NATIONAL EDUCATION POLICY-2020

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

BACHELOR IN COMPUTER SCIENCE (BCS) 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.

11.7.2023

		Subject I (Computer Science)		Subject II	Subject III	Subject IV	Vocational	Co-Curricular	Industrial Training / Survey / Research Project	{Minimum Credits} for the Year	{Cumulative Minimum Credits} Required for Award of Certificate/ Diploma/ Degree
		Major		Major	Major	Minor Elective	Minor	Minor	Major		
		4/5/6 Credits		4/5/6 Credits	4/5/6 Credits	4/5/6 Credits	3 Credits		4 Credits		
Year	Sem	Science Faculty		Science Faculty	Science/Other Faculty	Science/Other Faculty	Vocational/Skill Development Course	Co-Curricular Courses (Qualifying)	Inter/Intra Faculty related to main subject		
1	I	CS101 - Computer Fundamentals & Problem Solving	Th-1 (4)	To be opted from other subjects of science faculty	To be opted from other subjects of science/other faculty	To be opted by the students of other subjects. List of offered minor elective courses given below (*EL1 & **EL2)	To be opted from subject list offered by Institute	To be opted from subject list offered by Institute	N/A	46	{46} Certificate in Science
		CS103 - Lab: Computer Fundamentals & Problem Solving	Pract-1(2)								
	II	CS102 - Data Structures & Algorithms	Th-1 (4)								
		CS104 - Lab: Data Structures & Algorithms	Pract-1(2)								
2	III	CS201 - Digital Electronics & Computer System Architecture	Th-1 (6)							46	{92} Diploma in Science
	IV	CS202 - Database Management System with Python	Th-1 (4)								
		CS204 - Lab: Database Management System with Python	Pract-1(2)								

		Subject I (Computer Science)		Subject II	Subject III	Subject IV	Vocational	Co-Curricular	Industrial Training / Survey / Research Project	{Minimum Credits} for the Year	{Cumulative Minimum Credits} Required for Award of Certificate/ Diploma/ Degree
		Major		Major	Major	Minor Elective	Minor	Minor	Major		
		4/5/6 Credits		4/5/6 Credits	4/5/6 Credits	4/5/6 Credits	3 Credits		4 Credits		
Year	Sem	Science Faculty		Science Faculty	Science/Other Faculty	Science/Other Faculty	Vocational/Skill Development Course	Co-Curricular Courses (Qualifying)	Inter/Intra Faculty related to main subject		
3	V	CS301 - Computer Graphics in JAVA	Th (4)	To be opted from other subjects of science faculty	N/A	N/A	To be opted from subject list offered by Institute	To be opted from subject list offered by Institute	CS307: Industrial Training/Research Project (Qualifying)	40	{132} Bachelor in Science
		CS303 - Computer Networks	Th (4)								
		CS305 - Lab: Computer Graphics in JAVA	Pract (2)								
	VI	CS302- Operating System & System Administration	Th (4)						CS308: Industrial Training/Research Project (Qualifying)		
		CS304 - Information Security	Th (4)								
		CS306 - Lab: Operating Systems & System Administration	Th (4)								

		Subject I (Computer Science)		Subject II	Subject III	Subject IV	Vocational	Co-Curricular	Industrial Training / Survey / Research Project	{Minimum Credits} for the Year	{Cumulative Minimum Credits} Required for Award of Certificate/ Diploma/ Degree
		Major		Major	Major	Minor Elective	Minor	Minor	Major		
		4/5/6 Credits		4/5/6 Credits	4/5/6 Credits	4/5/6 Credits	3 Credits		4 Credits		
Year	Sem	Science Faculty		Science Faculty	Science/Other Faculty	Science/Other Faculty	Vocational/Skill Development Course	Co-Curricular Courses (Qualifying)	Inter/Intra Faculty related to main subject		
4	VII	CS401 - Discrete Mathematics	Th (4)	N/A	N/A	To be opted by the students of other Faculty. List of offered minor elective courses given below (**EL3)	N/A	N/A	CS411: Industrial Training/Research Project (4)	52	{184} Bachelor (Research in Computer Science)
		CS403 - Theoretical foundation of Computing	Th (4)								
		CS405 - Artificial Intelligence	Th (4)								
		CS407 - Design and Analysis of Algorithms	Th (4)								
		CS409 - Lab: Design and Analysis of Algorithms	Pract (4)								
	VIII	CS402 - Compiler Design	Th (4)						CS412: Industrial Training/Research Project (4)		
		CS404 - Research trends in Computer Science	Th (4)								
		CS406 - Machine Learning with Python	Th (4)								
		CS408 - Software Engineering	Th (4)								
		CS410 – Lab : Machine Learning with Python	Pract (4)								

