Department of Computer Science
D.D.U. Gorakhpur University, Gorakhpur

Year wise Structure of B.A. / B.Sc. Computer Application Major

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits
1	I	COA101	Basics of Computer Application	Theory	2
1	I	COA102	Introducing to Computer and PC Software	Theory	4
1	I	COA103	PC Software Lab	Practical	2
1	II	COA104	Problem Solving using Computer	Theory	4
1	II	COA105	Software Lab	Practical	2
2	III	COA201	Object Oriented Programming and C++	Theory	4
2	III	COA202	OOPs Lab	Practical	2
2	IV	COA203	Database Management System	Theory	4
2	IV	COA204	DBMS Lab	Practical	2
3	V	COA301	Data Communication and Computer Networks	Theory	4
3	V	COA302	Internet and Web Technologies	Theory	4
3	V	COA303	Lab on Web Technologies and Computer Networks	Practical	2
3	V	COA304	Research Project I	Project	3
3	VI	COA305	Software Engineering and Project Management	Theory	4
3	VI	COA306	Algorithms and Data Structures	Theory	4
3	VI	COA307	Lab on Algorithms and Data Structures	Practical	2
3	VI	COA308	Research Project II	Project	3

Programme outcomes(POs): Students taking admission to B.A. / B.Sc. program are expected to get prepared with following outcomes:	
PO1	Explaining the basic scientific principles and methods.
PO2	Inculcating scientific thinking and awareness among the student.
Programme Specific outcomes(PSOs)	
PSO1	To prepare students for career in Computer Application and its applications in professional Career.
PSO2	To develop the student to cope up with the advancements in respective fields.
PSO3	The student will determine the appropriate level of technology for use in: a) Experimental design and implementation, b) Analysis of experimental data, and c) Numerical and mathematical methods in problem solutions.
PSO4	Investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry, and illustrate these solutions using symbolic, numeric, or graphical methods.

Year wise Structure of B.A./B.Sc. for Computer Application subject

Programme	Year	Sem.	Paper 1 Theory	credit	Paper 2 Theory	credit	Paper 3 Practical	credit	Research Project	credit	Total Credits of the subject
B.A./B.Sc. I Year	1	I	Basics of Computer Application	2	Introducing to Computer and PC Software	4	PC Software Lab	2	Nil	Nil	8
		II	Problem Solving using Computer	4	--		Software Lab	2	Nil	Nil	6
B.A. / B.Sc. II Year	2	III	Object Oriented Programming and C++	4	--		OOPs Lab	2	Nil	Nil	6
		IV	Database Management System	4	--		DBMS Lab	2	Nil	Nil	6
B.A. / B.Sc. III Year	3	V	Data Communication and Computer Networks	4	Internet & Web Technology	4	Lab on Web Technology & Computer Networks	2	Research Project-I	3	13
		VI	Software Engineering and Project Management	4	Algorithm and Data Structure	4	Lab on Algorithm and Data Structure	2	Research Project-II	3	13
									Total Credits :		**52**

Syllabus for B.A. / B.Sc.
Subject: Computer Application

Programme/Class: **B.A. / B.Sc.**	Year: **First**	Semester: **First**
Subject: **Computer Application**		
Course Code: COA101	Course Title: Basics of Computer Application	

Course outcomes:
After the completion of the course the students will be able to:
1: History and evolution of Computer System, understand hardware components of computer system such as memory system organization, input/output devices, aware of software components of computer system, and windows operating system concepts.
2: Develops basic understanding of computers, the concept of flow chart, algorithm and algorithmic thinking.
3: Develops the ability to analyze a problem, develop an algorithm to solve it.
4: Develops the ability to use office application software through word processing software.
5: To get employment opportunity in the basic of computer area.

