NATIONAL EDUCATION POLICY-2020

Syllabus for Sridev Suman Uttarakhand University, Badshahithaul, Tehri (Garhwal) and Affiliated Colleges

BACHELOR IN COMPUTER APPLICATION (BCA) SYLLABUS

2023

Sri Dev Suman Uttarakhand University Badshahithaul, Tehri (Garhwal)

Curriculum Design Committee, Uttarakhand

S. No.	Name & Designation	
1.	Prof. N.K. Joshi Vice-Chancellor, Sridev Suman Uttarakhand University, New Tehri	Chairman
2.	Vice-Chancellor, Kumaun University, Nainital	Member
3.	Prof. Jagat Singh Bisht Vice-Chancellor, Soban Singh Jeena University Almora	Member
4.	Prof. Surekha Dangwal Vice-Chancellor, Doon University, Dehradun	Member
5.	Prof. O. P. S. Negi Vice-Chancellor, Uttarakhand Open University, Haldwani	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 Preparation Committee

A: Department of Physics, Sri Dev Suman Uttarakhand University Pt. Lalit Mohan Sharma Campus, Rishikesh

S.No.	Name	Designation
1.	Dr. Yogesh Kumar Sharma	Professor & Head
2.	Dr. Manoj Yadav	Professor
3.	Dr. Bimal Prakash Bahuguna	Professor
4.	Dr. Hemant Singh	Associate Professor

B: Experts from Other Institutions

S.No.	Name	Designation and Address
1.	Prof. G.K Dhingra	Dean, Faculty of Science, Pt. Lalit Mohan Sharma Campus, Rishikesh
2.	Prof. M.P Thapliyal	Dean &Professor, Department of Computer Science and Engineering, H.N.B Garhwal University Srinagar Garhwal
3.	Prof. Karamjit Bhatia	Department of Computer Science, Faculty of Science,Gurukul Kangri (Deemed to be University) Haridwar
4.	Prof. Pankaj Pant	Principal ,Govt. P.G College, Nagnath Pokhari
5.	Prof. Kuldeep Singh Negi	Principal, Govt. P.G. College, Khanpur
6.	Prof. Anita Rawat	Director, USERC, Dehradun
7.	Geeta Chauhan	Deputy Director, Department of Computer Application, Mahadevi Institute of Technology,Dehradun,Uttrakhand.

List of Papers in Six Semesters (BCA Degree)
Semester-wise Titles of the Papers in Computer Application

Year	Semester	Course Code	Course Title	Theory /Practical	Credits
Certificate in Computer Application					
First Year	I	CCAT101	Computer Fundamental	Theory	4
		CCAT102	Problem Solving Using C	Theory	4
		CCAT103	Basic Mathematics	Theory	4
		CCAT104	**Elective Paper [one from the list] E1**	Theory	4
		CCAP105	LAB: Problem Solving Using C and UNIX	Practical	4
		CCAT106	**Minor Elective Paper [one from the list] ME1***		
	II	CCAT201	Digital Electronics	Theory	4
		CCAT202	Object Oriented Programming With C++	Theory	4
		CCAT203	Data Structures	Theory	4
		CCAT204	**Elective Paper [one from the list] E2**	Theory	4
		CCAP205	LAB: Object Oriented Programming With C++ and Data Structure	Practical	4
		CCAT206	**Minor Elective Paper [one from the list] ME1***		
Diploma in Computer Application					
Second Year	III	DCAT301	Computer System Architecture	Theory	4
		DCAT302	Programming in Python	Theory	4
		DCAT303	Operational Research	Theory	4
		DCAT304	**Elective Paper [one from the list] E3**	Theory	4
		DCAP305	LAB: Programming in Python	Practical	4
		DCAT306	**Minor Elective Paper [one from the list] ME2****		
	IV	DCAT401	Operating System and System Administration	Theory	4
		DCAT402	Database Management System	Theory	4
		DCAT403	Numerical Analysis and Statistical Techniques	Theory	4
		DCAT404	**Elective Paper [one from the list] E4**	Theory	4
		DCAP405	LAB: Database Management System	Practical	4
		DCAT406	**Minor Elective Paper [one from the list] ME2****		
Bachelor of Computer Application					
Third Year	V	BCAT501	Digital Communication and Networks	Theory	4
		BCAT502	Programming in JAVA	Theory	4
		BCAT503	Computer Graphics	Theory	4
		BCAT504	**Elective Paper [one from the list] E5**	Theory	4
		BCAP505	LAB: Programming in JAVA	Practical	4
		BCAT506	**Minor Elective Paper [one from the list] ME3*****		
		BCAP507	**Industrial Training/Research Project**		Qualifying
	VI	BCAT601	Artificial Intelligence	Theory	4
		BCAT602	Web Technologies	Theory	4
		BCAT603	Software Engineering & Software Project Management	Theory	4
		BCAT604	**Elective Paper [one from the list] E6**	Theory	4
		BCAP605	LAB: Web Technologies	Practical	4
		BCAT606	**Minor Elective Paper [one from the list] ME3*****		
		BCAP607	**Industrial Training/Research Project**		Qualifying

