2. Insertion Sort	1
2	Recursive Sorting Techniques 1. Quick Sort 2. Merge Sort	2
3	Searching Techniques 1. Linear search 2. Binary Search	2
4	Linked List 1. Linked List 2. Singly Circular Linked List 3. Doubly Linked List 4. Doubly Circular Linked List	2

5	Stack 1. Static Stack Implementation 2. Dynamic Stack Implementation	2
6	Queue 1. Static Queue Implementation 2. Dynamic Queue Implementation	2
7	Binary Search Tree (Dynamic)	1
8	Graph 1. Adjacency Matrix Representation 2. Adjacency List Representation 3. In-degree and Out-degree calculation	2
Total Number of sessions per batch		14

SEMESTER III

BCA235:Database Management Systems-II Laboratory

Teaching Scheme: Practical: 04 Hrs./Week/Batch	Credits 02	Examination Scheme: Continuous Evaluation: 15Marks End-Semester :35Marks
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Prerequisite Courses: BCA – 128

Companion Course: BCA232: Database Management Systems-II

Course Objectives:

- To learn advanced features in SQL such as Nested queries and Views
- To become familiar with PL/Postgre SQL

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

- Formulate SQL queries using advanced features
- Write stored procedures, cursors and triggers using PL/Postgre SQL.
- Design a database using database normalization technique

Lab Course Contents

Assignment No	Topics for the Assignments	No. Of Sessions
1	Simple and Nested Queries	02
2	Views Creation	02
3	Stored Functions	02
4	Cursors 1) Simple Cursor 2) Parameterize Cursor	02
5	Designing a Database using normalization theory for the given application/database design	02
6	Error and Exception handling 1) Raise Notice 2) Raise Exception	02
7	Triggers 1) Before (Insert, Update, Delete) 2) After (Insert, Update, Delete)	02
Total Number of Sessions per batch		14

SEMESTER III

BCA 236: Computer Networks and Web Programming Laboratory

Teaching Scheme: Theory: 02 Hrs/Week Practical: 04 HRs/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 35 Marks
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Pre-requisite Course: BCA 111

Companion Course: BCA 233 Computer Network

Course Objectives:

- To use network commands and study network devices and LAN
- To understand the principles and methodologies of web based applications development process
- To learn HTML, CSS, Java Scripts, Cookies and XML

Course Outcomes:

After successful completion of this course, learner will be able to -

- Use Networking commands, identify network devices and topology
- Design a website using HTML and CSS.
- Write java scripts
- Interpret and formulate XML queries

Course Contents (For Theory Sessions)

Unit I	Introduction to Web Technologies	04Hrs
1.1	Introduction to Web Technologies	
1.2	Website – Working principal	
1.3	Software to create websites	
1.4	Qualities of a good website	
1.5	Client-Server and its Communication	
1.6	Client and Server Scripting Languages	
1.7	Basic working of the Internet, Internet Protocols (HTTP, FTP, IP)	
1.8	World Wide Web (WWW).	
1.9	HTTP request message, HTTP response message	
1.10	Types of Websites (Static and Dynamic Websites)	
Unit II	Introduction to HTML	02Hrs
2.1	Introduction to HTML	
2.2	HTML tags and attributes	
2.3	Working with Elements.	
2.4	Inserting Images	
2.5	Client Server image mapping	
2.6	Lists	
2.7	Tables	
2.8	Text and Image links	
2.9	Frames	
2.10	Forms and controls	
2.11	Text boxes, buttons – radio & checkbox, List boxes	
Unit III	Introduction to CSS	04Hrs

- 3.1 Introduction to Style Sheets
- 3.2 Introduction to Responsive Website
- 3.3 Types of CSS
- 3.4 CSS Border, margin, Positioning, color, text, link, background, list, table, padding, image, display properties
- 3.5 Use of Id & classes in CSS
- 3.6 Use of &
- 3.7 Introduction of CSS3 : Gradients, Transitions, Animations, multiple columns
- 3.8 Introduction of Bootstrap

Unit IV Introduction to JavaScript	06Hrs
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- 4.1 Concept of script, Types of Scripts, Introduction to javascript
- 4.2 Variables, identifier & operator, control structure.
- 4.3.Examples on javascript operators
- 4.4 Functions
- 4.5 Event Handling in Java Scripts
- 4.6 Concept of array, Arrays in javascript , types of arrays with examples
- 4.7 Event handling in javascript with examples
- 4.8 Math and date objects with examples.
- 4.9 String objects with examples, and related functions
- 4. 10 DOM in javascript, DOM objects
- 4.11 Validations in javascript with examples.