Credits: 2	
Unit	**Topic**
I	**KNOWING COMPUTER:** What is Computer, Basic Applications of Computer, Components of Computer System, Concept of Hardware and Software (Application Software Systems software), Concept of computing, data and information.
II	**OPERATING COMPUTER USING GUI BASED OPERATING SYSTEM:** Basics of Operating System, The User Interface (Task Bar, Icons, Menu, running an application), File and Directory Management (Creating and renaming of files and directories), Operating System Simple Setting (Changing System Date and Time, Changing Display Properties, To Add or Remove a Windows Component, Changing Mouse Properties).
III	**UNDERSTANDING WORD PROCESSING AND SPREAD SHEET:** Word Processing Basics, Opening and closing Documents, Text Creation and manipulation, Formatting the Text, Elements of Electronic Spread Sheet, Manipulation of Cells
IV	**WWW and Web Browser** – Internet, world wide web, popular web browsing software, search engines, understanding url.

Suggested Readings:
1. P.K. Sinha & Priti Sinha, "Computer Fundamentals", BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
Suggestive digital platforms web-links-
https://www.pearsoned.co.in/prc/book/anita-goel-computer-fundamentals-1e-1/9788131733097

Programme/Class: **B.A. / B.Sc.**	Year: **First**	Semester: **First**

Subject: **Computer Application**		
Course Code:COA102	Course Title: Introducing to Computer and PC software	

Course outcomes:
After the completion of the course the students will be able to:
1: Understand hardware components of computer system such as memory system organization, input/output devices, aware of software components of computer system, and windows operating system concepts.
2: Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
3: Develops the ability to analyze a problem, develop an algorithm to solve it.
4: To get employment opportunity in the area of computer software.

Credits: 4	
Unit	**Topic**
I	**Introduction to computers** – Definition, Characteristics, Generation, Applications, Classifications, Hardware, Software, Computer Arithmetic & Number System, Decimal, Binary, Octal & Hexadecimal System. Arithmetic Operations on Binary Numbers. ASCII, EBCDIC, BCD codes, Fixed point & floating point representation of numbers. **Computer Organization & Architecture** – Memory hierarchy, Primary Memory - memory unit, SRAM, DRAM, SDRAM, RDRAM, Flash memory. Secondary storage devices- Magnetic Disk, Floppy Disk, Optical Disk, Magnetic Drum , Input Devices, Output Devices.
II	**Software** – Introductory ideas of System Software, Application Software, Operating System, Translators, Interpreters, Compilers, Assemblers, Generation of Languages. **Operating System**: Definition, Introductory ideas of single user and multi-uer operating system, Time sharing, multitasking, multiprogramming, Batch Processing, on-line processing, spooling.
III	**Microsoft Office: Word Processing Software**–file menu, edit menu, view menu, insert menu, format menu, tools menu table menu, alignment of text, applying fonts, working with wizards, size of text, font of the text, color of the text.
IV	**Microsoft Excel for windows**– understanding spreadsheets, file menu, edit menu, view menu, insert menu, format menu, tools menu, data menu, creating a Worksheet in Excel for windows, copying formula, formulas that make decisions, functions in Excel, sum function, average function, function wizard, functions in Excel, Date and time functions, logical functions, creating charts in Excel, creating graphs, modifying chart, adding data to a chart,
V	**PowerPoint for windows**– file menu, edit menu, view menu, insert menu, format menu, tools menu, slide show menu, creating presentation by AutoContent Wizard, creating a new presentation entering the text, moving the text, reordering slides, duplicating slides, deleting slides, making slide shows, adding effects, adding animation, creating your own animation,

Suggested Readings:
1. P.K. Sinha & Priti Sinha, "Computer Fundamentals", BPB Publications,2007.
2. V. Rajaraman, "Fundamentals of Computers", PHI publications, 2015.
3. Dr. Anita Goel, Computer Fundamentals, Pearson Education,2010.
   Suggestive digital platforms web-links-
   https://www.pearsoned.co.in/prc/book/anita-goel-computer-fundamentals-1e-1/9788131733097

Programme/Class: **B.A. / B.Sc.**	Year: **First**	Semester: **First**
	Subject: Computer Application	
Course Code: COA103	**Course Title: PC Software Lab**	

Course outcomes:
After the completion of the course the students will be able to:
1: Understand hardware components of computer system such as memory system organization, input/output devices, aware of software components of computer system, andwindows operating system concepts.
2: Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
3: Develops the ability to analyze a problem, develop an algorithm to solve it.
4: To get employment opportunity in the area of computer software.