Elective Papers (for BCA Students)				
List of Elective Papers E1				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1		Communicative English	4	I
2		CIT-002: Introduction to Information Technology(SWAYAM) https://onlinecourses.swayam2.ac.in/nou23_cs02/preview	4	I
List of Elective Papers E2				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1		Discrete Mathematics	4	II
2		Digital Forensics (SWAYAM) https://onlinecourses.swayam2.ac.in/nou22_cs05/preview	4	VI
List of Elective Papers E3				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1		Organizational Behaviour	4	III
2		E-Commerce Technologies (SWAYAM) https://onlinecourses.swayam2.ac.in/cec22_mg05/preview	4	III
List of Elective Papers E4				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1		Introduction to Cyber Security	4	IV
2		Data Mining (SWAYAM) https://onlinecourses.swayam2.ac.in/cec22_cs06/preview	4	IV
List of Elective Papers E5				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1		Cloud Computing	4	V
2		Cyber Security Tools Techniques and Counter Measures (SWAYAM) https://onlinecourses.swayam2.ac.in/nou22_ge24/preview	4	V
List of Elective Papers E6				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1		C# and .NET Framework	4	VI
2		Android Mobile Application Development (SWAYAM) https://onlinecourses.swayam2.ac.in/nou22_ge25/preview	4	VI

Minor Elective Papers (for Students of Other Faculty)				
*List of Minor Elective Papers MEL1				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1		CIT-001: Fundamentals of Computer Systems (SWAYAM) https://onlinecourses.swayam2.ac.in/nou22_cs06/preview	4	I/II
2		Computer Fundamentals(SWAYAM) https://onlinecourses.swayam2.ac.in/cec22_cs14/preview	4	I/II
3		Web Based Technologies and Multimedia Applications (SWAYAM) https://onlinecourses.swayam2.ac.in/nou23_cs03/preview	4	I/II
**List of Minor Elective Papers MEL2				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1		E-Commerce Technologies (SWAYAM) https://onlinecourses.swayam2.ac.in/cec22_mg05/preview	4	III/IV
2		Problem solving Aspects and Python Programming(SWAYAM) https://onlinecourses.swayam2.ac.in/cec23_cs02/preview	4	III/IV
3		Introduction to Cyber Security (SWAYAM) https://onlinecourses.swayam2.ac.in/nou23_cs04/preview	4	III/IV
***List of Minor Elective Papers EL3				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1		Basics of Remote sensing, GIS & GNSS technology and their applications (SWAYAM) https://onlinecourses.swayam2.ac.in/aic22_ge16/preview	4	V/VI
2		Cyber Security Tools Techniques and Counter Measures (SWAYAM) https://onlinecourses.swayam2.ac.in/nou22_ge24/preview	4	V/VI
3		Production Management(SWAYAM) https://onlinecourses.swayam2.ac.in/nou20_cs07/preview	4	V/VI