Department of Computer Science

Semester-wise Titles of the Papers in Computer Science (Major)					
Year	Semester	Course Code	Course Title	Theory /Practical	Credits
Certificate in Science					
First Year	I	CS101	Computer Fundamentals & Problem Solving	Theory	4
		CS103	Lab: Computer Fundamentals & Problem Solving	Practical	2
	II	CS102	Data Structures & Algorithms	Theory	4
		CS104	Lab: Data Structures & Algorithms	Practical	2
Diploma in Science					
Second Year	III	CS201	Digital Electronics & Computer System Architecture	Theory	6
	IV	CS202	Database Management System with Python	Theory	4
		CS204	Lab: Database Management System with Python	Practical	2
Bachelor in Science (with specialization in Computer Science)					
Third Year	V	CS301	Computer Graphics in JAVA	Theory	4
		CS303	Computer Networks	Theory	4
		CS305	Lab: Computer Graphics in JAVA	Practical	2
		CS307	Industrial Training/Research Project		Qualifying
	VI	CS302	Operating System & System Administration	Theory	4
		CS304	Information Security	Theory	4
		CS306	Lab: Operating Systems & System Administration	Practical	2
		CS308	Industrial Training/Research Project		Qualifying
Bachelor (Research In Computer Science)					
Fourth Year	VII	CS401	Discrete Mathematics	Theory	4
		CS403	Theoretical foundation of Computing	Theory	4
		CS405	Artificial Intelligence	Theory	4
		CS407	Design and Analysis of Algorithms	Theory	4
		CS409	Lab: Design and Analysis of Algorithms	Practical	4
		CS411	Industrial Training/Research Project		4
	VIII	CS402	Compiler Design	Theory	4
		CS404	Research trends in Computer Science	Theory	4
		CS406	Machine Learning with Python	Theory	4
		CS408	Software Engineering	Theory	4
		CS410	Lab: Machine Learning with Python	Practical	4
		CS412	Industrial Training/Research Project		4

List of Elective Papers offered by the department (EL1)				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1	CS105E	Fundamentals of Computer Systems (SWYAM) https://onlinecourses.swayam2.ac.in/nou22_cs06/preview	4	I/II
2	CS106E	Web Based Technologies and Multimedia Applications (SWYAM) https://onlinecourses.swayam2.ac.in/nou22_cs03/preview	4	I/II
3	CS107E	Introduction to Cyber Security (SWYAM) https://onlinecourses.swayam2.ac.in/nou22_cs04/preview	4	I/II
****List of Elective Papers offered by the department (EL2)**				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1	CS205E	PHP and MySQL (SWYAM) https://onlinecourses.swayam2.ac.in/aic20_sp32/preview	4	III/IV
2	CS206E	Cyber Security Tools Techniques and Counter Measures (SWYAM) https://onlinecourses.swayam2.ac.in/nou22_ge24/preview	4	III/IV
3	CS207E	Python 3.4.3 (SWYAM) https://onlinecourses.swayam2.ac.in/aic20_sp33/preview	4	III/IV
****List of Elective Papers offered by the department (EL3)**				
S. No.	**Course Code**	**Course Title**	**Credits**	**To be Opted in the Semester**
1	CS413E	Basics of Remote sensing, GIS & GNSS technology and their applications (SWYAM) https://onlinecourses.swayam2.ac.in/aic22_ge16/preview	4	VII/VIII
3	CS414E	Digital Forensics (SWYAM) https://onlinecourses.swayam2.ac.in/nou22_cs05/preview	4	VII/VIII
4	CS415E	E-Commerce Technologies (SWYAM) https://onlinecourses.swayam2.ac.in/cec22_mg05/preview	4	VII/VIII