<div align="center">Credits:2</div>

Lab exercises on PC Software lab –
Working with MS-Word: Prepare a word document with various formatting tools and tables,
Working with MS-Excel: Prepare worksheets, use of formulae, Prepare Tables and Charts (Pi-chart, Bar-chart), Insert pictures in a worksheet,
Working with Power Point: Prepare Power Point presentation with various features of animations and sounds etc.
 Various assignments can be given to students related to these packages.

Programme/Class: **B.A. / B.Sc.**	Year: **First**	Semester: **Second**

Subject: **Computer Application**		
Course Code:COA104	Course Title: Problem Solving using Computer	

Course outcomes:
After the completion of the course the students will be able to:
1: Understand hardware components of computer system such as memory system organization, input/output devices, aware of software components of computer system, and windows operating system concepts.
2: Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
3: Develops the ability to analyze a problem, develop an algorithm to solve it.
4: To get employment opportunity in the field of programming.

Credits:**4**

Unit	Topic
I	Overview of Programming – Introduction to Computer Based problem Solving, requirements of Problem Solving by the Computer, Programs & Algorithms & Flow Charts. An Overview of C, Structure of C Program, Storage class specifier & data types, Construct and variable declaration, operator & expression.
II	Program Control Statements – True and false in C, C statements, Conditional Statements, if, switch, for, while, do/while, break, exit (), continue, goto. Basic I/O : Formatted and unformatted input/output, Functions Return statement, local & global variables, Scope rule of functions, function arguments, parameters passing – call-by-value, call-by- reference, function prototypes, function call with array, recursion, implementation issue.
III	Arrays, declaration, one- & two-dimensional array, multidimensional arrays. Advanced Features in C – Pointers, pointers variables, pointers operators, pointer expression, dynamic allocation function – malloc (), free (), calloc(), Initialising pointers, pointers to function, pointers and arrays.
IV	Structures, Unions and user defined variables - Basics of structure, declaration of structure, Array of structure, passing structure to function, structure pointers, and nested structure. File Management – Stream and files, Console I/O, file pointer, file management functions.
V	Data Structures – Basic concept of data representation, algorithm design and data structure. Overview of arrays, linked list, stack and queue.

Suggested Readings:
1. Herbert Schildt, "C: The Complete Reference", McGraw Hill Education India.
2. Kanetkar Yashavant, "Let Us C", BPB Publications.
3. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education India.

Programme/Class: **B.A. / B.Sc.**	Year: **First**	Semester: **Second**
Subject: Computer Application		
Course Code: COA105	**Course Title: Software Lab**	

Course outcomes:
After the completion of the course the students will be able to:
1: Understand hardware components of computer system such as memory system organization, input/output devices, aware of software components of computer system, and windows operating system concepts.
2: Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
3: Develops the ability to analyze a problem, develop an algorithm to solve it.
4: To get employment opportunity in the field of programming.

Credits:**2**

Sample Programs

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
2. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria:
   Grade A: Percentage>=80
   Grade B: Percentage>=70 and <80
   Grade C: Percentage>=60 and <70
   Grade D: Percentage>=40 and <60
   Grade E: Percentage<40
3. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
4. WAP to display the first n terms of Fibonacci series.
5. WAP to find factorial of the given number.
   Similar programming exercises based on the syllabus.

Programme/Class: **B.A. / B.Sc.**	Year: **Second**	Semester: **Third**
Subject: **Computer Application**		
CourseCode:COA201	Course Title: Object Oriented Programming and C++	

Course outcomes:
After the completion of the course the students will be able to:
1. Understands the basic concepts of OOPs.
2. Design class & object diagrams for real world applications.
3. Formulate OOPs concepts like encapsulation, inheritance, polymorphism and dynamic binding to implement C++ programs.
4. To get employment opportunity in the field of real world programming.

