NATIONAL EDUCATION POLICY-2020

Common Minimum Syllabus for all Uttarakhand State Universities and Colleges for First Three Years of Higher Education

PROPOSED STRUCTURE OF
UG – BACHELOR OF COMPUTER APPLICATION
SYLLABUS

2021

Curriculum Design Committee, Uttarakhand

Sr.No.	Name & Designation	
1.	**Prof. N.K. Joshi** Vice-Chancellor , Kumaun University Nainital	Chairman
2.	**Prof. O.P.S. Negi** Vice-Chancellor , Uttarakhand Open University	Member
3.	**Prof. P. P. Dhyani** Vice-Chancellor , Sri Dev Suman Uttarakhand University	Member
4.	**Prof. N.S. Bhandari** Vice-Chancellor, Soban Singh Jeena University Almora	Member
5.	**Prof. Surekha Dangwal** Vice-Chancellor, Doon University, Dehradun	Member
6.	**Prof. M.S.M. Rawat** Advisor, Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand	Member
7.	**Prof. K. D. Purohit** Advisor, Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand	Member

Syllabus Developed By

S.No.	Name	Designation	Department	Affiliation
1.	Dr. Ashish Mehta	Associate Professor, Convener & Head	Department of Computer Science	D. S. B. Campus, Kumaun University, Nainital

Syllabus Moderated By

S.No.	Name	Designation	Department	Affiliation
2.	Dr. Ashish Mehta	Associate Professor, Convener & Head	Department of Computer Science	D. S. B. Campus, Kumaun University, Nainital
3.	Dr. Ashutosh Kumar Bhatt	Associate Professor	School of Computer Sciences & Information Technology	Uttarakhand Open University
4.	Dr. Jeetendra Pande	Associate Professor	School of Computer Sciences & Information Technology	Uttarakhand Open University
5.	Dr. Parul Saxena	Assistant Professor	Department of Computer Science	S.S.J. University, Almora
6.	Dr. Manoj Kumar Bisht	Assistant Professor	Department of Computer Science	S.S.J. University, Almora

Semester-wise Titles of the Papers in Computer Science					
Year	**Semester**	**Course Code**	**Course Title**	**Theory /Practical**	**Credits**
Certificate in Computer Application					
First Year	I		Introduction to C Language	Theory	4
			Basic Mathematics	Theory	4
			Elective Paper [one from the list] E1	Theory	4
			Communicative English	Theory	4
			LAB: (C and UNIX)	Practical	2
			Minor Elective Paper [one from the list] EL1*	Theory	4
	II		Introduction to C++	Theory	4
			Data Structures	Theory	4
			Elective Paper [one from the list] E2	Theory	4
			Digital Electronics	Theory	4
			LAB: (C++)	Practical	2
			Minor Elective Paper [one from the list] EL1*	Theory	4
Diploma in Computer Application					
Second Year	III		Programming in Python	Theory	4
			Organizational Behavior	Theory	4
			Elective Paper [one from the list] E3	Theory	4
			Computer System Architecture	Theory	4
			LAB: (Python)	Practical	2
			Minor Elective Paper [one from the list] EL2**	Theory	4
	IV		Introduction to Database System	Theory	4
			Operating System and System Administration	Theory	4
			Elective Paper [one from the list] E4	Theory	4
			Numerical Analysis and Statistical Technique	Theory	4
			LAB: (DBMS)	Practical	2
			Minor Elective Paper [one from the list] EL2**	Theory	4
Bachelor of Computer Application					
Third Year	V		Digital Communication and Networks	Theory	4
			Programming in JAVA	Theory	4
			Elective Paper [one from the list] E5	Theory	4
			Computer Graphics	Theory	4
			LAB: (Programming in JAVA)	Practical	2
	VI		Artificial Intelligence	Theory	4
			Web Technologies	Theory	4
			Elective Paper [one from the list] E6	Theory	4
			C# and .NET Framework	Theory	4
			LAB: (C# and Web Technologies)	Practical	2

List of Core/Compulsory Courses					
S. No.	**Course Code**	**Course Title**	**Theory/ Practical**	**Credits**	**To be Opted in the Semester**
1		Introduction to C Language	Theory	4	I
2		Basic Mathematics	Theory	4	I
3		Communicative English	Theory	4	I
4		LAB : (C and UNIX)	Practical	2	I
5		Introduction to C++	Theory	4	II
6		Data Structures	Theory	4	II
7		Digital Electronics	Theory	4	II
8		LAB : (C++)	Practical	2	II
9		Programming in Python	Theory	4	III
10		Organizational Behavior	Theory	4	III
11		Computer System Architecture	Theory	4	III
12		LAB: (Python)	Practical	2	III
13		Introduction to Database System	Theory	4	IV
14		Operating System	Theory	4	IV
15		Numerical Analysis and Statistical Technique	Theory	4	IV
16		LAB: (DBMS)	Practical	2	IV
17		Digital Communication and Networks	Theory	4	V
18		JAVA	Theory	4	V
19		Computer Graphics	Theory	4	V
20		LAB : (JAVA)	Practical	2	V
21		Artificial Intelligence	Theory	4	VI
22		Web Technologies	Theory	4	VI
23		C# and .NET Framework	Theory	4	VI
24		LAB: (C# and Web Technologies)	Practical	2	VI

Elective Papers (for BCA Students)			
List of Elective Papers E1			
S. No.	**Course Code**	**Course Title**	**To be Opted in the Semester**
1		Information System for Business	I
2		Druple - Content Management System (SWAYAM) https://onlinecourses.swayam2.ac.in/aic20_sp07/preview	I
3		E-Commerce Technologies (SWAYAM) https://onlinecourses.swayam2.ac.in/cec22_mg05/preview	I
List of Elective Papers E2			
S. No.	**Course Code**	**Course Title**	**To be Opted in the Semester**
1		Discrete Mathematics	II
2		Moodle Learning Management System (SWAYAM) https://onlinecourses.swayam2.ac.in/aic20_sp27/preview	II
3		Open-Source Software (ePG Pathshala) https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=iLkSuZZ 5a+koxhsE1m+YjQ==	II
List of Elective Papers E3			
S. No.	**Course Code**	**Course Title**	**To be Opted in the Semester**
1		Operational Research	III
2		R Programming (SWAYAM) https://onlinecourses.swayam2.ac.in/aic20_sp35/preview	III
3		Cryptography and Network (ePG Pathshala) https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQ KJvP3a/8Vd3L08tQ==	III
List of Elective Papers E4			
S. No.	**Course Code**	**Course Title**	**To be Opted in the Semester**
1		Introduction to Cyber Security	IV
2		Data Mining (SWAYAM) https://onlinecourses.swayam2.ac.in/cec22_cs06/preview	IV
3		Data Analytics (ePG Pathshala) https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQ KJvP3a/8Vd3L08tQ==	IV

List of Elective Papers E5			
S. No.	**Course Code**	**Course Title**	**To be Opted in the Semester**
1		Cloud Computing	V
2		Cyber Security Tools Techniques and Counter Measures (SWAYAM) https://onlinecourses.swayam2.ac.in/nou22_ge24/preview	V
3		Android Mobile Application Development (SWAYAM) https://onlinecourses.swayam2.ac.in/nou22_ge25/preview	V
List of Elective Papers E6			
S. No.	**Course Code**	**Course Title**	**To be Opted in the Semester**
1		Software Engineering	VI
2		Digital Forensics (SWAYAM) https://onlinecourses.swayam2.ac.in/nou22_cs05/preview	VI
3		Basics of Remote sensing, GIS & GNSS technology and their applications (SWAYAM) https://onlinecourses.swayam2.ac.in/aic22_ge16/preview	VI

Elective Papers (for Students of Other Faculty)			
***List of Elective Papers EL1**			
S. No.	**Course Code**	**Course Title**	**To be Opted in the Semester**
1		Information System for Business	I
2		Open-Source Software (ePG Pathshala) https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=iLkS uZZ5a+koxhsE1m+YjQ==	I/II
3		Introduction to Cyber Security (SWYAM) https://onlinecourses.swayam2.ac.in/nou19_cs08/preview	I/II
4		Skill Development of the youths and their Livelihood (SWYAM) https://onlinecourses.swayam2.ac.in/nou22_ge30/preview	I/II
****List of Elective Papers EL2**			
S. No.	**Course Code**	**Course Title**	**To be Opted in the Semester**
1		Programming in Python	III
2		E-Commerce Technologies (SWYAM) https://onlinecourses.swayam2.ac.in/cec22_mg05/preview	III/IV
3		Cyber Security Tools Techniques and Counter Measures (SWYAM) https://onlinecourses.swayam2.ac.in/nou22_ge24/preview	III/IV
4		Druple - Content Management System(SWAYAM) https://onlinecourses.swayam2.ac.in/aic20_sp07/preview	III/IV

Programme Prerequisites:

1. To study Computer Science, a student must have had the subject Mathematics learnt at 10+2 level with 50% minimum passing marks/grade (overall and in mathematics).
2. Keen interest Computer Science & Technology
3. Skills and aptitude for scientific study and research
4. Creativity and good comprehension while working on scientific procedures and research

Programme Introduction

Computer Science is the study of computers and technology. Computers have been shaping the future of mankind with the great surge in technologies like machine learning and IoT in the last decade. The curriculum of our subject aims to provide any pupil in the course to understand the architecture, theory, and math behind the technologies that drive our modern world forward.