Unit V Working with cookies	04Hrs
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- 5.1 Basics of cookies
- 5.2 Reading a cookie value, writing a cookie value
- 5.3 Creating cookies, deleting cookies
- 5.4 Setting expiry date of cookies.
- 5.5 Examples on cookies.

Unit VI Introduction to XML	04Hrs
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- 6.1 Introduction to XML
- 5.2 Uses of XML
- 5.3 Simple XML examples,
- 5.4 XML key components
- 5.5.DTD and Schemas,
- 5.6 Using XML in web applications.
- 5.7.Introduction to XSL, XSL elements, transforming with XSLT

Course Contents (For Lab Sessions)

Assignment No	Topics for the Assignments	No. of Sessions
1	Using Networking commands – ping, hostname, traceroute, netstat, ifconfig, who, nmap, nslookup etc	01
2	Study of network devices – cables, switches, Modem etc	01
3	Study of LAN Environment – IP, MAC addresses, DHCP Server, Drawing network topology	01
4	Basic HTML Tags - headings, paragraphs, line break, colors etc fonts, links, Images etc	01
5	Creating List using HTML Tags	01
6	Creating List and Tables using HTML Tags	01
7	Creating Frames and Forms by using HTML Tags	01
8	Styling HTML pages using CSS	01
9	Basics of JavaScript	01
10	Functions in JavaScript	01
11	Validation using JavaScript	01
12	Designing Input screens using HTML & CSS.	01
13	Field and Form validation.	01
14	Testing a developed client application	01
Total Number of Sessions per Batch		14

Theory lectures will be conducted for the whole class at a time

Lab Sessions will be conducted for each batch of 12 students separately

End sem practical exam of 35 marks will be conducted based on assignments carried out during lab sessions only

Continuous assessment of 15 marks will be carried out based on performance in both lab and theory sessions

Reference Books

1. Steven Holzner, IIHTML Black BookII, Dremtech press.
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson Education
5. Programming PHP By Rasmus Lerdorf and Kevin Tatroe, O'Reilly publication
6. Programming the World Wide Web , Robert W Sebesta (3rd Edition)
7. Thinking in HTML eBook by Aravind Shenoy
8. Learn HTML and CSS faster by Mark Myers

E-books

1. <https://www.w3schools.com>
2. <https://www.tutorialspoint.com>
3. <https://www.php.net>

Semester IV

SEMESTER IV

BCA241: Object Oriented
Programming and C++

Teaching Scheme: Theory: 05 Hrs./Week	Credits 04	Examination Scheme: Continuous Evaluation: 30 Marks End-Semester : 70 Marks
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Pre-requisite Course: BCA - 112 & BCA – 122

Companion Course: BCA244: C++ Programming Laboratory

Course Objectives:

- To learn principles of Object Oriented Programming (OOP).
- To understand object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism.
- To use the object-oriented paradigm in program design.

Course Outcomes:

After successful completion of this course, learner will be able to–

- Compare and contrast procedural and object oriented programming
- Apply principles of OOP
- Design and develop applications using object oriented programming language C++