Credits:**4**	
Unit	**Topic**
I	Introduction to Object Oriented Concept : Overview of object oriented system, Abstract data Types, Inheritance, Polymorphism, Object Identity, Object Modeling Concepts, Object Oriented Design, Object Oriented Programming Languages, Object Oriented Database.
II	C++ Programming Language: Overview of C++, Programming Paradigm, Support For Data Abstraction, Support for Object Oriented Programming, Declaration and Constants, Expression and Statement, Function and Files: Linkages, How to Make a Library, Functions.
III	Classes and Objects : Definition of Class, Class Declaration, Class Function Definition, Member Function definition inside and outside the class declaration, Scope resolution operator(: :),Private and Public member function, Nesting member function, Creating Objects, Accessing Class data members, Accessing member functions, Arrays of Objects, Objects as function arguments.
IV	Operator Overloading: Operator Function, User Defined Type Conversion, Litreral, large objects, Assignments and Initialisation, subscripting, function call, dereferencing, increment and decrement, A string Class, Friends and members. Inheritance through Extending Classes: Concept of Inheritance, Base Class, Derived Class, Defining derived classes, Visibility modes, single inheritance.
V	Streams, Templates and Design of Libraries: Output, Input, Formatting, Files and Streams, C-I/O, Design of Libraries.

Suggested Readings:
1. Grady Booch, "Object-Oriented Analysis and Design with Applications (3rd Edition)", PERSON publication.
2. Herbert Schildt, "C++: The Complete Reference", McGraw Hill Education India.
3. E. Balagurusamy, "Object Oriented Programming in C++", McGraw Hill Education India.

Programme/Class: **B.A. / B.Sc.**	Year: **Second**	Semester: **Third**
Subject: **Computer Application**		
Course Code: COA202	**Course Title: OOPs Lab**	

Course outcomes:
   1. To learn and understand C++ programming basics.
   2. To learn and understand C++ functionalities.
   3. To learn and know the concepts of encapsulation, inheritance, polymorphism, and dynamic
      binding, etc.
   4. To get employment opportunity in the field of real world programming.		

Credits:**2**		

OOPs Lab

Write program in 'C++' language.
1. Using input and output statements.
2. Using control statements.
3. Using functions.
4. Using array.
5. Using Classes and implementation of Constructor and Destructor.
6. Using files.
7. Using OOPS Concept Inheritance.
8. Using OOPS Concept Polymorphism
9. Using OOPS Concept Encapsulation
10. Using OOPS Concepts Friend and Static Functions.
Note: Program should be fully documented with simple 1/0 data. Flow charts should be developed wherever necessary.

Programme/Class: **B.A. / B.Sc.**	Year: **Second**	Semester: **Fourth**
Subject: **Computer Application**		
CourseCode:COA203	Course Title: **Database Management System**	

Course outcomes:

After the completion of the course the students will be able to:
1. Understands the basic concepts of database management systems.
2. To get employment opportunity in the area of DBMS.
3. Formulate relational algebraic expressions using relational data models and languages.
4. Apply normalization transaction properties and concurrency control to design database.

Credits:**4**

Unit	Topic
I	Overview of Database Management – File oriented approach versus database oriented approach to data management, Disadvantage of file oriented approach Data Independence, DBA and its role, DBMS architecture, Different types of DBMS users, Data dictionary and its contents, Types of Database Languages, Different Type of Data Models
II	Relational Model - Definition of relational model, concept of keys, candidate key, Primary key, Foreign key, Fundamentals integrity rules, Relational Algebra. Database Design – E – R model as a tool for conceptual design, entities, attributes and relationship E R diagram, strong and weak entities,
III	Normalization concept in relational model, Functional dependencies, Normal Forms (1 N F, 2 N F, 3 N F, B C N F, 4 N F). SQL – SQL Construct, (SELECT - - - FROM - - - WHERE - - - GROUP BY - - - HAVING - - - ORDER BY), INSERT, DELETE, UPDATE, VIEW, definition & use, Nested Queries.
IV	FoxPro – Introduction to FoxPro, Database Construction, searching, sorting, indexing, Updation, Reports, Screen Designing, Programming Concepts, Managing numbers & date. Case Studies - Inventory control system, Payroll Processing etc.

Suggested Readings:
1. Paul Du Bois, "MySQL Cookbook: Solutions for Database Developers and Administrators," Third Edition, O' Reilly Media, 2014.
2. FrankM.Kromann,"BeginningPHPandMySQL:FromNovicetoProfessional,"FifthEdition,A press, 2018.
3. JoelMurachandRayHarris,"Murach'sPHPandMySQL,"FirstEdition,MikeMurach&Associates,2010.
4. Luke Welling, Laura Thomson, "PHP and MySQL Web Development," Fourth Edition, Addison-Wesley, 2008.