BCA in Computer Science facilitate the knowledge about the science behind computers and provide a platform to develop skills like programming, networking, and database administration. It also focuses on the ethics of developing and working with new technologies by providing strong arguments for green computing, security, and user privacy protection.

Programme outcomes (POs):	
PO 1	Gain a complete exposure to the theories and practices of Computer science.
PO 2	Get transformed into a skilled learner and active programmer, enabling the students to focus on their higher studies.
PO 3	Value computer professionals and programmers.
PO 4	Explore how the concepts and applications of Computer science lead to innovative thinking with a problem-solving attitude.
Programme specific outcomes (PSOs) Certificate in Computer Application	
PSO 1	Develop and maintain problem-solving skills.
PSO 2	Communicate Efficiently and with Confidence in English.
PSO 3	Understand concepts of data organization.
PSO 4	Solve trivial problems using programming languages.
Programme specific outcomes (PSOs) Diploma in Computer Application	
PSO 1	Remember the aspects of behavior people in an organization.
PSO 2	Understand, create and maintain Relational Databases.
PSO 3	Explore real-world problems, develop solutions using Computer.
PSO 4	Familiarize with the importance of ethical hacking, its tool and ethical hacking process.
Programme specific outcomes (PSOs)	

Bachelor of Computer Application	
PSO 1	Understand, analyze and develop computer programs in the areas related to algorithm, web design and networking for efficient design of computer-based system.
PSO 2	To view the real-world problems from the spectacles of conceptual knowledge of Computer Science and to develop their solutions in a technical oriented way
PSO 3	Apply standard software engineering practices and strategies in software project development using open-source programming environment to deliver a quality of product for business success.
PSO 4	Work in the IT sector as system engineer, software tester, junior programmer, web developer

Year wise Structure of B.C.A (CORE / ELECTIVE COURSES & PROJECTS)

Subject: Computer Application

Programme	Year	Sem	Paper I	Credit /hrs	Paper 2	Credit /hrs	Paper 3	Credits /hrs	Paper 4	Credits /hrs	Paper 5	Credits /hrs	Elective Paper	Credits /hrs	Research Project	Credits / hrs
Certificate in Computer Application	I	I	Introduction to C Language	4/60	Basic Mathematics	4/60	Elective Paper [from the list] E1	4/60	Communicative English	4/60	Lab: (C and Unix)	2/60	Minor Elective Paper [one from the list] EL1*	4/60		
		II	Introduction to C++	4/60	Data Structures	4/60	Elective Paper [from the list] E2	4/60	Digital Electronics	4/60	Lab: (C++)	2/60				
Diploma in Computer Application	II	III	Programming in Python	4/60	Organizational Behavior	4/60	Elective Paper [from the list] E3	4/60	Computer System Architecture	4/60	Lab: (Python)	2/60	Minor Elective Paper [one from the list] EL2**	4/60		
		IV	Introduction to Database System	4/60	Operating System	4/60	Elective Paper [from the list] E4	4/60	Numerical Analysis and Statistical Technique	4/60	Lab: (DBMS)	2/60				
Bachelor of Computer Application	III	V	Digital Communication and Network	4/60	JAVA	4/60	Elective Paper [from the list] E5	4/60	Computer Graphics	4/60	Lab: (JAVA)	2/60			Industrial Training / Research Project	Qualifying
		VI	Artificial Intelligence	4/60	Web Technologies	4/60	Elective Paper [from the list] E6	4/60	C# and .NET Framework	4/60	Lab: (C# and Web Technology)	2/60			Industrial Training / Research Project	Qualifying

Subject: Computer Application			
Programme/Class: Certificate in Computer Application		**Year:** 1st	**Semester:** 1st
Course Code:	**Course Title:** Introduction to C Language		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Use the fundamentals of C programming in trivial problem solving.		
CO 2:	Enhance skill on problem solving by constructing algorithms.		
CO 3:	Identify solution to a problem and apply control structures and user defined functions for solving the problem.		
CO 4:	Apply skill of identifying appropriate programming constructs for problem solving.		

Credits: 4	**Core Compulsory**
Max. Marks: 30+70	**Min. Passing Marks:**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures
I	Evolution of C, Programming languages, Structure of a C program, Compiling a C program, Character set in C, Keywords in C, Hierarchy of operators, Basic data types, Qualifiers used with basic data types, Variables in C, Type declaration, Output function, Input function and format specifiers, arithmetic operators, Unary operators, Relational and logical operators	12
II	if statement, if else statement, for statement, while loop, do while statements, break statements, continue statements, switch statement, goto statement, ternary operators.	12
III	Advantages of arrays, types of arrays, array declaration, array initialization, accessing data from array, array inside the memory, multidimensional arrays. Character arrays, Array overflow, String Variables, Reading & writing strings, string handling functions	12
IV	Advantages of functions, declaring a function, calling a function, variables, passing arguments to a function, nested functions, passing array to functions, recursion in functions, Call by value and Call by reference. Pointers and function, Array of pointers, Pointer and Strings, Pointer to structure, Pointers within structure, Introduction of Static and Dynamic memory allocation, Dynamic memory allocation, DMA functions, malloc () function, Size of () operator, Function free (), Function realloc().	12
V	Introduction to File Handling: File structure, File handling function, File types, Streams, Text, Binary, File system basics, The file pointer, Opening a file, reading from file, writing to file, Closing a file.	12

Suggested Readings:

- Brian W. Kernighan and Dennis Ritchie, “The C Programming Language” Pearson Publication
- Let us C-Yashwant Kanetkar
- K.R.Venugopal, S.R.Prasad, “Mastering C” McGraw-Hill Education India

Suggested equivalent online courses:

- https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs40/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Mark

	s
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: The students opting for this subject must have Mathematics as a subject in 12^{th} Class.

Subject: Computer Application			
Programme/Class: Certificate in Computer Application		**Year:** 1st	**Semester:** 1st
Course Code:	**Course Title:** Basic Mathematics		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Perform basic computations in higher mathematics.		
CO 2:	Solve problems in Integral calculus, limits and Continuity, Coordinate Geometry, Matrices and Differential Equations		
CO 3:	Develop and maintain problem-solving skills.		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	**Limits and Continuity:** Definition of Limit, Algebra of limits, Right & left-hand limits, Infinite limits, Continuity (Definitions & examples, Algebra of Continuous functions), Differentiability, Rolle's and Mean value theorem with numerical problems.	13
II	**Integral Calculus:** Integral as an inverse of Differentiation. Integration by parts. Methods of substitution & use of partial fractions, standard forms and simple examples, Definite integral & their applications to areas and length & Curves.	13
III	**Differential Equation:** First order and first-degree differential equations, separation of variables, Homogeneous, linear, exact differential equations, second order linear equations with constant coefficients, Orthogonal trajectories.	13
IV	**Co-ordinate Geometry:** System of lines, System of Circles, Standard equations & properties of parabola & ellipse.	8
V	**Matrices:** Definition, Types of matrices, Laws of operations on matrices, Transpose, adjoint and inverse of matrices, solution of linear system of equations, and Cramer's rule, Rank of Matrices, square Matrices, Eigen values, Eigen Vectors, Characteristic polynomials, Cayley Hamilton theorem.	13

Suggested Readings:

- Bansi lal & S. Arora" Two-Dimensional Co-ordinate Geometry" S. chand
- S.C.Gupta 'Matrices", S. Chand
- R.S. Agarwal Differential Calculus S. Chand
- Harikrishna Real Analysis S.Chand

Suggested equivalent online courses:

- https://nptel.ac.in/courses/111/105/111105121/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: To study this course, a student must have had the subject Mathematics in

class 12th.

Subject: Computer Application			
Programme/Class: Certificate in Computer Application		**Year:** 1st	**Semester:** 1st
Course Code:	**Course Title:** Information System for Business		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Remember the role of Information System in an organization.		
CO 2:	Understand terminologies related to Information System.		
CO 3:	Analyze the development process of an Information System.		
CO 4:	Understand ethics and responsibilities of a person and organization in a Digital Age.		
Credits: 4	**Elective and Minor elective for students of other Subject/Faculty**		
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	What is an Information System, Components of Information System, Role of Information System, System hardware, Moore's Law, Role of Software in an organization, Types of Software,	12
II	Data and Databases, Types of Database, Big Data, Data Warehouse, Networking and Communication, History of Internet, Organizational Networking, Information System Security Triad, Tools of Information Security, Personel Information Security.	12
III	Why IT matters, Collaborative Systems, Decision Support Systems, Business process, role of Information System in Business process, ERP Systems, People in Information System, emerging roles.	12
IV	Information System Development, System Development Lifecycle, Types of Programming Languages, What is Globalization, Impact of Internet on Globalization, what is digital divide, Steps to alleviate Digital Divide	12
V	Ethics in Information System, Intellectual Property and Copyright, Patent, Responsibilities of individual, organization and government in Information Age, Future Trends in Information System.	12

Suggested Readings:

- Information Systems for Business and Beyond by David T. Bourgeois, PhD, The Saylor Academy.
- Business Information Systems, 5th edn by Paul Bocji, Pearson.
- Principle of Information System, Ralph Stair.