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 & PROJECT

Subject: Computer Application

Programme	Year	Semester	Paper I	Credit/hrs	Paper 2	Credit/hrs	Paper 3	Credits/hrs	Paper 4	Credits/hrs	Paper 5	Credits/hrs
Certificate in Computer Application	I	I	Computer Fundamental	4/60	Problem Solving Using C	4/60	Basic Mathematics	4/60	Elective Paper [one from the list] E1	4/60	LAB: Problem Solving Using C and UNIX	4/60
		II	Digital Electronics	4/60	Object Oriented Programming With C++	4/60	Data Structures	4/60	Elective Paper [one from the list] E2	4/60	LAB: Object Oriented Programming With C++ and Data Structure	4/60
Diploma in Computer Application	II	III	Computer System Architecture	4/60	Programming in Python	4/60	Operational Research	4/60	Elective Paper [one from the list] E3	4/60	LAB: Programming in Python	4/60
		IV	Operating System and System Administration	4/60	Database Management System	4/60	Numerical Analysis and Statistical Techniques	4/60	Elective Paper [one from the list] E4	4/60	LAB: Database Management System	4/60
Bachelor of Computer Application	III	V	Digital Communication and Network	4/60	Programming in JAVA	4/60	Computer Graphics	4/60	Elective Paper [one from the list] E5	4/60	LAB: Programming in JAVA	4/60
		VI	Artificial Intelligence	4/60	Web Technologies	4/60	Software Engineering & Software Project Management	4/60	Elective Paper [one from the list] E6	4/60	LAB: Web Technologies	4/60

Subject: Computer Application			
Programme/Class: Certificate in Computer Application		**Year:** 1st	**Semester:** 1st
Course Code:	**Course Title:** Computer Fundamental		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understanding the evolution and classification of computers, different types of memory, storage devices, and software.		
CO 2:	Ability to perform conversions between different number systems.		
CO 3:	Understanding basic concepts in virtual and augmented reality, Bluetooth, Wi-Fi, and networks.		
CO 4:	Knowledge of different operating systems and their functions.		
CO 5:	Ability to use basic UNIX commands.		
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 Computer: Evolution of computers, Generation of Computers, Classification of Computers, Analog Digital and Hybrid Computers, Classification of Computers according to size, Super Computers, Mainframe Computers, Personal Computers (Different Types), Components of Computer System, Advantages and Disadvantages of Computer System, Block Diagram of a Digital Computer, Basic introduction to Input/ Output Devices.	12
II	Different number systems and their conversions (Decimal, Binary, Octal, and Hexadecimal), 1'sComplement and 2's complement, Floating Point numbers, Binary arithmetic, Coding Techniques – BCD, EBCDIC, Gray, and Excess-3.	12
III	Memory: Memory hierarchy, Registers (Types of Registers), Cache Memory, Primary Memory (RAM, how data is stored in a RAM, DRAM and SRAM. ROM (BIOS/ Firmware & Types of ROM). Secondary Memory (Hard disk: Structure of a hard disk, how data is stored in a hard disk, concept of tracks, sectors, clusters, cylinders, Various Storage Devices (Magnetic Tape, Floppy Disks, Optical Disks, SD/MMC Memory cards, USB Pen drive).	12
IV	Software: Software and its Need, Types of Software: - System software, Application software. Definition of Operating System, History of Operating System, Function of Operating System, OS classification (Batch, Multiprogramming, Multitasking, Multithreading, Multiprocessing, Multiuser, Time sharing, Real time).	12
V	High level language and low-level language, Hardware, Firmware, Compiler, Interpreter and Assembler. Introduction: Virtual reality, augmented reality, Bluetooth, Wi-Fi, Network Fundamental: Categories, Data flow, Topology. Introduction: UNIX, Basic Commands	12

Suggested Readings:

- "Computer Fundamentals and Applications" by P. K. Sinha.
- "An Introduction to Computer Science" by James Tam.
- "Computer Basics Absolute Beginner's Guide" by Michael Miller.