Programme/Class: **B.A. / B.Sc.**	Year: **Second**	Semester: **Fourth**
Subject: Computer Application		
Course Code: COA204	Course Title: DBMS Lab	

Course outcomes:
After the completion of the course the students will be able to:
1. Understands the basic concepts of database management systems.
2. To get employment opportunity in the area of DBMS.
3. Formulate relational algebraic expressions using relational data models and languages.
4. Apply normalization transaction properties and concurrency control to design database

Credits:**2**

Software Lab based on Database Management Systems

Note: PHP/MySQL may be used

List of Experiments
1. Creation of databases and execution of SQL queries.
2. Creation of Tables using MySQL: Data types, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables.
3. Practicing DML commands- Insert, Select, Update, Delete.
4. Practicing Queries using ANY, ALL, IN, EXISTS, NOT, EXISTS, UNION, INTERSECT, and CONSTRAINTS, etc.
5. Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUPBY, HAVING, VIEWS Creation and Dropping.
6. Use of COMMIT, ROLLBACK and SAVEPOINT.

Programme/Class: **B.A. / B.Sc.**	Year: **Third**	Semester: **Fifth**

Subject: **Computer Application**		
CourseCode:COA301	Course Title: **Data Communication and Computer Networks**	

Course outcomes:

After the completion of the course the students will be able:
1. To develop understanding of computer networks and communication basics.
2. To understand design issues and services at different layers of reference models.
3. To learn various error detection/correction techniques, routing protocols, congestion control algorithms, and connection establishment/release.
4. To get employment opportunity in the field of Networking and Communication.

Credits: **4**	
Unit	**Topic**
I	**Computer Communication & Network:** Data Communication, Data Transmission : Serial and Parallel, Modes of Data Transmission : Asynchronous and synchronous, Time and Frequency Domain, Composite Signals
II	**Types of Transmission :** Analog and Digital, Types of Transmission System : Simplex, Half – Duplex and Full – duplex, Communication Media, Modems, Data Multiplexers, Computers Networks, Server, Transmission Technology, Local Area Network, Topologies : Star, Ring, Bus, Wide Area Networks, MAN, OSI Models of ISO, Network Protocols : SPX/IPX TCP/IP.
III	**Telnet :** Remote Login, Telnet Protocols, Basic Concepts, Telnet Clients : Windows 98/95 Telnet Program, Hyper terminal, Unix for Telnetting , Terminal Emulation.
IV	**Management of a LAN**: – LAN, Definition and usage, Major components, architecture, initiation to Novell Netware, IPX command, Changing Drives, Logging in , Giving passwords, changing password, Logging out, Login Restriction, LAN Community, Regular user, User group, operator & Supervisor, Storing of files, Network drives, Map command, Network rights, File management, Netware Rescue, Filter utility, Access method, Login scripts.

Suggested Readings:
1. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks, "5th Edition, Pearson, 2014.
2. William Stallings, "Data and Computer Communications", 10th Edition, Pearson, 2013.
3. Behrouz A. Forouzan, "Data Communications and Networking," 4th Edition, McGraw-Hill Higher Education, 2007

Programme/Class: **B.A. / B.Sc.**	Year: **Third**	Semester: **Fifth**
Subject: **Computer Application**		
CourseCode:COA302	Course Title : **Internet and web Technologies**	

Course outcomes:
After the completion of the course the students will be able to:
1. Understand the Internet.
2. Understanding the World Wide Web.
3. Understanding the Internet Security
4. To get employment in the field of emerging area of Internet & web technologies.