Course Contents

Unit I	Introduction to C++	06Hrs.
	<ul style="list-style-type: none"> • How C++ evolved from C? • Features of C++ • Procedure-oriented programming Vs Object-oriented programming • The basic anatomy of a C++ program, Simple “Hello World” program • Compiling, linking and running a C++ program. 	
Unit II	Object Oriented Programming Concepts	08Hrs.
	<ul style="list-style-type: none"> • Classes and objects • Abstraction • Inheritance • Polymorphism • Data Binding • Encapsulation • Message Passing 	
Unit III	Programming in C++	08Hrs
	<ul style="list-style-type: none"> • Data Types, • New operators and keywords, • Type casting in C++, • reference variables, • Classes and Access Specifiers • Defining data members and member functions • Arrays and Array of objects • Usage of namespace, Managing Console I/O, Usage of Manipulators 	
Unit IV	Constructors, Destructors, Function and Operator overloading	14Hrs.
	<ul style="list-style-type: none"> • Static Members Call by reference, return by reference • Inline Function 	

- Friend Function
- Function overloading
- Constructor & Destructor and their types
- Overloading unary and binary operators (with member function and with friend function)
- Usage of this pointer
- Overloading using friend functions Overloading “<<>>” operator Type Conversion, Function overloading

Unit V	Inheritance	14Hrs.
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- Introduction
- Types of Inheritance
- Base class and derived class examples
- Virtual base class
- Abstract class
- Polymorphism
- Virtual functions and pure virtual functions, Overriding

Unit VI	Files and Exception Handling	10Hrs.
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- Classes for file stream operations
- Opening and closing a file
- Random access files
- Introduction to Exception handling mechanism

Reference Books

1. Object Oriented Programming (C++) Balaguruswamy, McGraw Hill Education; Seventh edition
2. Deitel, —C++ How to Programll, 4th Edition, Pearson Education
3. The Complete Reference C++ by Herbert Schildt, McGraw Hill Education; 4 edition
4. Mastering C++ by Venugopal, T Ravishankar, McGraw Hill Education; 2 edition

E-Books

- 1) Head First C++ Programming – Harry. H. Chaudhary
<https://books.google.co.in/books?id=xzIAwAAQBAJ&printsec=frontcover&dq=C%2B%2B+ebook&hl=en&sa=X&ved=0ahUKEwj7yKfmnaLpAhXhX3wKHx31Bn4Q6AEIjzAA#v=onepage&q&f=false>
- 2) A Complete Guide to Programming C++ - Jones and Bartett Computer Science
https://books.google.co.in/books?id=yhuY0Wg_QcC&printsec=frontcover&dq=C%2B%2B+ebook&hl=en&sa=X&ved=0ahUKEwj7yKfmnaLpAhXhX3wKHx31Bn4Q6AEINzAC#v=onepage&q&f=false
- 3) Programming with C++ - D Ravichandran
<https://books.google.co.in/books?id=Zw0jqouq61gC&printsec=frontcover&dq=C%2B%2B+ebook&hl=en&sa=X&ved=0ahUKEwj7yKfmnaLpAhXhX3wKHx31Bn4Q6AEILzAB#v=onepage&q=C%2B%2B%20ebook&f=false>
- 4) C++ Programming – D.S.Malik
<https://books.google.co.in/books?id=NxleCgAAQBAJ&printsec=frontcover&dq=C%2B%2B+ebook&hl=en&sa=X&ved=0ahUKEwj7yKfmnaLpAhXhX3wKHx31Bn4Q6AEIajAl#v=onepage&q=C%2B%2B%20ebook&f=false>

SEMESTER IV

BCA242: Web Technology

Teaching Scheme: Theory: 05 Hrs./Week	Credits 04	Examination Scheme: Continuous Evaluation: 30 Marks End-Semester : 70 Marks
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Prerequisite Courses: BCA – 233 & 236

Companion Course : BCA245 Web Technology Laboratory

Course Objectives:

- To learn PHP programming and database connectivity
- To understand and learn AJAX and XML

Course Outcomes: After completion of this course, learner will be able to

- Develop web based application using suitable client side and server side web technologies.
- Build Dynamic web site using server side PHP Programming and Database connectivity.
- Build applications using AJAX and XML