Suggested equivalent online courses:

- https://onlinecourses.swayam2.ac.in/nou23_cs01/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: 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:** 1st
Course Code:	**Course Title:** Problem Solving Using C		
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, File structure, File handling function, File types, Streams, Text, Binary, File system basics, The file pointer, Opening a file, Closing a file, Writing a character, Reading a character, Using fopen( ), getc( ), putc( ), and fclose( ), Using feof( ).	12

Suggested Readings:

- E. Balagurusamy, "PROGRAMMING IN ANSI C" McGraw-Hill publication, New Delhi
- 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	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:** 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	**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.	12
II	**Co-ordinate Geometry:** System of lines, System of Circles, Standard equations & properties of parabola & ellipse.	12
III	**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.	12
IV	**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.	12
V	**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.	12

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://epgp.inflibnet.ac.in/Home/ViewSubject?catid=ZLCHeZEhCZ8yCri36nSF3A==
- 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: 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:** 1st
Course Code:	**Course Title:** Communicative English		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Demonstrate improved writing skills in English without grammatical error.		
CO 2:	To Express their viewpoints effectively and with confidence in English.		
CO 3:	To Learn official drafting and use it for formal communication.		
CO 4:	Better understand the inter-personal communication skills and positive attitude leading to their professional competence.		
CO 5:	To understand the importance of building healthy relationships in an organization.		
CO 6:	To improve presentation skills and voice-dynamics.		
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 : Origin and Scope, Process of Communication, Types of communication, Inter-cultural Communication, Verbal and Non-Verbal Communication, Principles and Barriers to Communication, Strategies for effective Communication.	12
II	Understanding language skills: Listening, Speaking and Reading i. Enhancing Listening Skills: Active and Passive listening, the listening process, Types of Listening, Deterrents to the effective listening and Essentials for good listening. ii. Effective Speaking Skills: Principles of effective speaking, Organs of Speech, Intonation, Spelling and Pronunciation. iii. Reading Comprehension; Skimming, Scanning and searching for the information.	10
III	Importance of Written Communication, Media of written communication, Merits and demerits of written communication. Practicing- Precise Writing, Business letters, Preparation of resume, Office memorandum, and E-mails.	14
IV	Effective Presentation Strategies, Use of Visual Aids, Interviews, Group Discussion, Conferences and PPT making.	14
V	Perception of Human Conduct, Intrapersonal Skills & Interpersonal Skills. Professional Etiquettes Level, Common English Greetings and Expressions, Business Greetings & Formal Greetings.	10

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: 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:** 1st
Course Code:	**Course Title:** LAB: Problem Solving Using 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:** 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:** Object Oriented Programming With 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 data 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:

- E.Balagurusamy: Object oriented programming with C++
- K.R.Venugopal: Mastering C++
- 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: 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:** Data Structures		
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: 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:** 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		**Core Compulsory**	
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: Computer Application			
Programme/Class: Certificate in Computer Application		**Year:** 1st	**Semester:** 2nd
Course Code:	**Course Title:** Object Oriented Programming With C++ and Data Structure		
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.	**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:** 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:** Programming in Python		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand the basics of Python programming, including the interpreter in interactive and script mode, program structure, indentation, identifiers, keywords, constants, variables, and operators.		
CO 2:	Demonstrate an understanding of data types, including mutable and immutable data types, and evaluate expressions involving different data types.		
CO 3:	Develop programs using conditional and loop blocks, including if-else statements, simple and nested for loops, while loops, and loop manipulation using pass, continue, break, and else.		
CO 4:	Use string, list, and dictionary data types and manipulate them using in-built functions and methods to solve programming problems.		
CO 5:	Understand the concepts of functions and organize Python code using functions.		
CO 5:	Develop an understanding of object-oriented programming in Python, including classes, objects, operator overloading, overriding, and special methods.		
CO 7:	Demonstrate proficiency in file operations in Python, including reading and writing files, manipulating file pointers, and understanding file modes.		
CO 8:	Understand the concepts of iterators and generators and use them to create iterable objects.		
CO 9:	Use assertions for testing and debugging Python projects and apply web scraping techniques using Python.		
CO 10:	Understand the basics of data handling using Pandas, including the creation of Series and Data Frames, mathematical operations, selection, indexing, and slicing.		
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	Basics of Python programming, Python interpreter - interactive and script mode, the structure of a program, indentation, identifiers, keywords, constants, variables, types of operators, precedence of operators, data types, mutable and immutable data types, statements, expressions, evaluation of expressions, comments, input and output statements, data type conversion. Python Program Flow Control Conditional blocks: if, else and else if, Simple for loops in python, For loop using ranges, string, list and dictionaries. Use of while loops in python, Loop manipulation using pass, continue, break and else. Programming using Python conditional and loop blocks.	12
II	Python Complex data types: Using string data type and string operations, Defining list and list slicing, Use of Tuple data type. String, List and Dictionary, Manipulations Building blocks of python programs, string manipulation methods, List manipulation. Dictionary manipulation, Programming using string, list and dictionary in-built functions.	12
III	Python Functions, Organizing python codes using functions. Classes and Objects: An introduction to object-oriented programming in Python. objects, operator overloading, overriding, special methods. Inheritance, polymorphism and composition.	12
IV	Python File Operations: Reading files, Writing files in python, Understanding read functions, read(), readline(), readlines(). Understanding write functions, write() and writelines() Manipulating file pointer using seek, Programming using file operations. File Modes. 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
V	Data Handling using Pandas: Data structures in Pandas - Series and Data Frames. Series: Creation of Series from – ndarray, dictionary, scalar value; mathematical operations; and Tail functions; Selection, Indexing and Slicing. Data Frames: creation - from dictionary of Series, list of dictionaries, Text/CSV files; display; iteration; Operations on rows and columns: add, select, delete, rename; Head and Tail functions; Indexing using Labels, Boolean Indexing; Importing/Exporting Data between CSV files and Data Frames.	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