Credits: **4**

Unit	Topic
I	**Internet** – evolution, Applications, Technologies, Working, Clients & Servers, Internet Services, Online Services, TCP/IP, Getting Connected, Different type of connections, ISP, Address in internet, intranets.
II	**E – mail** – E-mail basics, E – mail networks, Protocols, working, Format of an E-mail message, Basic E – mail functions, E-mail clients – Netscape messenger, outlook express, E-mail security, FTP – The file transfer protocol introduction and basic procedure, Types of FTP Servers, FTP Software, Command Driven clients and GUI – driven Clients, FTP with web Browsers.
III	**World Wide Web (WWW) –** Evolution, Basic features. Clients & servers, URL, HTTP, HTML, XML, multimedia, WWW Browsers, WWW Servers, using a Web Browser eg. Internet Explorer.
IV	**Web Publishing** – Website planning, Publishing Tools, The Front Page Solution, HTML – Designing and decoration of web pages using HTML's basic features in different style & Looks.
V	**Internet Security –** Need, Web Search engine, web meta searcher, web search Agents, E-mail Threats, Firewall, Firewall Architecture, Choosing a suitable Firewall.

Suggested Readings:
1. Reeta Sahoo, **"Web Technologies",** New Sarswati House Publication.
2. Uttam Kumar Roy "**Web Technologies**", Oxford University Press.

Programme/Class: **B.A. / B.Sc.**	Year: **Third**	Semester: **Fifth**
Subject: Computer Application		
Course Code: COA303	Course Title: Lab on Web Technologies and Computer Network	

Course outcomes:

After the completion of the course the students will be able to:
1. To develop understanding of computer networks and communication basics.
2. Understanding the World Wide Web and Internet Security.
3. To get employment opportunity in the field of Networking and Internet.

Credits:**2**

Lab based on Computer Networks:
1. Simulate Checksum Algorithm.
2. Simulate CRC Algorithm
3. Simulate Stop& Wait Protocol.
4. Simulate Go-Back-N Protocol.
5. Simulate Selective Repeat Protocol.

Lab based on Internet and Web technologies:
6. Programming exercises on HTML programming: Page designing, Text formatting, table creation, Form designing.
7. Understanding email creation and uses.
8. Understanding Web Publishing
9. Establishing Internet connection

Programme/Class: **B.A. / B.Sc.**	Year: **Third**	Semester: **Six**

Subject: **Computer Application**		

Course Code: COA305	Course Title: Software Engineering and Project Management

Course outcomes:

After the completion of the course the students will be able to:

1. Upon the completion of this course the student will have the knowledge of software design and development concepts.
2. He would be able to choose and design suitable software development for real world problems.
3. He can appropriately use software development tools to develop application software.
4. To get employment opportunity in the field of software engineering and project management.

Credits: **4**

Unit	Topic
I	**Introduction:** Characteristics, Components. Applications, Software Development Lifecycle Models: Waterfall, Iterative Waterfall, Spiral. Prototyping, incremental development, Fourth Generation Techniques, Concepts of Project Management, Role of Metrics & Measurements.
II	**Software Analysis:** Principles of Structured & Object Oriented Analysis, Requirement analysis, DFD, Entity Relationship diagram, Data dictionary, **Software Design:** Objectives, Principles; Concepts, Design methodologies: Data design, Architectural Design, procedural design, Object -oriented concepts.
III	**Software Project Planning:** Objectives, Decomposition techniques: S/W Sizing, Problem-based estimation, Process based estimation. Cost Estimation Models: COCOMO Model, the S/W Equation, and System, Budgeting, Capital Budgeting, Net present value (NPV). ROI (Rate Of Interest), Payback Models.
IV	**Software Configuration Management:** Baseline, Software Configuration Items (SCI). Software Configuration Management Process. Identification of Objects in the Software Configuration. Version Control, Change Control, Configuration Audit, Status Reporting, Goals of SCM.
V	**Project Closure and Software Quality Assurance:** Goals of SQA, FTR (Formal Technical Review), Standards and Procedures, SQA activities, Software Qualities – Reliability, Maintainability, Transportability, Interoperability, Efficiency, Creating a SQA plan. Project Closure Analysis, Role of Closure Analysis, Closure Analysis Report.