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 Science	
PSO 1	Bridge the fundamental concepts of computers with the present level of knowledge of the students.
PSO 2	Illustrate the process of problem solving using C++ and apply solutions to real world problems.
PSO 3	Apply applications for a range of problems using object-oriented programming Techniques.
PSO 4	Understand various techniques of data organisation.
Programme specific outcomes (PSOs) Diploma in Computer Science	
PSO 1	Understand Digital Computer and Digital Systems.
PSO 2	Remember and Understand the basics of computer organization and Design.
PSO 3	Learn fundamentals of Database Management System
PSO 4	Create, Maintain, and query MySQL database
Programme specific outcomes (PSOs) Bachelor in Science (with specialization in Computer Science)	
PSO 1	To Gain knowledge of the fundamentals and intermediate-level concepts of Computer Science would have enhanced
PSO 2	To understand the basics and intermediate-level soft skills.
PSO 3	To understand of the traditional and current technologies and practices in the world of Computers and digital platforms.
PSO 4	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
Programme specific outcomes (PSOs): Bachelor (Research In Computer Science)	
PSO 1	Learn the concepts of software development life cycle models.
PSO 2	Discuss the key technological components of the Network.
PSO 3	Gain knowledge of advanced and sophisticated data structures, their mechanism, operations, and interconnection with algorithms.
PSO 4	Analyze & implement required module, which may include front-end, back-end, and a small set of middle-end optimizations.

Year wise Structure of B.Sc. in Computer Science (CORE / ELECTIVE COURSES & PROJECTS)												
	Subject: Computer Science											
Type of Programme	**Year**	**Sem**	**Paper I**	**Credit /hrs**	**Paper 2**	**Credit/ hrs**	**Paper 3**	**Credits /hrs**	**Elective Paper**	**Credits /hrs**	**Research Project**	**Credit/hrs**
Certificate	I	I	Computer Fundamentals & Problem Solving	4/60	Lab: Computer Fundamentals & Problem Solving	2/60			* Elective Paper [from the list] EL1	4/60		
		II	Data Structures & Algorithms	4/60	Lab: Data Structures & Algorithms	2/60				4/60		
Diploma	II	III	Digital Electronics & Computer System Architecture	6/90					** Elective Paper [from the list] EL2	4/60		
		IV	Database Management System with Python	4/60	Lab: Database Management System with Python	2/60				4/60		
Bachelor of Science	III	V	Computer Graphics in JAVA	4/60	Computer Networks	4/60	Lab: Computer Graphics in JAVA	2/60			Industrial Training/Research Project	Qualifying
		VI	Operating Systems & System Administration	4/60	Information Security	4/60	Lab: Operating Systems & System Administration	2/60			Industrial Training/Research Project	Qualifying

Year wise Structure of M.Sc. in Computer Science (CORE / ELECTIVE COURSES & PROJECTS)

Subject: Computer Science

Programme	Year	Sem	Paper I	Credit /hrs	Paper 2	Credit /hrs	Paper 3	Credits /hrs	Paper 4	Credits /hrs	Paper 5	Credits /hrs	Elective Paper	Credits /hrs	Research Project	Credits /hrs
Bachelor (Research in Computer Science)	IV	VII	Discrete Mathematics	4/60	Theoretical foundation of Computing	4/60	Artificial Intelligence	4/60	Design and Analysis of Algorithms	4/60	Lab: Design and Analysis of Algorithms	4/60	*** Elective Paper [from the list] EL3		Industrial Training/ Research Project	4/60
		VIII	Compiler Design	4/60	Research trends in Computer Science	4/60	Machine Learning with Python	4/60	Software Engineering	4/60	Lab: Machine Learning with Python	4/60	*** Elective Paper [from the list] EL3		Industrial Training/ Research Project	4/60