Course Contents

Unit I	Introduction to PHP	6 Hrs
	<ul style="list-style-type: none"> • HTTP basics, Introduction to web server and web browser • Introduction to PHP • PHP - Lexical structure, Language basics. 	
Unit II	Functions and Arrays	8 Hrs
	<ul style="list-style-type: none"> • Defining and calling a function • Default parameters • Variable parameters, Missing parameters • Variable function, Anonymous function • Indexed Vs Associative arrays • Identifying elements of an array • Storing data in arrays • Multidimensional arrays • Extracting multiple values • Traversing arrays • Sorting Using arrays 	
Unit III	Object Oriented Programming	10 Hrs
	<ul style="list-style-type: none"> • Classes • Objects • Introspection • Serialization • Inheritance • Interfaces • Encapsulation 	
Unit IV	Web Techniques	12 Hrs

- Variables
- Server information
- Processing forms
- Setting response headers
- Maintaining state
- SSL

Unit V	Databases	12 Hrs
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- Using PHP to access a database
- Relational databases and SQL
- PEAR DB basics
- Advanced database techniques

Unit VI	Ajax and XML	12 Hrs
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- Understanding java scripts for AJAX
 - AJAX web application model
 - AJAX –PHP framework
 - Performing AJAX validation
 - Handling XML data using php and AJAX
 - What is XML?
 - XML document Structure
 - PHP and XML
 - XML parser
 - The document object model
 - The simple XML extension
- Changing a value with simple XML

Reference Books

1. Programming PHP By Rasmus Lerdorf and Kevin Tatroe, O'Reilly publication
2. Beginning PHP5, Wrox publication
3. PHP for Beginners, SPD publication

E-Books

1) The Complete Reference – Steven Holzner

<https://books.google.co.in/books?id=bGS4CmJY0I8C&printsec=frontcover&dq=PHP+ebook&hl=en&sa=X&ved=0ahUKEWjl4PuNoKLpAhURwTgGHXadDbYQ6AEIVTAF#v=onepage&q&f=false>

2) Programming PHP – Rasmus Lerdorf , Kevin Tatroe and Peter Macintyre

<https://books.google.co.in/books?id=h-E1IVko-skC&printsec=frontcover&dq=PHP+ebook&hl=en&sa=X&ved=0ahUKEWjl4PuNoKLpAhURwTgGHXadDbYQ6AEIcDAI#v=onepage&q=PHP%20ebook&f=false>

3) Beginner to Intermediate PHP5 – Mario Lurig

<https://books.google.co.in/books?id=noi76uKOJ5wC&printsec=frontcover&dq=PHP+ebook&hl=en&sa=X&ved=0ahUKEWjl4PuNoKLpAhURwTgGHXadDbYQ6AEIMDAB#v=onepage&q&f=false>

4) PHP MySQL, JavaScript & HTML5 – A iley Brand

<https://books.google.co.in/books?id=p9BuBqAAQBAJ&printsec=frontcover&dq=PHP+ebook&hl=en&sa=X&ved=0ahUKEWjl4PuNoKLpAhURwTgGHXadDbYQ6AEIQTAD#v=onepage&q&f=false>

SEMESTER III		
BCA-233: Software Engineering		
Teaching Scheme:	Credits 04	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 35 Marks
Theory: 05 Hrs/Week		
Pre-requisite Course: Knowledge of Programming, Databases		
Course Objectives:		
<ul style="list-style-type: none"> To learn and understand the principles of System and Software Engineering To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements. To learn design processes and software quality parameters 		
Course Outcomes: After successful completion of this course, learner will be able to		
<ul style="list-style-type: none"> Compare and contrast various Software Engineering models Decide on appropriate process model for a developing a software project Classify software applications and Identify unique features of various domains Prepare System Requirement Specification (SRS) for the given problem Design and analyze Data Flow diagrams 		
Course Contents		
Unit I	Introduction to System Engineering	06 Hrs
1.1 Definition 1.2 Basic Components 1.3 Elements of the system 1.4 System Components 1.5 Types of System		
Unit II	Introduction to Software Engineering	10Hrs
2.1 Definition of Software 2.2 Characteristics of Software 2.3 Software Application Domain 2.4 Definition of Software Engineering 2.5 Need for software Engineering 2.6 Mc Call's Quality factors 2.7 The Software Process 2.8 Software Engineering Practice		
Unit III	Software Development Life Cycle (SDLC) and Methodologies	10 Hrs
3.1 Introduction 3.2 Activities of SDLC 3.3 A Generic Process Model 3.4 Prescriptive Process models 3.4.1 Waterfall Model 3.4.2 Incremental Process Models 3.4.3 Evolutionary process Models (Prototyping and Spiral Model) 3.5 Concurrent Models, Types		
Unit IV	Requirement Engineering	10 Hrs
4.1 Introduction 4.2 Requirement Engineering Tasks		