Suggested equivalent online courses:

This course can be opted as an elective by the students of following subjects: Faculty of Science

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	25

Course Prerequisites: To study this course, a student must have had the subject Mathematics in class 12th.

Subject: Computer Application			
Programme/Class: Certificate in Computer Application		**Year:** 1st	**Semester:** 1st
Course Code:	**Course Title:** Communicative English		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Analyse and restate the meaning of a text in English.		
CO 2:	Demonstrate the skill to write in English without grammatical error.		
CO 3:	Practice listening effectively to communication in English.		
CO 4:	Express the viewpoints with confidence in English.		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	What is Communication, Levels of Communication, Importance, Scope and Process of communication, Essentials of good communication, 7 Cs of communication, Channels of communication, Verbal and Non-Verbal communication, Formal and Informal communication, Barriers to communication.	12
II	Objectives of written Communication, Media of written communication, Merits and demerits of written communication. Words and Phrases, Guidelines for Effectiveness, Sentence Construction, Paragraph Development, Essay writing, Precise Writing.	12
III	Principles of effective oral communication, Media of oral communication, Advantages of oral communication, Disadvantages of oral communication, Styles of oral communication.	12
IV	Effective listening, Active vs. Passive Listening, Effective Presentation Strategies, Effective Use of Visual Aids, Interviews, Types of Interviews, Group Discussion, Meetings, Conferences	12
V	Business letters, Preparation of resume, Office memorandum, Letter writing, Memorandums, E-mails, Report Writing, Technical Proposals.	12

Suggested Readings:

- Technical Communication – Principles and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press, Sixteenth Impression 2007.
- High School English Grammar and Composition by Wren & Martin
- Business Communication by Meenakshi Raman & Prakash Singh, Oxford University Press, Seventh Impression 2008.
- Technical Writing by B.N.Basu, Prentice-Hall India Pvt. Ltd., 2007

Suggested equivalent online courses:

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: To study this course, a student must have had the subject Mathematics in class 12th.

Subject: Computer Application			
Programme/Class: Certificate in Computer Application		**Year:** 1st	**Semester:** 1st
Course Code:	**Course Title:** Lab: (C and Unix)		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Program in C Programming Language to Solve Problems using Computer		
CO 2:	Use CLI in Unix-like Operating System		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4			

Unit	Topic	No. of Lectures
	Lab Experiment List	
	● To learn elementary techniques involving arithmetic operators and mathematical ● expressions, appropriate use of selection (if, switch, conditional operators) and ● control structures ● Learn how to use functions and parameter passing in functions, writing recursive ● programs. ● Write Programs to learn the use of strings and string handling operations. ● Problems which can effectively demonstrate use of Arrays. Structures and Union. ● Write programs using pointers. ● Write programs to use files for data input and output. ● To learn directory navigation in Unix-like systems. ● To practice Unix commands ● Practice pattern matching with awk, grep. ● Practice file editing with vi/nano.	**60**

Suggested Continuous Evaluation Methods:
Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Record File	5
Viva-Voce	5
Practical Assessment	20
Total	30

Subject: Computer Application			
Programme/Class: Certificate in Computer Application		**Year:** 1st	**Semester:** 2nd
Course Code:	**Course Title:** Introduction to C++		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand the difference between the top-down and bottom-up approach		
CO 2:	Describe the object-oriented programming approach in connection with C++		
CO 3:	Apply the concepts of object-oriented programming to solve problems.		
CO 4:	Illustrate the process of file manipulations using C++		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Procedural vs. Object oriented programming, The main function, C++ preprocessors and the <iostream.h> file, C++ input and output with cin and cout. Simple variables, naming simple variables, Integer types, Floating types, Operators, Operator precedence and associativity, Type conversion, symbolic constants, Derived data types, Arrays, strings, structure, reference variables, new and delete operators. Relational expression in C++, relational operators, for loop, while loop, do-while loop, if-else statement, logical operators, conditional operators, switch statements, break and continue statements.	12
II	Defining a function, function prototyping and function calls, function arguments, passing by reference, inline functions, default arguments.	12
III	Defining classes, implementing member functions, class constructor and destructor, this pointer, friend function, examples based on class and object problems. Base classes, derived classes, implementing and using derived classes, virtual base class, types of inheritance. Problem based on multiple inheritance	12
IV	Stream classes, output with ostream class methods, input with cin, introduction with file handling. Memory Leak, Memory Leak Prevention, Smart pointers, unique_ptr.	12
V	Standard Template Library: STL containers containing vectors, list, queue, map, set, hash_map,hash_set. STL algorithms functions: Sorting Algorithms functions: sort, partial_sort. Searching Algorithms functions: binary_search, lower_bound, upper_bound, equal_range. Non-Modifying Algorithms: count, equal, mismatch,search, search_n. Modifying Algorithms functions: copy, copy_n, fill, fill_n,move,transform, generate etc	12

Suggested Readings:

- 'C++ Primer' by Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo
- The 'Effective Modern C++' by Scott Meyers
- Bjarne Stroustrup: The C++ programming language

Suggested equivalent online courses:

- https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs42/
- https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs43/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks

Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5

	Unit Test/Class Test	15	
	Total	30	
Course Prerequisites: To study this course, a student must have had the subject Introduction to C Language in 1st Semester.			

Subject: Computer Application		
Programme/Class: Certificate in Computer Application	**Year:** 1st	**Semester:** 2nd
Course Code:	**Course Title:** Data Structure	
Course outcomes:	On completion of the course, the student will be able to:	
CO 1:	Understand concepts such as Data Organizations, Need of Data Structures, Types of Data Structure, Algorithm Complexity, and Time-Space trade-off.	
CO 2:	Understand and apply data structures such as Stacks, Queues, Arrays, and Linked List.	
CO 3:	Understand the concept of different searching and sorting algorithms.	
Credits: 4	**Core Compulsory**	
Max. Marks: 30+70	**Min. Passing Marks:**	

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures
I	**Introduction to Data Structures:** Basic Terminology, Data type, Data object, Need of Data Structure, Types of Data Structure, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time-Space trade-off.	10
II	**Arrays & Linked Lists:** Arrays, Single and Multidimensional Arrays, address calculation, application of arrays, Linked list: Representation and implementation of Singly Linked Lists, Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to and from Linked Lists, Doubly linked list.	13
III	**Stacks & Queues:** Stacks: Array and linked representation and implementation of stack, Operations on Stacks: Push & Pop, Applications of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Recursion: Introduction, recursion in C, example of recursion, recursive functions. Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Insert, Delete, Full and Empty. Circular queue, Deques, and Priority Queues.	14
IV	**Trees & Graphs:** Trees: Basic terminology, Binary Trees, Binary tree representation, algebraic expressions, Complete Binary Tree., Traversing Binary trees, Binary Search Tree, searching BST, insertion and deletion in BST. Graph: Basic terminology, Traversal: BFS, DFS. Spanning Tree: Prims, Kruskal Algorithm, Dijkstra's Algorithm.	13
V	**Searching & Sorting:** Searching- Sequential search, binary search. Sorting algorithms with efficiency- Bubble sort, selection sort, Insertion sort, Merge sort, Quick Sort.	10

Suggested Readings:

- Data Structures- Seymour Lipschutz
- Data Structures using C and C++- Tanenbaum

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/102/106102064/
- https://nptel.ac.in/courses/106/106/106106127/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5

	Quiz/ Assignments	5	
	Seminar/Presentation	5	
	Unit Test/Class Test	15	
	Total	30	
Course Prerequisites: To study this course, a student must have had the subject Introduction to C Language in 1st Semester.			

Subject: BCA		
Programme/Class: Certificate in Computer Application	**Year:** 1st	**Semester:** 2nd

Course Code:	**Course Title:** Discrete Mathematics

Course outcomes:	On completion of the course, the student will be able to:
CO 1:	Analyze logical propositions via truth tables.
CO 2:	Understand and construct correct mathematical arguments.
CO 3:	Understand sets and perform operations and algebra on sets.
CO 4:	Determine properties of relations, identify equivalence and partial order relations, sketch relations.
CO 5:	Identify functions and determine their properties.
CO 6:	Understand algebraic structures.
CO 7:	Introduce the basic preliminaries and theoretical foundations of computer science.
CO 8:	Understanding of the notion of a regular set and its representation by DFA's, NFA's, and regular expressions.