Subject: Computer Science			
Programme/Class: Certificate		**Year:** 1st	**Semester:** I
Course Code: CS101		**Course Title:** Computer Fundamentals & Problem Solving	
Course outcomes:			
CO 1:	Bridge the fundamental concepts of computers with the present level of knowledge of the students.		
CO 2:	Familiarize operating systems, programming languages, peripheral devices, networking, multimedia and internet		
CO 3:	Understand binary, hexadecimal and octal number systems and their arithmetic.		
CO 4:	Understand the difference between the top-down and bottom-up approach and concepts of object-oriented programming in connection with C++.		
CO 5:	Illustrate the process of data file manipulations using C++ and apply virtual and pure virtual function & complex programming situations.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**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:** Computer System, Advantages and Disadvantages of Computer System, Evolution of computers, Generation of Computers, Classification of Computers, , Block Diagram of a Digital Computer, introduction to Input/ Output Devices.	6
II	**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).	8
III	**Software:** Software and its Need, Types of Software: - System software, Application software. **Operating System:** History of Operating System, Function of Operating System, OS classification (Batch, Multiprogramming, Multitasking, Multithreading, Multiprocessing, Multiuser, Time sharing, real time). Programming languages, **Translators:** Compiler, Interpreter and Assembler. **Network Fundamental**: Categories, Data flow, Topology.	6
IV	**Fundamentals of C++:** Data Types and Sizes, Declaration of variables, Modifiers, Identifiers and keywords, Symbolic constants. Operators, Precedence and order of evaluation. **Control statements**: if-else, else-if clause, switch. Loops: for, while, do-while, break, continue. **Functions**: Defining a function, function prototyping and function calls, function arguments, passing by reference, inline functions, and default arguments. **Arrays**: linear arrays, multidimensional arrays, passing arrays to functions.	8
V	**Object Oriented Concepts**: Elements of Object-Oriented programming, Objects, Classes, and OOPs features. **Classes & Objects**: Specifying a Class, Creating Objects, Accessing Class members, defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access Specifiers, Constructors and Destructors, Exception Handling basics	8
VI	**Operator Overloading**: Definition, Overloadable Operators, Unary and Binary Operators overloading through Member Functions and Friend Functions,	8

	Function Overloading, Constructor Overloading. **Dynamic Memory Allocation**: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, 'this' Pointer.	
VII	Inheritance, Types of Inheritance, Virtual Functions, Pure Virtual Function, Templates, Standard Template Library, Containers: Vectors, Lists, Iterators. File Handling.	8
VIII	Standard Template Library: STL containers containing vectors, list, queue, map, set, hash_map, hash_set. STL algorithms functions: Sorting Algorithms functions: sort, partial_sort.	8

Suggested Readings:

- Fundamentals of Computers- P. K. Sinha.
- Robert Lafore, Object Oriented Programming in C++, PHI.

Suggested equivalent online courses:

- nptel.ac.in/courses/106/105/106105151/

This course can be opted as an elective by the students of following subjects: N/A

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	10
Total	25

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

Subject: Computer Science			
Programme/Class: Certificate		**Year:** 1st	**Semester:** I
Course Code: CS103	**Course Title:** Lab: Computer Fundamentals & Problem Solving		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Develop programs with reusability.		
CO 2:	Construct programs for file handling Handle exceptions in programming.		
CO 3:	Apply applications for a range of problems using object-oriented programming Techniques.		
Credits: 2		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4			

Unit	Topic	No. of Lectures
	Lab Experiment List	
	1. Study of C++ Standard library functions. 2. Write a C++ program to find the sum of individual digits of a positive integer. 3. Write a C++ program to generate the first n terms of the sequence. 4. Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user. 5. Write a C++ program to find both the largest and smallest number in a list of integers. 6. Write a C++ program to sort a list of numbers in ascending order. 7. Write a Program to illustrate New and Delete Keywords for dynamic memory allocation 8. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members. 9. Program to illustrate default constructor, parameterized constructor and copy constructors 10. Write a Program to Implement a Class STUDENT having Following Members:	**60**

Member	Description
Data members	
sname	Name of the student
Marks array	Marks of the student
total	Total marks obtained
tmax	Total maximum marks

Member functions	
Member	Description
assign()	Assign Initial Values
compute()	to Compute Total, Average
display()	to Display the Data.

11. Write a Program to Demonstrate the
    i) Operator Overloading. ii) Function Overloading.
12. Write a Program to Demonstrate Friend Function and Friend Class.
13. Write a Program to Access Members of a STUDENT Class Using Pointer to Object Members.
14. Write a Program to Generate Fibonacci Series use Constructor to Initialize the Data Members.
15. Write a C++ program to implement the matrix ADT using a class. The operations supported by this ADT are:

    a) Reading a matrix b) Addition of matrices. c) Printing a matrix
    d) Subtraction of matrices. e) Multiplication of matrices
16. Write C++ programs that illustrate how the following forms of inheritance are supported:
    a) Single inheritance b) Multiple inheritance
    c) Multi level inheritance d) Hierarchical inheritance
17. Write a C++ program that illustrates the order of execution of constructors and destructors when new class is derived from more than one base class.
18. Write a Program to Invoking Derived Class Member Through Base Class Pointer.
19. Write a Template Based Program to Sort the Given List of Elements.
20. Write a C++ program that uses function templates to find the largest and smallest number in a list of integers and to sort a list of numbers in ascending order.
21. Write a Program Containing a Possible Exception. Use a Try Block to throw it and a Catch Block to handle it properly.
22. Write a Program to Demonstrate the Catching of All Exceptions.