- 4.3 Establishing Groundwork for understanding of Software Requirement
 4.4 Requirement Gathering
 4.5 Feasibility study
 4.6 Fact Finding Techniques

Unit V	Analysis and Design Engineering	10 Hrs
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- 5.1 Decision Tree and Decision Table
 5.2 Data Flow Diagrams (DFD)
 5.3 Data Dictionary
 5.3.1 Elements of DD
 5.3.2 Advantages of DD
 5.4 Input and Output Design
 5.5 PseudoCode
 5.6 Case Studies on above topics

Unit VI	Agile Development	10 Hrs
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- 6.1 Agility
 6.2 Agile Process
 6.2.1 Principles
 6.2.2 The Politics Of Agile Development
 6.2.3 Human Factors
 6.3 Extreme Programming(XP)
 6.4 Adaptive Software Development(ASD)
 6.5 Scrum
 6.6 Dynamic System Development Model (DSDM)

Reference Books

1. Software Engineering : A Practitioner's Approach- Roger S. Pressman, McGraw hill International Editions 2010(Seventh Edition)
2. System Analysis, Design and Introduction to Software Engineering (SADSE) - S. Parthasarthy, B.W. Khalkar
3. Analysis and Design of Information Systems(Second Edition) - James A. Senn, McGraw Hill
4. System Analysis and Design- Elias Awad, Galgotia Publication, Second Edition
5. Fundamentals of Software Engineering- Rajib Mall, PHI Publication, Fourth Edition

E-Books

- 1)Software Engineering and Quality Assurance – Mrs Anuradha A. Puntambekar
<https://books.google.co.in/books?id=r203sZeGhhcC&printsec=frontcover&dq=Software+Engineering+ebook&hl=en&sa=X&ved=0ahUKEwi9wJr-I6LpAhU46nMBHeWQCQwQ6AEINDAB#v=onepage&q&f=false>
- 2)Software Engineering – Bharat Bhushan Agarawal and Sumit Prakash Tayal
<https://books.google.co.in/books?id=CDWRq0B9e5kC&printsec=frontcover&dq=Software+Engineering+ebook&hl=en&sa=X&ved=0ahUKEwi9wJr-I6LpAhU46nMBHeWQCQwQ6AEIVzAF#v=onepage&q&f=false>
- 3) Software Engineering – Jibitesh Mishtre and Ashok Mohanty
<https://books.google.co.in/books?id=YnGz2qhKF-gC&printsec=frontcover&dq=Software+Engineering+ebook&hl=en&sa=X&ved=0ahUKEwi9wJr-I6LpAhU46nMBHeWQCQwQ6AEIaTAH#v=onepage&q&f=false>

SEMESTER IV

BCA244 : C++ Programming Laboratory

Teaching Scheme: Theory: 04 Hrs./Week/Batch	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 35 Marks
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Prerequisite Courses: BCA 112 and BCA 122

Companion Course: BCA 241 Object oriented Programming and C++

Course Objectives:

- To learn principles of Object Oriented Programming (OOP).
- To understand object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism.
- To use the object-oriented paradigm in program design.