Credits: 4	**Elective**
Max. Marks: 30+70	**Min. Passing Marks:**

Total No. of Lectures-Tutorials-Practical (in hours per week): 3-0-0

Unit	Topic	No. of Lectures
I	Propositional Logic: Propositions, Logical connectives, Compound propositions, Conditional and biconditional propositions, Truth tables, Tautologies and contradictions, Contrapositive, Logical equivalences and implications, DeMorgan's Laws, Normal forms, Principal conjunctive and disjunctive normal forms, Rules of inference, Arguments, Validity of arguments.	10
II	Set Theory: Basic concepts, Notations, Subset, Algebra of sets, The power set, Ordered pairs and Cartesian product, Relations on sets, Types of relations and their properties, Relational matrix and the graph of a relation, Partitions, Equivalence relations, Partial ordering, Poset, Hasse diagram, Lattices and their properties, Sublattices, Boolean algebra, Homomorphism.	15
III	Functions: Definitions of functions, Classification of functions, Type of functions, Examples, Composition of functions, Inverse functions, Binary and n-ary operations, Characteristic function of a set.	10
IV	Groups: Algebraic systems, Definitions, Examples, Properties, Semigroups, Monoids, Homomorphism, Sub semigroups and Submonoids, Cosets and Lagrange's theorem, Normal subgroups, Normal algebraic system with two binary operations.	10
V	Formal Languages, operations on languages, Kleen closure, Regular Set, Regular expression, regular language, Phrase structure grammars, Types of grammars, types of languages. Conversion of regular expression to Finite Automata, NFA, DFA. Moore Machine, Mealy Machine.	15

Suggested Readings:

- Richard Johnsonbaugh, "Discrete Mathematics", Pearson Pub.
- Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Tata McGraw-Hill Pub.
- Harry Lewis, Rachel Zax, "Essential Discrete Mathematics for Computer Science" Princeton

University Press Pub.
Suggested equivalent online courses: ● https://nptel.ac.in/courses/106/106/106106183/ ● https://nptel.ac.in/courses/106/103/106103205/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	**Marks**
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: To study this course, a student must have had the subject Mathematics in class 12th.

Subject: BCA			
Programme/Class: : Certificate in Computer Application		**Year:** 1st	**Semester:** 2nd
Course Code:	**Course Title:** Digital Electronics		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand Digital Computer and Digital Systems.		
CO 2:	Understand the logic and applications of Boolean algebra and logic gates.		
CO 3:	Understand the concept of Combinational circuits, Sequential circuits and memory		
Credits: 4	**Core Compulsory**		
Max. Marks: 30+70	**Min. Passing Marks:**		

Total No. of Lectures-Tutorials-Practical (in hours per week):
4-0-0

Unit	Topic	No. of Lectures
I	**Fundamental concepts:** Digital Computer and Digital Systems, Binary Numbers, Number Base Conversion, Complements, Binary Codes.	10
II	**Boolean algebra and logic gates:** Basic Theorem and Properties of Boolean Algebra, Boolean functions, Canonical and standard forms. Digital logic gates, Simplification of Boolean functions: two and three variable Maps, four variable maps. POS simplification, NAND and NOR Implementation, don't care conditions.	12
III	**Combinational Logic Design:** Design procedure, Adders, Subtractors, Code conversion, Binary Parallel adder, Decimal adder, Magnitude Comparator, Decoder, Encoder, Multiplexers, De-Multiplexers, Parity generation and checking.	13
IV	**Sequential Logic Design:** Flip-flops: Basic flip-flop, RS, JK, D, T, Triggering of flip-flops, Analysis of clocked sequential circuits, state reduction and assignment, flip-flop excitation tables.	13
V	**Registers, Counters and the Memory unit:** Registers, shift registers, Counters, Asynchronous and synchronous counters, Ripple counters. Memory-RAM, ROM, Programmable logic array (PLA).	12

Suggested Readings:

- "Modern Digital Electronics" - R.P. Jain
- Digital logic and Computer design- M. Morris Mano

Suggested equivalent online courses:

- https://nptel.ac.in/courses/108/105/108105132/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: The students opting for this subject must have Mathematics as a subject in 12th Class.

Subject: Computer Application			
Programme/Class: Certificate in Computer Application		**Year:** 1st	**Semester:** 2nd
Course Code:	**Course Title:** Lab: (C++)		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Program in C++ Programming Language		
CO 2:	Use OOPs to Model Real World Problems and Solve Them.		
Credits: 4			**Core Compulsory**
Max. Marks: 30+70			**Min. Passing Marks:**
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4			

Unit	Topic	No. of Lectures
	Lab Experiment List	
	● To learn elementary techniques involving arithmetic operators and mathematical ● expressions, appropriate use of selection (if, switch, conditional operators) and ● control structures ● Learn how to use functions and parameter passing in functions, writing recursive ● programs. ● Write Programs to learn the use of strings and string handling operations. ● Problems which can effectively demonstrate use of Arrays. Structures and Union. ● Write programs using pointers. ● Write programs to use files for data input and output. ● Learn how to implement OOPs in C++. ● Develop OOPs solutions to problems. ● Write programs using polymorphism, inheritance. ● Demonstration of virtual function. ● Demonstration of static function. ● Accessing a particular record in a student's file. ● Demonstration of operator overloading. ● Learn practices of Modern C++. ● Problems which can effectively demonstrate use of smart pointers. ● Use C++ containers and rest of the STL library. ● Implement various Data Structures using C++. ● Implement searching and sorting using C++.	**60**

Suggested Continuous Evaluation Methods:
Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks
shall

Internal Assessment	Marks
Record File	5
Viva-Voce	5
Practical Assessment	20
Total	30

Subject: Computer Application			
Programme/Class: Diploma in Computer Application		**Year:** 2nd	**Semester:** 3rd
Course Code:	**Course Title:** Programming in Python		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Remember the basic principles of Python programming language		
CO 2:	Implement object oriented concepts in Python.		
CO 3:	Analyze Functional Programming Paradigm with Python.		
CO 4:	Create tools for web scrapping.		
Credits: 4	**Core Compulsory and Minor elective for students of other Subject/Faculty**		
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Introduction and Overview: Overview of Python Programming: Structure of a Python Program, Elements of Python, Python Interpreter, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings.	12
II	Operators and Statements: Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator). Creating Python Programs: Input and Output Statements.	12
III	Decision making and Branching: Control statements (Branching, Looping, Conditional Statement, Difference between break, continue and pass, default arguments. Defining Functions.	12
IV	Classes and Objects: An introduction to object-oriented programming in Python. objects, operator overloading, overriding, special methods. Inheritance, polymorphism and composition.	12
V	Iterators and Generators: Iteration protocol, Iterable objects, generators and generator expressions. Use of generators, assertions. Testing and debugging of a python project, Web Scrapping in Python.	12

Suggested Readings:

- T. Budd, Exploring Python, TMH, 1st Ed, 2011
- Python Tutorial/Documentation www.python.or 2015
- Allen Downey, Jeffrey Elkner, Chris Meyers, how to think like a computer scientist: learning with Python, Freely available online.2012

Suggested equivalent online courses:

- https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs31/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Certificate in Computer Application

Subject: Computer Application			
Programme/Class: Diploma in Computer Application		**Year:** 2nd	**Semester:** 3rd
Course Code:	**Course Title:** Organizational Behaviour		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand the behavior of people in the organization.		
CO 2:	Analyse the complexities associated with management of individual behavior in the organization.		
CO 3:	Analyse the complexities associated with management of the group behavior in the organization.		
CO 4:	Understand the motivation (why) behind behavior of people in the organization.		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Nature, Scope, Definition and Goals ofOrganizational Behaviour, Fundamental Concepts of Organizational Behaviour, Models of Organizational Behaviour, Emerging aspects of Organizational Behaviour: TQM, Managing Cultural Diversity, Managing the Perception Process	12
II	Effects of employee attitudes Personal and Organizational Values Job Satisfaction Nature and Importance of Motivation Achievement Motive Theories of Work Motivation: Maslow's Need Hierarchy Theory, McGregor's Theory 'X' and Theory 'Y'	12
III	Definition of Personality, Determinants of Personality Theories of Personality – Trait and Type Theories, The Big Five Traits, Myers-Briggs Indicator, Locus of Control, Type A and Type B Assessment of Personality	12
IV	Meaning and definition of Stress, Symptoms of Stress Sources of Stress: Individual Level, Group Level, Organizational Level Stressors, Extra Organizational Stressors Effect of Stress– Burnouts Stress Management – Individual Strategies, Organizational Strategies Employee Counselling	12
V	Nature of Group, Types of Groups Nature and Characteristics of team building, Effective Teamwork Nature of Leadership, Leadership Styles Traits of Effective Leaders	12

Suggested Readings:

- Organizational Behavior Text, Cases and Games- By K. Aswathappa, Himalaya Publishing House, Mumbai, Sixth Edition (2005)
- Organizational Behavior Human Behavior at Work by J. W. Newstrom, Tata McGraw Hill Publishing Company Limited, New Delhi, 12 th Edition (2007)

Suggested equivalent online courses:

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Certificate in Computer Application

Subject: Computer Application			
Programme/Class: Diploma in Computer Application		**Year:** 2nd	**Semester:** 3rd
Course Code:	**Course Title:** Operational Research		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Define and formulate linear programming problems and appreciate their limitations		
CO 2:	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.		
CO 3:	Determine the optimal solution for Transportation problems and Assignment problems.		
CO 4:	Decide an optimal replacement period/policy for a given item/equipment/machine.		
CO 5:	Explain the concepts of dynamic optimization and its application in real-world problems and define the solution concepts and optimality conditions		
CO 6:	Simulate different real life probabilistic situations using Monte Carlo simulation technique.		
CO 7:	Plan, Schedule and Control the given project.		
Credits: 4		**Elective**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem: Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M method, two-phase method, degeneracy and unbound solutions.	15
II	Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the steppingstone method and MODI method. Assignment Problem: Formulation, Hungarian method for optimal solution. Solving unbalanced problem. Traveling salesman problem as assignment problem.	10
III	Sequencing models: Solution of Sequencing Problem, Processing n Jobs through 2 Machines, Processing n Jobs through 3 Machines, Processing 2 Jobs through m machines, Processing n Jobs through m Machines.	10
IV	Dynamic programming: Characteristics of dynamic programming, Dynamic programming approach for Priority Management, Employment Smoothening, Capital Budgeting, Stagecoach/Shortest Path, Cargo Loading and Reliability problems.	10
V	Simulation: Advantages of Simulation, Limitations of Simulation, Monte-Carlo Simulation, Random Numbers. CPM and PERT: Drawing of networks, Removal of redundancy, Network computations, Free slack, Total slack, Crashing, Resource allocation.	15

Suggested Readings:

- Rader, D. J. 2010, Deterministic Operations Research: Models and Methods in Linear Optimization, J. Wiley & Sons
- Taha, H. A. 2007, Operations Research, 8th edn, Pearson
- P. Sankara Iyer," Operations Research", Tata McGraw-Hill, 2008.
- J K Sharma., "Operations Research Theory & Applications, 3e", Macmillan India Ltd, 2007.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/110/106/110106062/
- https://nptel.ac.in/courses/111/107/111107128/
- https://nptel.ac.in/courses/112/106/112106134/

This course can be opted as an elective by the students of following subjects: Students of B.Sc. with Mathematics/Statistics as a major subject

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	**Marks**
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Certificate in Computer Application

Subject: Computer Application			
Programme/Class: Diploma in Computer Application		**Year:** 2nd	**Semester:** 3rd
Course Code:	**Course Title:** Computer System Architecture		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Remember and Understand the basics of computer architecture, organization and Design.		
CO 2:	Understand the operations of CPU, I/O and Memory		
CO 3:	Understand the concept of parallel processing and pipelining		
Credits: 4	**Core Compulsory**		
Max. Marks: 30+70	**Min. Passing Marks:**		
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	**Basic Computer Organization and Design:** Register Transfer Language, Arithmetic and Logical, micro-operations, Shift micro-operation. Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference instructions, input-output and interrupt. Design of basic computer, Booth algorithm.	12
II	**Central Processing Unit:** Micro programmed control, Control memory, address sequencing, General Register organization, stack organization, Instruction formats, addressing modes, Data transfer and manipulation, Program Control, RISC, CISC.	12
III	**Input Output Organization:** Peripheral devices, I/O interface, Asynchronous data transfer, Strobe Control, Handshaking Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, and Serial Communication.	12
IV	**Memory Organization:** Memory Hierarchy, Main memory (RAM/ROM chips), Auxiliary memory, Associative memory, Cache memory, Virtual Memory, Memory Management Hardware.	12
V	**Pipelining:** Parallel processing, Amdahl's law, Pipelining, Flynn's classification, space-time diagram, speedup ratio, Arithmetic pipeline, Instruction pipeline.	12

Suggested Readings:

- M. Mano, Computer System Architecture, Pearson Education 1992
- W. Stallings, Computer Organization and Architecture Designing for Performance, 8th Edition, Prentice Hall of India,2009
- M.M. Mano, Digital Design, Pearson Education Asia,2013
- Carl Hamacher, Computer Organization, Fifth edition, McGraw-Hill, 2012.

Suggested equivalent online courses:

- **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ==**
- **https://nptel.ac.in/courses/106/105/106105163/**

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5

	Seminar/Presentation	5
	Unit Test/Class Test	15
	Total	30
Course Prerequisites: : Certificate in Computer Application		

Subject: Computer Application		
Programme/Class: Diploma in Computer Application	**Year:** 2nd	**Semester:** 3rd

Course Code:	**Course Title:** Lab: (Python)
Course outcomes:	On completion of the course, the student will be able to
CO 1:	Program in Python Programming Language.
CO 2:	Create Tools for Web Scrapping using Python.

Credits: 4	**Core Compulsory**
Max. Marks: 30+70	**Min. Passing Marks:**

Total No. of Lectures-Tutorials-Practical (in hours per week):
0-0-4

Unit	**Topic**	**No. of Lectures**
	Lab Experiment List	
	● Write a program to demonstrate different number data types in Python. ● Write a program to perform different Arithmetic Operations on numbers in Python. ● Write a programs to perform different String Operations. ● Write programs to showcase the python time library. ● Write a program to demonstrate working with lists in python. ● Write a program to demonstrate working with tuples in python. ● Write a program to demonstrate working with dictionaries in python. ● Write programs to demonstrate the uses of functions. ● Demonstrate the use of *args, **kwargs in python. ● Write Programs to showcase use of lambda functions. ● Write a python program to define a module and import a specific function in that module to another program. ● Write Programs for file operations in python. ● Write programs to demonstrated the working of generator. ● Implement programs to showcase the uses of Iterators. ● Demonstrate OOPs Capabilities of python language. ● Demonstrate Exception Handling features of Python. ● Write testing cases for python programs. ● Learn basics of web scrapping in python. ● Create a working web scrapper in python.	**60**

Suggested Continuous Evaluation Methods:
Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	**Marks**
Record File	5
Viva-Voce	5
Practical Assessment	20
Total	30

Subject: Computer Application			
Programme/Class: Diploma in Computer Application		**Year:** 2nd	**Semester:** 4th
Course Code:	**Course Title:** Introduction to DBMS		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand terms related to database design and management		
CO 2:	Assess various database models.		
CO 3:	Evaluate the normality of a logical data model, and correct any anomalies		
CO 4:	Implement relational databases using MySQL		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Elements of database system, DBMS and it's architecture, advantages of DBMS, data independence, types of database users, role of database administrator.	12
II	Brief overview of hierarchical and network model, relation model (Relations, properties of relational model, keys and entity integrity & referential integrity rules), CODD's rules for referential Model. Entity relationship Model: Entity sets, Relationship sets, Design Issue, Mapping constraints, E-R diagram, weak entity sets, specialization & generalization	12
III	Normalization concepts and update anomalies, Functional dependencies, Normal forms (1NF, 2NF, 3NF, BCNF)	12
IV	SQL fundamentals - Integrity – Triggers - Security – Advanced SQL features – Embedded SQL–Dynamic SQL- Missing Information– Views – Introduction to Distributed Databases and Client/Server Databases	12
V	Centralized system, Client-Server systems (Transaction server, Data server), Parallel system (Speedup & Scale up), Parallel database architecture (Shared memory, Shared Disk, SharedNothing), Distributed System (Structures, Trade-offs), Backup and Recovery, Security and Privacy.	12

Suggested Readings:

- Date C J, "An Introduction to Database System", Addison Wesley
- Navathe E, "Database management systems",
- Silberschatz & Korth, Database system Concepts, TMH
- Bipin Desai, An Introduction to Database System, Galgotia Pub

Suggested equivalent online courses:

- https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs57/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Certificate in Computer Application		

Subject: Computer Application			
Programme/Class: Diploma in Computer Application		**Year:** 2nd	**Semester:** 4th
Course Code:	**Course Title:** Operating System and System Administration		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand fundamental operating system abstractions such as processes, threads, files, semaphores, IPC abstractions, shared memory regions, etc.,		
CO 2:	Analyse important algorithms e.g. Process scheduling and memory management algorithms		
CO 3:	Categorize the operating system's resource management techniques, dead lock management techniques, memory management techniques		
CO 4:	Demonstrate the ability to perform System Administration tasks in LINUX		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Introduction: Basics of Operating Systems: Definition – Generations of Operating systems – Types of Operating Systems, OS Service, System Calls. Process Management: Processes: Definition, Process Relationship, Process states, Process State transitions, Process Control Block, Context switching – Threads – Concept of multithreads. Process Scheduling: Definition, Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time (Definition only), Scheduling algorithms: Pre-emptive and Non, pre-emptive, FCFS – SJF – RR	15
II	Inter-process Communication: Race Conditions, Critical Section, Mutual Exclusion, Peterson's Solution, The Producer Consumer Problem, Semaphores, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Deadlocks: Definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance: banker's algorithm, Deadlock detection and Recovery.	10
III	Memory Management: Basic Memory Management: Definition, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, Fixed and variable partition, Internal and External fragmentation and Compaction, Paging: Principle of operation, Page allocation, Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory, Hardware and control structures, Locality of reference, Page fault, Working Set, Dirty page/Dirty bit, Demand paging (Concepts only), Page Replacement policies: Optimal (OPT), First in First Out (FIFO, Least Recently used (LRU).	10
IV	I/O Management & Disk Scheduling: I/O Devices and the Organization of I/O Disk I/O, Disk Scheduling Algorithm, Operating System Design Issues. File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues.	10

V	Shell introduction and Shell Scripting: What is shell and various type of shell, Various editors present in linux, Different modes of operation in vi editor. What is shell script, Writing and executing the shell script, Shell variable (user defined and system variables) System calls, Using system calls, Pipes and Filters, Decision making in Shell Scripts (If else, switch), Loops in shell, Functions, Utility programs (cut, paste, join, tr , uniq utilities), Pattern matching utility (grep)	15

Suggested Readings:

- Andrew S. Tanenbaum and Herbert Bos," Modern Operating Systems," Fourth Edition,
  Pearson, 2014.