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	15
Total	25

Course Prerequisites: To study this course, a student must have had the subject Mathematics in class 12th and Computer Fundamentals & Problem Solving in 1st Semester.

Subject: Computer Science			
Programme/Class: Certificate		**Year:** 1st	**Semester:** II
Course Code: CS102		**Course Title:** Data Structures & Algorithms	
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: 25+75		**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 & Algorithms:** 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, Counting 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	10	
	Total	25	
Course Prerequisites: To study this course, a student must have had the subject Mathematics in class 12th and Computer Fundamentals & Problem So in first semester.			

Subject: Computer Science			
Programme/Class: Certificate		**Year:** 1st	**Semester:** II
Course Code: CS104		**Course Title:** Lab: Data Structures & Algorithms	
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Implement various data structures in C++		
CO 2:	Implement various Searching and Sorting algorithm in C++ and understand their performance in term of Space and Time complexity.		
CO 3:	Implement tree and graphs in C++		
Credits: 2		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4			

Unit	Topic	No. of Lectures
	Lab Experiment List	
	Write a program in c++ to implement 1) 1-D, 2-D arrays and different operations in an array. 2) Operations in Singly linked list. 3) Operations in Doubly linked list. 4) Stack operations using arrays. 5) Queue operations using arrays. 6) Stack operations using linked list. 7) Queue operations using linked list. 8) Recursion. 9) Linear search. 10) Binary search. 11) Bubble sort. 12) Selection sort 13) Insertion sort 14) Merge sort 15) Quick Sort. 16) Counting Sort. 17) Tree traversal. 18) Graph traversal. 19) Insertion, Deletion and searching in BST.	**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	15
Total	25

Subject: Computer Science			
Programme/Class: Diploma		**Year:** 2nd	**Semester:** III
Course Code: CS201	**Course Title:** Digital Electronics & Computer System Architecture		
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:	Remember and understand the basics of computer organization and Design.		
Credits: 6		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 6-0-0			

Unit	Topic	No. of Lectures
I	**Fundamental concepts, Boolean algebra and logic gates:** Digital Computer and Digital Systems, Binary Numbers, Number Base Conversion, Complements, Binary Codes. 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.	15
II	**Combinational & Sequential Logic Design:** Adders, Subtractors, Decoder, Encoder, Multiplexers, De-Multiplexers. 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.	15
III	**Registers, Counters and the Memory:** Registers, shift registers, Counters, Asynchronous and synchronous counters, Memory Hierarchy, Main memory (RAM/ROM chips), Concept of Cache memory and Virtual Memory.	15
IV	**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.	15
V	**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, and CISC.	15
VI	**Input-Output Organization & Pipelining:** 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. Parallel processing, Amdahl's law, Pipelining, Flynn's classification, space-time diagram, speedup ratio, Arithmetic pipeline, Instruction pipeline.	15

Suggested Readings:

- Digital logic and Computer design- M. Morris Mano
- M. Mano, Computer System Architecture, Pearson Education 1992
- Carl Hamacher, Computer Organization, Fifth edition, McGraw-Hill, 2012.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/108/105/108105132/
- https://nptel.ac.in/courses/106/103/106103068/

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	10	
	Total	25	
Course Prerequisites: Certificate with Computer Science as a Major Subject			

Subject: Computer Science			
Programme/Class: Diploma		**Year:** 2nd	**Semester:** IV
Course Code: CS202		**Course Title:** Database Management System with Python	
Course outcomes:	On completion of this programme, the student will be able to		
CO 1:	Remember fundamentals of Database Management System		
CO 2:	Understand RDBMS Concepts like Normalization and Functional Dependencies		
CO 3:	Apply Normalization Concepts to create Redundancy Free Databases.		
CO 4:	Understand Programming with Python		
CO 5:	Create MySQL database and Evaluate MySQL queries through Python		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Elements of Database System, Database Users, Data Independence, Database Models, CODD's Rules, Entity Relationship Model, Specialization and Generalization, Relational Algebra, Relational Calculus, Keys, Functional Dependencies, Normalization Concepts,	10
II	Transaction systems, schedule and recoverability, Testing of serializability, Serializability of schedules, conflicts. Concurrency control techniques: Locking techniques for concurrency control, Time stamping protocols validation techniques, multiple granularity, multiversion schemes	10
III	Introduction to Python, Data Types, Python Interpreter, Strings	5
IV	Program Organization and Functions, Decorators, Lambda Functions, Variable Length Arguments, Keywords Arguments, Generators	10
V	Class and Objects, OOPs Concepts, Operator Overloading, Dunder Methods, Iterators, Exception Handling	10
VI	SQL Fundamentals, MySQL Queries, MySQL using Python, Introduction to MySQL Connector Library, Executing MySQL Queries through Python	15