- "Python for Data Analysis, 2nd Edition: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney
- "Learning Python, 5th Edition" by Mark Lutz

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:** Operational Research		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Identify and develop operational research models from the verbal description of the real system.		
CO 2:	Solve the problems using special solution algorithms.		
CO 3:	Formulate and solve problems as networks and graphs.		
CO 4:	Construct linear integer programming models and discuss the solution techniques.		
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 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. Integer Programming Problems	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	Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models. 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: To study this course, a student must have had the subject Mathematics in class 12th

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 of Organizational 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 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:

- 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	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: Diploma in Computer Application		**Year:** 2nd	**Semester:** 3rd
Course Code:	**Course Title:** LAB: Programming in 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	
	• A program that takes user input and performs mathematical operations on the input data, including addition, subtraction, multiplication, and division. • A program that reads a file and displays the contents of the file on the console. • A program that manipulates strings, including concatenation, slicing, and searching for substrings. • A program that uses conditional statements to check if a number is positive or negative. • A program that uses a for loop to iterate through a list and performs a specific operation on each element. • A program that uses a while loop to keep prompting the user for input until a specific condition is met. • A program that defines a function that takes input data and performs a specific operation on the data. • A program that defines a class and creates objects of the class, demonstrating the concepts of object-oriented programming. • A program that reads a CSV file using Pandas and performs operations on the data, such as selecting specific columns, filtering rows based on a condition, and calculating summary statistics. • A program that performs web scraping using Python, extracting data from a website and saving it to a file.	**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:** 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 OS 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, Priority	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:

Subject: Computer Application			
Programme/Class: Diploma in Computer Application		**Year:** 2nd	**Semester:** 4th
Course Code:	**Course Title:** Database Management System		
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	Introduction to DBMS: Introduction of Database Management System, Objective of Database Management System, Importance of DBMS, Merit and Demerit of DBMS, Application of DBMS.	06
II	Database Design, Architecture and Model: Overview of The Database Designing Process and View of Data, Structure of Database Management System, Level Database Architecture and Data Independence, Database Languages: DDL, DML, QBE; Data Models: Hierarchical, Network, Relational, E-R Model, Object Base Data Model; E-R Diagram: Concepts, Relationship, Entity Relationship Diagram, Weak Entity Sets, Strong Entity Set, Aggregation, Generalization, Converting ER Diagrams to Tables.	12
III	Relational Database Model & Database Normalization: Structure of RDBMS and Terminology, Database Schema and Schema Diagram. Keys: Super, Candidates, Primary, Foreign, Composite etc., and Relationship: Introduction to Relational Algebra, Relational Algebra Operations: Select, Project, Cartesian Product, Union, Set Difference, Natural Join, Outer Join. Definition and Importance of Normalization, Functional dependencies. Normalization: 1NF, 2NF, 3NF, BCNF and 4NF.	12
IV	Creating and Altering Database and Tables (SQL): Introduction to SQL, Creating Database with Different Type of Arguments and Alter Database, Creating Normal tables and Complex tables with different Type of Constraints (Key, Check, Default); Alter Tables: Adding and Dropping Attributes and Other Constraints; Drop Statement: Table, Database. Manipulating and Querying Data: INSERT, SELECT, FROM Clause, WHERE Clause; ORDER and GROUP by Clause, Select Statement; INNER JOINS, OUTER JOIN and CROSS JOIN; Building Nested Queries, UPDATE Statement and DELETE Statement; Creating and Altering View. Math functions, Text functions, Date Functions, Aggregate Functions Interface of python with an SQL database: connecting SQL with Python, performing insert, update, delete queries using cursor, display data by using fetchone(), fetchall(), rowcount, creating database connectivity applications	18
V	Query Processing and Security: Overview of Query Processing, Measuring of Query Cost, Selection Operation, Sorting, Joining Evaluation of Expression, Query Optimization; Database Administrator: DBA Roles and Responsibilities, Database Security Issues, Types of Security, Access Protection, User Accounts and Database Audits, Discretionary Access Control, Mandatory Access Control; Data Encryption and Decryptions.	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: CS302	**Course Title:** Numerical Analysis and Statistical Techniques		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand the basics of statistics, including measures of central tendency and dispersion, and the importance of data visualization.		
CO 2:	Analyze and interpret data using various types of diagrams, graphs, and plots.		
CO 3:	Use Matplotlib to create and customize plots, including line plots, bar graphs, and histograms, by adding labels, titles, and legends.		
CO 4:	Apply correlation and regression analysis to investigate relationships between variables.		
CO 5:	Explain the concepts of probability and probability distributions, and use numerical methods to solve problems in numerical differentiation, integration, and interpolation.		
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. Data Visualization: Drawing and saving following types of plots using Matplotlib – line plot, bar graph, histogram Customizing plots: adding label, title, and legend in plots	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, Newton's and Lagrange's Interpolation for unequal intervals, Central differences: Gauss Forward, Gauss Backward, Stirling's & 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. Solution of Linear Algebraic Equations: Gaussian Elimination Method, Gauss-Jordan Method, Iterative Methods(Jacobi & Gauss-Seidel Iteration).	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:

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:	Understand 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:	Apply security principles to system design.		
CO 4:	Apply methods for authentication, access control, intrusion detection and prevention in Cyber Security.		
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 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 HACKINGAND 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:

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	5
Seminar	5
Assignment (Charts/ Flora/ Rural Service/ Technology Dissemination)	15
Total	30

Course Prerequisites:

	Diploma in computer Application.	
Subject: Computer Application		
Programme/Class: Diploma in Computer Application	**Year:** 2nd	**Semester:** 4th
Course Code:	**Course Title:** Lab: Database Management System	
Course outcomes:	On completion of the course, the student will be able to:	
CO 1:	Create, Maintain and Querry 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 relation ships 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	25

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:	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	Collection Framework, Interfaces - Collection - List - Set - SortedSet - Enumeration - Iterator – ListIterator, Classes - LinkedList - ArrayList - Vector - HashSet	12
IV	Exception: Exception types, Using try catch and multiple catch Nested try, throw, throws and finally, Creating user defined Exceptions File Handling: Stream ByteStream Classes CharacterStream Classes, File IO basics, File operations Creating file Reading file (character, byte) Writing file (character, byte), MultiThreading	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:** 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:** 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		**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**: 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:

- CloudComputingBible**,** BarrieSosinsky**,** 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	5
Seminar	5
Assignment (Charts/ Flora/ Rural Service/ Technology Dissemination)	15
Total	30

Course Prerequisites:

	Certificate 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: Check the equality of two strings, Reverse a string. ● Program using loops: to find the sum of digits of a given number, display a multiplication table, ● Display all prime numbers between 1 to 1000. ● Program to demonstrate all math class functions. ● Program on files: to copy a file to another file using Java to package classes. ● 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. ● Creating and using Packages. ● Programs to demonstrate the use of container classes of JAVA. ● Creating GUI applications using Java Swing. ● Create Clone of popular real-life windows Application.	**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 fundamental concepts and techniques of artificial intelligence.		
CO 2:	Apply various search algorithms and knowledge representation techniques to solve problems.		
CO 3:	Apply machine learning algorithms to analyze data and make predictions.		
CO 4:	Design and implement intelligent systems and 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	Introduction: Definition and brief history of AI, Applications of AI, Challenges and limitations of AI. Problem-solving methods and strategies: Uninformed search algorithms: depth-first search, breadth-first search, Informed search algorithms: A* algorithm, heuristic search	12
II	Knowledge representation languages: propositional logic, predicate logic Inference methods: forward chaining, backward chaining. Rule-based systems: production rules, certainty factors Expert systems: architecture, knowledge acquisition, reasoning	12
III	Introduction to Machine Learning: Types of machine learning: supervised learning, unsupervised learning, reinforcement learning, Training and testing data,Evaluation metrics	12
IV	Linear Regression: Definition and applications of linear regression, Simple linear regression and multiple linear regression, Gradient descent algorithm.Logistic Regression: Definition and applications of logistic regression, Binary logistic regression and multi-class logistic regression, Cost function and gradient descent algorithm	12
V	Neural Networks: Definition and applications of neural networks Perceptron, multi-layer perceptron, Backpropagation algorithm. Natural Language Processing: Overview of NLP, Text preprocessing: tokenization, stemming, lemmatization, Named entity recognition, sentiment analysis.	12

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.
- Tom Mitchell. Machine Learning. McGraw Hill, 1997.
- Dan Jurafsky and James H. Martin. Speech and Language Processing.

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:	Develop basic HTML pages with formatting, links, images, tables, and forms.		
CO 2:	Apply CSS to style HTML pages with backgrounds, colors, fonts, borders, and layout.		
CO 3:	Create interactive web pages with JavaScript by manipulating the DOM, handling events, and validating user input.		
CO 4:	Utilize server-side scripting with PHP to handle form submissions and connect to a MySQL database.		
CO 5:	Design and implement RESTful web services using Node.js and Express, including HTTP methods and status codes for API endpoints.		
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	10
III	Client-Side Scripting: Introduction to JavaScript, Variables and Data Types, Statements and Operators, Control Structures, Conditional Statements, Loop Statements, Object-Based Programming, Functions, Objects, Message box in JavaScript, Dialog Boxes, Alert Boxes, Confirm Boxes, Prompt Boxes, JavaScript with HTML, Events, Event Handlers, Forms, Forms Array. Document Object Model (DOM) manipulation, Validating user input using JavaScript	10
IV	Server-Side Scripting: Introduction to PHP, Variables, operators, and control structures in PHP, Functions and arrays in PHP, Server-side form handling and processing, Advance Features: Cookies and Sessions, Introduction to MySQL and database connectivity	15
V	RESTful Web Services and APIs: Introduction to REST architecture, Understanding RESTful web services, Designing RESTful APIs, HTTP methods and status codes for RESTful APIs, Implementing RESTful APIs using Node.js and Express	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:

Subject: Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:** 3rd	**Semester:** 6th
Course Code:	**Course Title:** Software Engineering &Software Project Management		
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		**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:** 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	5
Seminar	5
Assignment (Charts/ Flora/ Rural Service/ Technology Dissemination)	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. • Create a basic HTML page with proper formatting, links, images, and lists. • Add CSS to the HTML page to enhance the visual design with backgrounds, colors, fonts, and layout. • Use JavaScript to manipulate the DOM of the HTML page, create event handlers, and validate user input in a form. • Develop a server-side script using PHP to process form submissions and save data to a MySQL database. • Design and implement a RESTful API using Node.js and Express to retrieve and display data from the MySQL database on a web page. • Practice debugging techniques for HTML, CSS, JavaScript, and PHP code. • Collaborate with a partner to build a simple web application using all the tools learned in the course, including HTML, CSS, JavaScript, PHP, and MySQL. • Perform website optimization techniques such as minification and caching to improve website performance. • Explore responsive web design by creating web pages that adapt to different screen sizes and devices. • Create a final project that showcases the student's knowledge of HTML, CSS, JavaScript, PHP, and MySQL. The project could be a simple website, a web application, or a RESTful API.	**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