- Abraham Silberschatz, Greg Gagne, and Peter B. Galvin, "Operating System Concepts," Tenth Edition, Wiley, 2018.
- William Stallings, "Operating Systems: Internals and Design Principles," Seventh Edition, Prentice Hall, 2011.
- Milan Milankovic "Operating systems, Concepts and Design" McGraw Hill

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/105/106105214/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	**Marks**
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Certificate in Computer Application

Subject: Computer Application			
Programme/Class: Diploma in Computer Application		**Year:** 2nd	**Semester:** 4th
Course Code:		**Course Title:** Introduction to Cyber Security	
Course outcomes:	After successful completion of course the student will be able to:		
CO 1:	Remember the broad set of technical, social & political aspects of Cyber Security.		
CO 2:	Understand the importance of ethical hacking, its tool and ethical hacking process.		
CO 3:	Analyze security principles to system design.		
CO 4:	Understand the methods for authentication, access control, intrusion detection and prevention in Cyber Security.		
Credits: 4		**Elective**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	**Introduction to Cyber Security** - Importance and challenges in Cyber Security, Cyberspace, and Cyber threats, Cyber warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure.	12
II	**Hackers and Cyber Crimes** Types of Hackers - Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access - Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks. Worms, Trojans, Viruses, Backdoors.	12
III	**Ethical Hacking and Social Engineering** Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modeling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing - Types of Social Engineering - Insider Attack - Preventing Insider Threats - Social Engineering Targets and Defence Strategies.	12
IV	**Cryptography** Cryptography in Practice, Historical Perspectives - Algorithms - Hashing Functions - Symmetric Encryption, Asymmetric Encryption, Quantum Cryptography, Cryptography Algorithm Uses.	12
V	**Intrusion Detection Systems** History of Intrusion Detection Systems, IDS Overview, Network-Based IDSs, Host-Based IDSs, Intrusion Prevention Systems, Honeypots and Honeynets - Tools.	12

Suggested Readings:

- Nina Godbole, Sumit Belapure, “Cyber Security”, Willey, 2011
- Roger Grimes, “Hacking the Hacker”, Wiley, ist Edition, 2017
- Cybersecurity - Attack and Defense Strategies: Infrastructure security with Red Team and
  Blue Team tactics by Yuri Diogenes

Suggested equivalent online courses:

- https://onlinecourses.swayam2.ac.in/nou19_cs08/preview

This course can be opted as an elective by the students of following subjects: None

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Mark

	s
Class Interaction	5
Quiz/ Assignments	5

	Seminar/Presentation	5	
	Unit Test/Class Test	15	
	Total	30	
Course Prerequisites: Certificate in computer Application.			

Subject: Computer Application			
Programme/Class: Diploma in Computer Application		**Year:** 2nd	**Semester:** 4th
Course Code:	**Course Title:** Numerical Analysis and Statistical Technique		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.		
CO 2:	Analyze statistical data using measures of central tendency, dispersion and location		
CO 3:	Calculate and interpret the correlation between two variables.		
CO 4:	Employee the principles of linear regression and correlation, including least square method, predicting a particular value of Y for a given value of X and significance of the correlation coefficient.		
CO 5:	Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.		
CO 6:	Use different probability distributions to solve simple practical problems.		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Introduction: Raw material of statistics, ungrouped & grouped frequency distribution. Diagrammatic presentation: Bar diagram, Pie-diagram. Graphical presentation: Histogram, Frequency polygon, Frequency curve, Cumulative frequency curve.	10
II	Measures of Central Tendency and Dispersion: Arithmetic Mean, Mode, Median, Geometric Mean, Harmonic Mean, Range, Mean Deviation, Standard Deviation, Skewness and Kurtosis.	10
III	Correlation and Regression Analysis: Scatter diagram, Karl Pearson, Spearman and Concurrent deviation methods, Regression Lines, Method of least square.	10
IV	Probability & Probability Distribution: Classical, Empirical and axiomatic approach to probability, Addition and multiplicative law of probability, Binomial, Poisson & Normal Distribution	15
V	Numerical Methods: Interpolation: Finite difference, Operators Δ, E, Newton Gregory Interpolation for equal intervals, divided difference, Newton's Lagrange's Interpolation for unequal intervals. Central differences: Gauss Forward, Backward Formula, Stirling & Bessel's formula. Numerical Differentiation & integration: Numerical differentiation by Newton Gregory formula, general quadrature formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. Euler-Maclaurin's summation formula.	15

Suggested Readings:

- Fundamental of mathematical statistics Gupta & Kapoor S.Chand
- Introduction to Numerical Methods S.S.Shastri PHI
- Rajaraman V., "Computer Oriented Numerical Methods", PHI-2004
- Gerald & Wheatley, "Applied Numerical Analyses", AW-2003

Suggested equivalent online courses:

- https://nptel.ac.in/courses/111/106/111106101/
- https://nptel.ac.in/courses/111/107/111107105/
- https://nptel.ac.in/courses/111/107/111107062/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	**Marks**
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Certificate in computer Application.

Subject: Computer Application		
Programme/Class: Diploma in Computer Application	**Year:** 2nd	**Semester:** 4th

Course Code:	**Course Title:** Lab: (DBMS)
Course outcomes:	On completion of the course, the student will be able to:
CO 1:	Create, Maintain and Query MySQL Database.
CO 2:	Use MySQL to model real world data.

Credits: 4	**Core Compulsory**
Max. Marks: 30+70	**Min. Passing Marks:**

Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4

Unit	**Topic**	**No. of Lectures**
	Lab Experiment List	
	● Analyze the organization and identify the entities, attributes and relationships in it. ● Identify the primary keys for all the entities. Identify the other keys like candidate keys, partial ● keys, if any. ● Relate the entities appropriately. Apply cardinalities for each relationship. Identify strong entities ● and weak entities (if any). ● Represent all the entities (Strong, Weak) in tabular fashion. Represent relationships in a tabular ● fashion. ● Apply the First, Second and Third Normalization levels on the database designed for the ● organization ● Installation of Mysql and practicing DDL commands ● Installation of MySql. Creating databases, how to create tables, altering the database, dropping ● tables and databases if not required. Try truncate, rename commands etc. ● Practicing DML commands on the Database created for the example ● organization ● DML commands are used to for managing data within schema objects. Some examples: SELECT, INSERT, UPDATE, DELETE ● Practice queries (along with sub queries) involving ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT, Constraints etc. ● Practice queries using Aggregate functions (COUNT, SUM, AVG, and MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.	**60**

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	**Marks**
Record File	5
Viva-Voce	5
Practical Assessment	20
Total	30

Subject: Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:** 3rd	**Semester:** 5th
Course Code:	**Course Title:** Digital Communications and Networks		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Remember the fundamentals of Networking		
CO 2:	Understand Networking Models.		
CO 3:	Evaluate various Transmission Mediums.		
CO 4:	Analyze Technologies and Protocols of First Three Network Layers of OSI Models.		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Network definition; network topologies; network classifications; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.	12
II	Data Communication Fundamentals and Techniques: Analog and digital signal; data-rate limits;digital to digital line encoding schemes; pulse code modulation; digital to analog modulation- multiplexing techniques- FDM, TDM; transmission media	12
III	Error detection techniques; data-link control- framing and flow control; error recovery protocols- stopand wait ARQ, go-back-n ARQ; Multiple Access Protocol	12
IV	Networks Switching Techniques and Access mechanisms: Circuit switching; packet switching-connectionless datagram switching, connection-oriented virtual circuit switching;	12
V	Networks Layer Functions and Protocols: Routing algorithms; Distance vector routing and link state routing, protocol of Internet- IP protocol (IP4)	12

Suggested Readings:

- B. A. Forouzan: Data Communications and Networking, Fourth edition, THM ,2007
- S. Tanenbaum: Computer Networks, Fourth edition, PHI, 2002
- James F. Kurose, Keith W. Ross, “Computer Networking”, Pearson Education.
- Michael A. Gallo, William M. Hancock, “Computer Communications and Networking Technologies”, CENGAGE Learning.