Suggested Readings:

- Python the Complete Reference, Martin C. Brown
- Silberschatz & Korth,, Database system Concepts, TMH
- C.J.Date, An Introduction to Datbase System, Narosa Pub

Suggested equivalent online courses/content:

- **https://www.w3schools.com/python/python_mysql_getstarted.asp**
- **https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs57/**
- **http://docs.python.org/3/tutorial/index.html**

This course can be opted as an elective by the students of following subjects:
Students of Mathematics/Statistics

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	10
Total	25

Course Prerequisites: Diploma with Computer Science as a Major Subject

Subject: Computer Science			
Programme/Class: Diploma		**Year:** 2nd	**Semester:** IV
Course Code: CS204		**Course Title:** Lab: Database Management System in Python	
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Solve Computer Problems using Python.		
CO 2:	Create and Analyze MySQL Databases with/without python.		
Credits: 2		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4			

Unit	Topic	No. of Lectures
	Lab Experiment List	
	1. Creation of databases and execution of SQL queries. 2. Creation of Tables using MySQL: Data types, Creating Tables (along with Primary and Foreign keys), 3. Altering Tables and Dropping Tables. 4. Practicing DML commands- Insert, Select, Update, Delete. 5. Practicing Queries using ANY, ALL, IN, EXISTS, NOT, EXISTS, UNION, INTERSECT, and CONSTRAINTS, etc. 6. Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping. 7. Write a program in Python to find if a number is prime or not. 8. Write a program in Python to check if the given number is an Armstrong Number or not. 9. Write a program in python to print fibbonacci sequence up to n terms using generators. 10. Write a program in Python to find all the duplicate characters in a String. 11. Write a program in Python for Tower of Hanoi. 12. Write a program in Python to implement a Linked List. Make this Linked list Iterable. 13. Write a program in Python for implementing a Adjacent List Implementation of a Graph. 14. Write a Program in Python to implement your own Complex Number Data Type and overload operators for basic Complex Numbers Arithmetic Operations. 15. Write a program in python to create a link to a local database. 16. Implement Queries given in 2,3,4,5,6 using Python.	**60**

Suggested Continuous Evaluation Methods:

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

Internal Assessment	Marks
Record File	5
Viva Voce	5
Practical Assessment	15
Total	25

Subject: Computer Science			
Programme/Class: Bachelor in Science		**Year:** 3rd	**Semester:** V
Course Code: CS301		**Course Title:** Computer Graphics in JAVA	
Course outcomes:	**On completion of this programme, the student will be able to**		
CO 1:	Remember the fundamentals of generating graphics using a computer		
CO 2:	Understand various 2D shapes drawing Algorithms.		
CO 3:	Analyze various Computer Graphics Transformation Operations.		
CO 4:	Remember the fundamentals of JAVA programming.		
CO 5:	Understand the workings of JVM.		
CO 6:	Create programs to demonstrate the various Computer Graphics Algorithms.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Basic elements and Applications of Computer Graphics. Graphics Hardware, Video Display Devices,Architecture of Raster and Random scan display devices, Input devices, Hard-copy devices, Graphics software. 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.	12
II	Basic Transformations- Translation, Rotation, Scaling. Matrix representations and Homogeneous Coordinates, Composite Transformations. Other Transformations: Reflection, Shearing. 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-Hodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping, Curve Clipping, Text Clipping, Exterior Clipping.	15
III	3-D display methods: Parallel projection, Perspective projection, Depth cueing, Visible line and surface identification, Surface rendering. Basic Transformations-Translation, Rotation, Scaling.	12
IV	Introduction to JAVA, JVM, JRE, Garbage Collectors, Structure of a JAVA Program, Data Types,Variables, Operators, Keywords, Naming Conventions Loops, Arrays.Memory Allocation, OOPs Concepts using JAVA, Methods, final keyword Abstract classes and interfaces, Packages, JAVA Built-In Packages, Exception Handling.	9
V	Introduction to AWT and Swing, JFrame and JPanel, Listener and Adapter Classes, Swing Components, Event and Delegation Model, Graphics API Methods, drawing shapes using Graphics API. Implementing Graphics Algorithms for Line Drawing(DDA, Bresenhams), Circle Drawing(Mid-Point), ScanLine Polygon Fill in JAVA, 3D Graphics in JAVA.	12