Suggested Readings:
1. Roger S. Pressman, Bruce R. Maxim, "Software Engineering: A Practitioner's Approach", McGraw-Hill Education, 2014.
2. Ronald J. Leach, "Introduction to Software Engineering", CRC Press, 2018.
3. B. B. Agarwal, S. P. Tayal, Mahesh Gupta, "Software Engineering and Testing", Jones & Bartlett Learning, 2010

Programme/Class: **B.A. / B.Sc.**	Year: **Third**	Semester: **Sixth**

Subject: **Computer Application**

Course Code: COA306	Course Title: **Algorithm and Data Structures**

Course outcomes:

After the completion of the course the students will be able to:
1: Understand that various problem solving categories exist such as; iterative technique, divide and conquer, dynamic programming, greedy algorithms, and understand various searching and sorting algorithms.
2: Employ a deep knowledge of various data structures when constructing program.
3: Design and construct simple object-oriented software with an appreciation for data abstraction and information hiding.
4: To get employment opportunity in the field of software development tools including libraries, compilers, editors, linkers and debuggers to write and troubleshoot programs.

Credits: **4**

Unit	Topic
I	**Introduction**: Basic Design and Analysis techniques of Algorithms, time and space complexity, Correctness of Algorithm, Algorithm Design Techniques: Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms.
II	**Searching Techniques & Sorting Techniques**: Linear and Binary search, Elementary sorting techniques: Bubble Sort, Insertion Sort, Merge Sort, Heap Sort, Quick Sort.
III	**Stacks and Queues:** Implementing stack using array and linked list, Array and Linked representation of Queue.
IV	**Linked Lists:** Singly, Doubly and Circular Lists, representation of Stack and Queue as Linked Lists.
V	**Trees and Graph**: Introduction to Tree and Graph as a data structure, Binary Trees, Binary Search Tree,(Creation, and Traversals Trees), Type of Graph, Spanning tree of Graph.

Suggested Readings:
1. Cormen T. H., Leiserson Charles E., Rivest Ronald L., Stein Clifford, Introduction to Algorithms, PHI Learning Pvt. Ltd., 2009, 3rd Edition.
2. Basse Sara & A.V. Gelder, Computer Algorithm: Introduction to Design and Analysis, Pearson, 2000, 3rd Edition.
3. Tenenbaum Aaron M., Augenstein Moshe J., Langsam Yedidyah, "Data Structures Using C and C++, PHI, 2009, Second edition.
4. Kruse Robert L., "Data Structures and Program Design in C++", Pearson.
5. **Suggestive digital platforms web links or online course-**

   https://www.oercommons.org/authoring/14873-data-structure/view

   https://www.oercommons.org/courses/data-structure-and-algorithms

Programme/Class: **B.A. / B.Sc.**	Year: **Third**	Semester: **Sixth**
Subject: **Computer Application**		
Course Code: COA307	Course Title: **Lab on Algorithm and Data Structures**	

Course outcomes:

After the completion of the course the students will be able to:
1: Understand that various problem solving categories exist such as; iterative technique, divide and conquer, dynamic programming, greedy algorithms, and understand various searching and sorting algorithms.
2: Employ a deep knowledge of various data structures when constructing program.
3: Design and construct simple object-oriented software with an appreciation for data abstraction and information hiding.
4: To get employment opportunity in the field of software development tools including libraries, compilers, editors, linkers and debuggers to write and troubleshoot programs

Credits:**2**

Practical List on Analysis of Algorithms and Data Structures:

1. Write a program that uses functions to perform the following:
   a) Create a singly linked list of integers.
   b) Delete a given integer from the above linked list.

2. Write a program that uses functions to perform the following:
   a) Create a doubly linked list of integers.
   b) Delete a given integer from the above doubly linked list.

3. Write program to implement a double ended queue using
   i)   Array.
   ii)   Linked list.

4. Write a program that uses functions to perform the following:
   a) Create a binary search tree of characters.
   b) Traverse the above Binary search tree recursively in different orders.

5. Write program for implementing the searching methods.

6. Write program to implement Sorting.

Research Project Guidelines for V and VI Semester

1. **Objectives of the Project**
- To facilitate the student to independently formulate and solve a social, philosophical,commercial, or technological problem and present the results in written and oral form.
- To render students to the real life problems.
- To provide opportunities to students to interact with people and present themconfidently.
- A student can work on given project in group as well as independently.

2. **Types of Project**
The students are expected to work on:
(1) Application Oriented Project or
(2) Research Oriented Project.

#The rules for examinations for programme and courses will be according to the University Guidelines decided by time to time.