Suggested equivalent online courses:

- https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs19/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Diploma in Computer Application

Subject: Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:** 3rd	**Semester:** 5th
Course Code:	**Course Title:** Programming in JAVA		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Use the syntax and semantics of java programming language and basic concepts of OOP.		
CO 2:	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.		
CO 3:	Apply the concepts of Multi-threading and Exception handling to develop efficient and error free codes.		
CO 4:	Create & Maintain MYSQL Databases using JAVA		
CO 5:	Design event driven GUI Applications.		

Credits: 4	**Core Compulsory**
Max. Marks: 30+70	**Min. Passing Marks:**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures
I	Features of java, JDK Environment & tools like (java, javac, applet viewer, javadoc, jdb), OOPs Concepts Class, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C++ and JAVA, Structure of java program, Data types, Variables, Operators, Keywords , Naming Convention, Decision Making (if, switch), Looping(for, while), Type Casting, Array Creating an array Types of Array - One Dimensional arrays - Two Dimensional array, String - Arrays , Methods. – String Buffer class	12
II	Creating Classes and objects, Memory allocation for objects, Constructor, Implementation of Inheritance Simple, Multilevel, Interfaces, Abstract classes and methods, Implementation of Polymorphism, Method Overloading, Method Overriding, Nested and Inner classes, Modifiers and Access Control, Packages Packages Concept Creating user defined packages, Java Built in packages: java.lang->math, java.util->Random, Date, Hashtable, Wrapper classes	12
III	Exception, Exception types, Terms related to Exceptions, User Defined Expressions, Stream Classes, File Handling, File IO basics, File operations MultiThreading, Thread vs Runnable, Thread Life Cycle, Collection Framework, Interfaces - Collection - List - Set - SortedSet - Enumeration - Iterator – ListIterator, Classes - LinkedList - ArrayList - Vector - HashSet	12
IV	Database Programming, The Design of JDBC. The Structured Query Language, JDBC Installation, Basic JDBC Programming Concepts, Query Execution, Scrollable and Updatable Result Sets, Metadata, Row Sets, Transactions.	12
V	AWT: Components and container used in AWT, Layout managers, Listeners and Adapter classes,Event Delegation model, Swing: Introduction to Swing Component and Container Classes	12

Suggested Readings:

- Margaret Levine Young, “The Complete Reference Internet”, TMH
- Balagurusamy E, “Programming in JAVA”, TMH
- Naughton, Schildt, “The Complete Reference JAVA2”, TMH
- Steven Holzner, “Java2 Black book”, dreamtech

Suggested equivalent online courses:

- https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs47/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

	Internal Assessment	Marks
	Class Interaction	5
	Quiz/ Assignments	5
	Seminar/Presentation	5
	Unit Test/Class Test	15
	Total	30

Course Prerequisites: Diploma in Computer Application

Subject: Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:** 3rd	**Semester:** 5th
Course Code:		**Course Title:** Cloud Computing	
Course outcomes:		After successful completion of course the student will be able to:	
CO 1:	Understand the key dimensions of the challenges and benefits of Cloud Computing.		
CO 2:	Describe the principles of Parallel and Distributed Computing and evolution of cloud computing from existing technologies		
CO 3:	Implement different types of Virtualization technologies and Service Oriented Architecture systems.		
CO 4:	Choose among various cloud technologies for implementing applications.		
CO 5:	Install and use current cloud technologies.		
Credits: 4		**Elective**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	**Introduction**: Cloud-definition, benefits, usage scenarios, History of Cloud Computing, Cloud Architecture, Types of Clouds, Players in Cloud Computing, issues in Clouds.	12
II	**Cloud Services**: Types of Cloud services, Software as a Service, Platform as a Service, Infrastructure as a Service, Database as a Service, Monitoring as a Service, Communication as services. Service Providers- Google, Amazon, Microsoft Azure, IBM, Sales force.	12
III	Collaborating Using Cloud Services Email Communication over the Cloud, CRM Management, Project Management, Event Management, Task Management, Calendar, Schedules, Word Processing, Presentation, Spreadsheet, Databases, Desktop, Social Networks and Groupware.	12
IV	Virtualization for Cloud Need for Virtualization, Pros and cons of Virtualization, Types of Virtualization, System VM, Process VM, Virtual Machine monitor, Virtual machine properties, HLL VM, Hypervisors, Xen, KVM, VMWare, Virtual Box, Hyper-V.	12
V	Cloud Security**:** Infrastructure Security- Network level security, Host level security, Application level security, Data security, Authentication in cloud computing**,** Cloud security challenges.	12

Suggested Readings:

- Cloud Computing Bible**,** Barrie Sosinsky**,** Wiley-India**,** 2010
- Cloud Computing: Concepts, Technology & Architecture by Thomas Erl
- James E Smith, Ravi Nair, Virtual Machines, Morgan Kaufmann Publishers,2006

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/105/106105167/

This course can be opted as an elective by the students of following subjects: None

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5

	Seminar/Presentation	5
	Unit Test/Class Test	15
	Total	30
Course Prerequisites: Diploma in Computer Application.		

Subject: Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:** 3rd	**Semester:** 5th
Course Code:		**Course Title:** Computer Graphics	
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand the basics of computer graphics, different graphics systems and applications of computer graphics.		
CO 2:	Understand various algorithms for scan conversion and filling of basic objects and their comparative analysis.		
CO 3:	Understand the use of geometric transformations on graphics objects and their application in composite form.		
CO 4:	Understand how to Extract scene with different clipping methods and its transformation to graphics display device.		
CO 5:	Explore projections techniques for display of 3D scene on 2D screen.		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	**Introduction:** Basic elements of Computer graphics, Applications of Computer Graphics. Graphics Hardware, Video Display Devices, Architecture of Raster and Random scan display devices, Input devices, Hard-copy devices, Graphics software.	8
II	**Fundamental Techniques in Graphics:** Line Drawing Algorithms: DDA Algorithm, Bresenham's Line algorithm, Circle Generating Algorithms: Midpoint Circle Algorithm. Filled-Area Primitives: Scan-line polygon fill algorithm, Inside-Outside Tests, boundary Fill Algorithm, Flood- Fill algorithm.	13
III	**Two- Dimensional Geometric Transformations:** Basic Transformations- Translation, Rotation, Scaling. Matrix representations and Homogeneous Coordinates, Composite Transformations. Other Transformations: Reflection, Shearing.	14
IV	**Two-Dimensional Viewing:** The Viewing Pipeline, Clipping operations: Point clipping, Line Clipping: Cohen Sutherland line clipping, Liang- Barsky line clipping, Nicholl-lee- Nicholl line clipping, Polygon Clipping: Sutherland-Hedgeman Polygon Clipping, Weiler-Atherton Polygon Clipping, Curve Clipping, Text Clipping, Exterior Clipping.	15
V	**Three-Dimensional Concepts and 3-D Transformations:** 3-D display methods: Parallel projection, Perspective projection. Basic Transformations- Translation, Rotation, Scaling.	10

Suggested Readings:

- J.D.Foley, A.Van Dan, Feiner, Hughes Computer Graphics Principles & Practice 2nd edition Publication Addison Wesley 1990.
- D.Hearn, Baker: Computer Graphics, Prentice Hall of India 2008.

Suggested equivalent online courses:

- **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ==**
- **https://nptel.ac.in/courses/106/106/106106090/**

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:
Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	**Marks**
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5

	Unit Test/Class Test	15	
	Total	30	
Course Prerequisites: Diploma in Computer Application			

Subject: Computer Application		
Programme/Class: Bachelor of Computer Application	**Year:** 3rd	**Semester:** 5th
Course Code:	**Course Title:** Lab: (Programming in JAVA)	
Course outcomes:	On completion of the course, the student will be able to:	
CO 1:	Use JAVA programming language to implement OOPs concepts.	
CO 2:	Create GUI applications that mimic real world scenarios.	
Credits: 4		**Core Compulsory**
Max. Marks: 30+70		**Min. Passing Marks:**
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4		

Unit	Topic	No. of Lectures
	Lab Experiment List	
	● Program on strings. ● Programs to practice loops. ● Program to demonstrate all math class functions. ● Program on files. ● Program to demonstrate method over-riding and overloading ● Programs on Inheritances. ● Program to create a Date object using the Calendar class. ● Program to add some hours to the current time. ● Multi-threaded programming. ● Programs to demonstrate the use of container classes of JAVA. ● Programs to demonstrate Database Programming. ● Programs to queries MySQL database through JAVA. ● Creating and using Packages. ● Creating GUI applications using Java Swing. ● Creating Applications that uses GUI concepts as well as Database Programming Concepts. ● Create Clone of popular real-life windows Application using Swing and JDBC.	**60**

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Record File	5
Viva-Voce	5
Practical Assessment	20
Total	30