Suggested Readings:

- Computer Graphics via Java by Ian Ferguson
- D.Hearn, Baker: Computer Graphics, Prentice Hall of India 2008

Suggested equivalent online content/courses:

- https://www.javatpoint.com/computer-graphics-tutorial
- https://personal.cis.strath.ac.uk/mark.dunlop/teaching/graphics/ferguson_book.pdf

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**	
	Record File	5	
	Viva Voce	5	
	Practical Assessment	15	
	Total	25	
Course Prerequisites: Diploma with Computer Science as a Major Subject			

Subject: Computer Science			
Programme/Class: Bachelor in Science		**Year:** 3rd	**Semester:** V
Course Code: CS303		**Course Title:** Computer 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 Networking Devices and understand their workings.		
CO 4:	Analyze Technologies and Protocols of First Three Network Layers of OSI Models.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	

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

Unit	Topic	No. of Lectures
I	Network definition - Layered network architecture, OSI reference model, TCP/IP Model, Comparison between OSI and TCP/IP.	10
II	Analog and digital signal, data-rate limits, digital to digital line encoding schemes, PCM, digital to analog modulation, multiplexing techniques- FDM, TDM,transmission media, repeaters and hubs	12
III	Framing and Flow control, Stop-And-Wait ARQ, Go-Back-N ARQ, Multiple Access Protocol and Networks:-CSMA/CD protocols,Ethernet LANS, connecting LAN, Bridges and Switches	12
IV	Circuit switching, packet switching- connection-less datagram switching, connection-oriented virtual circuit switching, dial-up modems, digital subscriber line, cable TV for data transfer.	12
V	Networks Layer Functions and Protocols, Distance vector routing and link state routing, IP protocol (IP4), Transport Layer Functions and Protocols, TCP Protocol overview. Routers and Gateways	14

Suggested Readings:

- B. A. Forouzan: Data Communications and Networking, Fourth edition, THM ,2007
- James F. Kurose, Keith W. Ross, "Computer Networking", Pearson Education

Suggested equivalent online courses:

- https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs19/
- https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf

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	10
Total	25

Course Prerequisites: Diploma with Computer Science as a Major Subject

Subject: Computer Science			
Programme/Class: Bachelor in Science		**Year:** 3rd	**Semester:** V
Course Code: CS305		**Course Title:** Lab: Computer Graphics in Java	
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Solve Computer Problems using Java.		
CO 2:	Implement various Computer Graphics Algorithm using Java Graphics API.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4			

Unit	Topic	No. of Lectures
	Lab Experiment List	
	1. Write a program in JAVA to find all the prime numbers smaller to n using sieve of Eratosthenes. 2. Write a program in JAVA to check if the given number is an Armstrong Number or not. 3. Write a program in JAVA to print pascal's triangle. 4. Write a program in JAVA to convert a given string into a Title. 5. Write a program in JAVA for Tower of Hanoi. 6. Write a program in JAVA to implement BFS and DFS using Collection framework. 7. Write a program in JAVA for implementing a HashSet of your own which uses AVL trees for collisions. 8. Write a Program in JAVA to implement your own Complex Number Data Type and implement methods for basic Complex Numbers Arithmetic Operations. 9. Write a Program to Implement Shop Billing System using Java Swing. 10. Write a Program to Implement Student Record System using Java Swing. 11. Write a Program to Implement Student Grade Calculator using Java Swing. 12. Write a Program to Implement draw various 2D shapes using JAVA Graphics API. 13. Write a Program in JAVA to implement DDA Line Drawing Algorithm. 14. Write a Program in JAVA to implement Bresenham's Line Drawing Algorithm. 15. Write a Program in JAVA to draw a circle using Mid-Point Algorithm. 16. Write a Program in JAVA to implement Scanline Polygon Fill Algorithm. 17. Write a Program in JAVA to create a Simple Image Drawing Program	**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	15
Total	25