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

- Compare and contrast procedural and object oriented programming
- Apply principles of OOP
- Design and develop applications using object oriented programming language C++

Lab Course Contents

Assignment No	Topics for the Assignments	No. Of Sessions
1	Class , Object and methods implementation	02
2	Constructor: Copy Constructor, Default Constructor, Parameterized Constructor	02
3	Memory Allocation: new and delete operators , dynamic constructor	02
4	Inline function, friend function, default argument, Function Overloading, Operator overloading	03
5	Inheritance: Single, multiple, multilevel, hierarchy, Constructor and destructor in derived class	03
6	File Handling: Read, Write, Updating of files using random access	02
Total Number of Sessions per batch		14

SEMESTER IV		
BCA245 : Web Technology Laboratory		
Teaching Scheme: Practical: 04 Hrs./Week/Batch	Credits 02	Examination Scheme: Continuous Evaluation: 15Marks End-Semester: 35Marks
Prerequisite Courses: BCA – 236		
Companion Course: BCA242: Web Technology		
Course Objectives: <ul style="list-style-type: none"> • To get familiar with basics of the Internet Programming. • To acquire knowledge and skills for creation of web site using client and server side programming • To understand process of developing responsive web applications • To explore different web extensions and web services standards 		
Course Outcomes: After successful completion of this course, learners will be able to <ul style="list-style-type: none"> • Design and implement static and dynamic websites using appropriate client side and server side technologies. • Build Dynamic web site using PHP Programming and Database connectivity. • Build applications using AJAX and XML and web services. 		
Lab Course Contents		
Assignment No	Topics for the Assignments	No. Of Sessions
1	PHP Programming	02
2	Use Functions	02
3	Use Arrays	02
4	Use Inheritance and Interfaces	02
5	Accessing Databases (PostgreSQL)	02
6	Use XML and AJAX	04
Total Number of Sessions per Batch		14

SEMESTER IV		
BCA246: Python Programming Laboratory		
Teaching Scheme: Theory: 02Hrs/Week Practical: 04 Hrs/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester: 35 Marks
Prerequisite Course:	BCA – 126, BCA – 234	
Course Objectives:		
<ul style="list-style-type: none"> • To understand programming constructs in Python. • To learn problems solving using Python 		
Course Outcomes: After successful completion of this course, learner will be able to-		
<ul style="list-style-type: none"> • Write programs using Python programming constructs. • Develop applications using Python programming. 		
Course Contents (Theory Sessions)		
Unit I	Introduction to Python Scripting	04 Hrs
1.1 Why Scripting is Useful in Computational Science <ul style="list-style-type: none"> • Classification of Programming Languages • Productive Pairs of Programming Languages • Gluing Existing Applications • Scripting Yields Shorter Code, Efficiency • Type-Specification (Declaration) of Variables • Flexible Function Interfaces • Interactive Computing • Creating Code at Run Time • Nested Heterogeneous Data Structures • GUI Programming • Mixed Language Programming 1.2 When to Choose a Dynamically Typed Language 1.3 Why Python? Script or Program? 1.4 Application of Python		
Unit II	Basic Python	04 Hrs
2.1 Python identifiers and reserved words 2.2 Lines and indentation, multi-line statements Comments 2.3 Input/output with print and input functions, 2.4 Command line arguments and processing command line arguments 2.5 Standard data types - basic, none, Boolean (true & False), numbers 2.6 Python strings 2.7 Data type conversion 2.8 Python basic operators (Arithmetic, comparison, assignment, bitwise logical) 2.9 Python membership operators (in & not in) 2.10 Python identity operators (is & is not) 2.11 Operator precedence		