Subject: Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:** 3rd	**Semester:** 6th
Course Code:	**Course Title:** Artificial Intelligence		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand the basics of Artificial Intelligence and gain knowledge of the learning process and its models.		
CO 2:	Understand different types of search techniques.		
CO 3:	Understand different knowledge representation schemes.		
CO 4:	Understand the AI applications in the design of expert systems.		
CO 5:	Understand basic concepts of machine learning, ANN, SVM and fuzzy logic		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Introduction: Introduction to Artificial Intelligence, Background and Applications, AI techniques, Tic Tac-Toe problem, Problem Characteristics.	10
II	Problem Solving and Searching Techniques: Problem Characteristics, Production Systems, Water Jug Problem, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics Search Techniques: Best First Search. 8-Puzzle Problem.	15
III	Knowledge Representation: Definition of Knowledge, Knowledge Based Systems, Representation of Knowledge. Introduction to First Order Predicate Logic, Conversion to clausal form, Unification, Resolution Principle.	12
IV	Expert Systems: Introduction to Expert Systems, Characteristic Features of Expert Systems, Applications of Expert Systems, Components and Working of Expert Systems	8
V	Introduction to Machine Learning Techniques: Fuzzy Logic, Fuzzy Set, Membership Function, Union, intersection and complement of a fuzzy set, Introduction to Artificial Neural Network, Introduction to Support Vector Machine.	15

Suggested Readings:

- DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
- Russell & Norvig, Artificial Intelligence-A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.
- Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition, 1991.
- W.F. Clocksin and Mellish, Programming in PROLOG, Narosa Publishing House, 3rd edition, 2001.

Suggested equivalent online courses:

- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034- artificial-intelligence-fall-2010/lecture-videos/
- https://nptel.ac.in/courses/106/102/106102220/
- https://nptel.ac.in/courses/106/105/106105078/

This course can be opted as an elective by the students of following subjects: NONE
Suggested Continuous Evaluation Methods: Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	**Marks**
Class Interaction	5

	Quiz/ Assignments	5	
	Seminar/Presentation	5	
	Unit Test/Class Test	15	
	Total	30	
Course Prerequisites: Diploma in Computer Application			

Subject: Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:** 3rd	**Semester:** 6th
Course Code:	**Course Title:** Web Technology		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand best technologies for solving web client/server problems		
CO 2:	Analyze and design real time web applications		
CO 3:	Use Java script for dynamic effects and to validate form input entry		
CO 4:	Analyze to Use appropriate client-side and Server-side application technology		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	

Total No. of Lectures-Tutorials-Practical (in hours per week):
4-0-0

Unit	Topic	No. of Lectures
I	Introduction to HTML: Basics of HTML, formatting and fonts, commenting code, hyperlink, lists, tables, images, forms, Meta tags, Character entities, frames and frame sets, Overview and features of HTML5.	10
II	Style Sheets: Need for CSS, Introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3	10
III	Introduction to JavaScript: JavaScript Variables and Data Types, Declaring Variables, Data Types, Statements and Operators, Control Structures, Conditional Statements, Loop Statements, Object-Based Programming, Functions, Executing Deferred Scripts, Objects, Message box in JavaScript, Dialog Boxes, Alert Boxes, Confirm Boxes, Prompt Boxes, JavaScript with HTML, Events, Event Handlers, Forms, Forms Array.	10
IV	PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP	15
V	PHP Database Connectivity: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs.	15

Suggested Readings:

- Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Prentice Hall, 2007
- JavaScript: The Good Parts by Douglas Crockford
- HTML5 for Web Designers by Jeremy Keith
- The Art and Science of CSS: Create Inspirational, Standards-Based Web Designs by Cameron Adams
- Headfirst PHP & MySQL by Lynn Beighley & Michael Morrison

Suggested equivalent online courses:

- https://onlinecourses.swayam2.ac.in/aic20_sp32/preview
- https://nptel.ac.in/courses/106/105/106105084/
- https://onlinecourses.swayam2.ac.in/aic20_sp11/preview

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5

Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Diploma in Computer Application

Subject: Computer Application		
Programme/Class: Bachelor of Computer Application	**Year:** 3rd	**Semester:** 6th

Course Code:	**Course Title:** Software Engineering
Course outcomes:	After successful completion of course the students will be able to:
CO 1:	Familiarize Software and Software Engineering.
CO 2:	Evaluate the Software Requirement Analysis.
CO 3:	Design about the Structured Analysis.
CO 4:	Identify the Software Design.
CO 5:	Appropriate about the Software Testing methods

Credits: 4	**Elective**
Max. Marks: 30+70	**Min. Passing Marks:**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures
I	**Introduction:** The Evolving Role of Software, Software characteristics, Software Engineering as a Layered Technology, Software Process Framework and Umbrella Activities, Process Models.	12
II	**Requirement Analysis:** Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modelling Techniques, Flow Oriented Modelling, Need for SRS, Characteristics and Components of SRS.	12
III	**Software Project Management**: Estimation in Project Planning Process, Project Scheduling. **Risk Management**: Software Risks, Risk Identification, Risk Projection and Risk Refinement,	12
IV	**Software Engineering Principles &Tools:** Tools of Design (Data Flow Diagrams, Data Dictionary, Decision Tree, Decision Tables), Modularization (Coupling)	12
V	**Testing Strategies & Tactics** : Software Testing Fundamentals, Test Strategies for Conventional Software, Validation Testing, System testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.	12

Suggested Readings:

- R.F.Fairley,, “Software Engineering Concepts”, McGraw Hill.
- R.S.Press Man , “Software Engineering A Practitioners Approach” McGraw Hill.
- Rajib Mall, “Fundamentals of Software Engineering”. PHI.
- Pankaj Jalote. “An Integrated Approach to Software Engineering”, Narosa

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/105/106105182/

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Diploma in computer Application.		

Subject: Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:** 3rd	**Semester:** 6th
Course Code:	**Course Title:** C# with .NET Framework		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Acquire the knowledge of the structure and model of the programming language C #		
CO 2:	Understand the use of programming language C # for various programming technologies		
CO 3:	Evaluate user requirements for software functionality required to decide whether the programming language C # can meet user requirements		
CO 4:	Develop variety of software in C #		
Credits: 4		**Core Compulsory**	
Max. Marks: 30+70		**Min. Passing Marks:**	

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures
I	The .NET Framework: Introduction, Common Language Runtime, Common Type System, Common Language specification, The Base Class Library, The .Net class library Intermediate language, Just-in time Compilation, Garbage Collection, Application Installation and Assemblies, Web services, Unified classes.	12
II	C# Basics: Introduction, Data Types, Identifiers, Variables and constants, C# statements, Object Oriented Concept, Object and Classes, Arrays and Strings, System collections, Delegates and Events, Indexes, Attributes, versioning.	12
III	C# Using Libraries: Namespace- System, Input Output, Multi-Threading, Networking and Sockets, Data Handling, Windows Forms, C# in web application, Error Handling	12
IV	Advanced Features Using C#: Web services, Windows services, messaging, Reflection, COM and C#, Localization.	12
V	Advanced Features Using C#: Distributed Application in C#, XML and C#, Unsafe Mode, Graphical Device Interface with C#, CASE Study (Messenger Application)	12

Suggested Readings:

- Jeffrey Richter, “Applied Microsoft .NET Framework Programming”, (Microsoft)
- Fergal Grimes, “Microsoft .Net for Programmers”, (SPD)
- Balagurusamy, “Programming with C# “, TMH
- Wiley,” Beginning Visual C# 2008”,Wrox

Suggested equivalent online courses:

This course can be opted as an elective by the students of following subjects: NONE

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Class Interaction	5
Quiz/ Assignments	5
Seminar/Presentation	5
Unit Test/Class Test	15
Total	30

Course Prerequisites: Diploma in Computer Application		

Subject: Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:** 3rd	**Semester:** 6th
Course Code:	**Course Title:** Lab: (Web Technology and C#)		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Create various software in C# programming language.		
CO 2:	Develop dynamic Web Applications.		
Credits: 4			**Core Compulsory**
Max. Marks: 30+70			**Min. Passing Marks:**
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4			

Unit	Topic	No. of Lectures
	Lab Experiment List	
	● Calculate Hypotenuse of triangle using dynamic initialization of variables ● Develop a C# application to print the students list using classes and objects ● Develop a C# application to implement inheritance concepts Single Inheritance, Multilevel Inheritance, Multiple Inheritance. ● Develop a console application to implement operator overloading concept in C# Unary Operator Overloading,Binary Operator Overloading ● Develop a C# application to implement multithreading. ● Develop a c# console application to implement the following concepts:Delegates, Events ● Design a window based application using C# ● Design windows based messenger application. ● Learn HTML fundamentals. ● Create Webpages with HTML, CSS. ● Practice javaScript. ● Create dynamic Webpages. ● Create a real life website.	**60**

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall

Internal Assessment	Marks
Record File	5
Viva-Voce	5
Practical Assessment	20

**********END OF DOCUMENT**********