2.12 Control Statements, Python loops, Iterating by subsequence index, loop control statements (break, continue, pass)	
2.13 Mathematical functions and constants (import math), Random number functions	
Unit III Python String	04 Hrs
3.1 Concept, escape characters	
3.2 String special operations, String formatting operator, Single quotes, Double quotes, Triple quotes, Raw String, Unicode strings, Built-in String methods.	
3.3 Python Lists - concept, creating and accessing elements, updating & deleting lists, basic list operations, reverse	
3.4 Indexing, slicing and Matrices	
Unit IV Python List	04 Hrs
4.1 built-in List functions	
4.2 Functional programming tools - filter(), map(), and reduce()	
4.3 Using Lists as stacks and Queues, List comprehensions.	
Unit V Python tuples and Sets	04 Hrs
5.1 Creating & deleting tuples <ul style="list-style-type: none"> · Accessing values in a tuple · Updating tuples, delete tuple elements 	
5.2 Basic tuple operations <ul style="list-style-type: none"> · Indexing, slicing and Matrices, built-in tuple functions. 	
5.3 Sets - Concept, operations	
Unit VI Python Dictionary	04 Hrs
6.1 Creating and accessing values in a dictionary	
6.2 Updating dictionary, delete dictionary elements	
6.3 Properties of dictionary keys	
6.4 Built-in dictionary functions and methods	
6.5 Defining a function (def)	
6.6 Function arguments - Pass by value, Keyword Arguments, default arguments	
6.7 Documentation Strings	
6.8 Variable Number of Arguments	
6.9 Call by Reference	
6.10 Order of arguments (positional, extra & keyword)	
Reference Books:	
1. Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O„Reilly Publication	
2. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress	
3. Practical Programming: An Introduction to Computer Science Using Python 3, Paul Gries, et al., Pragmatic Bookshelf, 2/E 2014	
4. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python “, Green Tea Press, 2002	
5. Python_tutorial. pdf, python_book_01.pdf	
6. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller	
7 A Beginner’s Python Tutorial: http://en.wikibooks.org/wiki/A_Beginner%27s_Python	
E-Books	

1) Python Programming – John Zelle

<https://books.google.co.in/books?id=aJQILILxRmAC&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjwntzPp6LpAhWQXCsKHb8aACkQ6AEIJzAA#v=onepage&q&f=false>

2) Learning Python – Mark Lutz

<https://books.google.co.in/books?id=4pgQfXQvekcC&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjwntzPp6LpAhWQXCsKHb8aACkQ6AEIMDAB#v=onepage&q=Python%20programming%20ebook&f=false>

3) Programming with Python – Vaibhav Gondaliya

https://books.google.co.in/books?id=LPOrDwAAQBAJ&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEWjBiaDfqKLpAhVHILcAHUJBC204ChDoAQg_MAM#v=onepage&q&f=false

4) A Primer on Scientific Programming with Python – Hans Petter Langtangen

<https://books.google.co.in/books?id=nUzADAAQBAJ&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEWjBiaDfqKLpAhVHILcAHUJBC204ChDoAQh0MAk#v=onepage&q=>

Course Contents (Laboratory Sessions)

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference, one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Assignment No.	Topics for the Assignments	Number of sessions
1	Basic Python	2
2	Python Strings	2
3	Python tuple	1
4	Python Set	2
5	Python Dictionary	2
6	Functions	2
7	Problem definition and the scope of the problem	1
8	Prepare SRS for a given problem	1
9	Design Data Flow Diagrams for the problem	1
Total Number of Sessions per Batch		14

Theory lectures will be conducted for the whole class at a time

Lab Sessions will be conducted for each batch of 12 students separately

End sem practical exam of 35 marks will be conducted based on assignments carried out during lab sessions only

Continuous assessment of 15 marks will be carried out based on performance in both lab and theory sessions

Equivalence of previous SYBCA syllabus with propose SYBCA syllabus

2016 Pattern		2019 Pattern	
Course Code	Course Name	Course Code	Course Name
Semester I			
BCA301	Data Structure	BCA231	Data Structures
BCA302	Advanced Relational Database Management	BCA232	Database Management Systems- II
BCA303	Software Engineering	BCA243	Software Engineering
BCA304	Computer Network	BCA233	Computer Networks
BCA305	Lab I Data Structure	BCA234	Data Structures Laboratory
BCA306	Lab II	BCA235	Database Management Systems Laboratory- II
Semester II			
BCA401	C++	BCA241	Object oriented programming and C++
BCA402	Introduction to Web Technology	BCA242	Web Technology
BCA403	Advanced Networking and Network Security	To be Continued	
BCA404	OOSE	To be Continued	
BCA405	Lab I C++	BCA244	C++ Programming Laboratory
BCA406	Lab II Web Technology	BCA245	Web Technology Laboratory
BCA407	Grid and Cloud Computing	To be Continued	