Subject: Computer Science			
Programme/Class: Bachelor in Science		**Year:** 3rd	**Semester:** VI
Course Code: CS302		**Course Title:** Operating System & 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:	Analyze important algorithms eg. 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: 25+75		**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	12
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	Unix Administration: Overview of System Administration – System Administrator Responsibilities, A Brief History of Unix. User Administration – what is a user, the /etc/passwd file, groups, the /etc/group file, passwords adding, deleting and modifying user attributes, /etc/profile file, the login process, /etc/motd file, the wall command. File System Basic - The Hierarchy, files, directories, device files, character and block devices, the /dev directory, links, symbolick links, a file system tour, df command, du command, find command. Disk Management – Makin a file system, mkfs command, mount command fstab file, fsck command, lost+found directory, prtvtoc command.	8

	Unix Process – overview, process space, process table, fork/exec mechanism, ps command, background process, kill command, scheduling jobs, the cron daemon, at command, crontab command, cron files. Configuring TCP/IP - /etc/hosts file, ifconfig command. /etc/services/ file, inetd daemon, /etc/inetd.conf, TCP/IP troubleshooting, the ping and netstat commands. Network Utilities- Network Services, telnet, ftp, rcp, rlogin, rsh.	
VI	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)	10

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	10
Total	25

Course Prerequisites: Diploma with Computer Science as a Major Subject

Subject: Computer Science			
Programme/Class: Bachelor in Science		**Year:** 3rd	**Semester:** VI
Course Code: CS304	**Course Title:** Information Security		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Formulate information security governance, and related legal and regulatory issues.		
CO 2:	Devices how threats to an organization are discovered, analyzed, and dealt with.		
CO 3:	Evaluate network security threats and countermeasures.		
CO 4:	Understand network security and Acquire the knowledge of advanced security issues.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**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 security, Computer Security Concepts (CIA), Threats, Attacks, and Assets, Computer criminals, Security services, Security mechanism.	12
II	Cryptography, Substitution ciphers, Transpositions Cipher, Confusion, diffusion, Symmetric, Asymmetric Encryption. DES, Modes of DES, Hash function, key exchange, Digital Signatures, Digital Certificates	12
III	Program Security: Secure Programs, Non malicious Program Errors, Viruses and other malicious code, Targeted Malicious code, Control against Program Threats, Trap doors, Salami Attacks, Vulnerabilities and protections.	12
IV	Threats, Protection in OS: Memory and Address Protection, Access control, File Protection, User Authentication, Database Security.	12
V	Network Security: Network security issues, Threats in Network, Sniffing, IP spoofing, Common threats, E-Mail security, IPSec, SSL, PGP, Intruders, Virus, Worms, Firewalls-need and features of firewall, Types of firewall, Intruder Detection Systems.	12

Suggested Readings:

- C. P. Pfleeger, S. L. Pfleeger; Security in Computing, Prentice Hall of India, 2006
- W. Stallings; Network Security Essentials: Applications and Standards, 4/E, 2010

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/106/106106129/

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	10
Total	25

Course Prerequisites: Diploma with Computer Science as a Major Subject

Subject: Computer Science			
Programme/Class: Bachelor in Science		**Year:** 3rd	**Semester:** VI
Course Code: CS306	**Course Title:** Lab: Operating Systems & System Administration		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Use of Linux operating system and able to write shell programs.		
CO 2:	Simulate and demonstrate the concepts of operating systems.		
Credits: 2		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4			

Unit	Topic	No. of Lectures
	Lab Experiment List	
	Note: Following exercises can be performed using Linux or Unix **1.** Usage of following commands: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, touch, cd. **2.** Usage of following commands: cal, cat(append), cat(concatenate), mv, cp, man, date. **3.** Usage of following commands: chmod, grep, tput (clear, highlight), bc. **4.** Write a shell script to check if the number entered at the command line is prime or not. **5.** Write a shell script to modify "cal" command to display calendars of the specified months. **6.** Write a shell script to modify "cal" command to display calendars of the specified range of months. **7.** Write a shell script to accept a login name. If not a valid login name display message – "Entered login name is invalid". **8.** Write a shell script to display date in the mm/dd/yy format. **9.** Write a shell script to display on the screen sorted output of "who" command along with the total number of users. **10.** Write a shell script to display the multiplication table any number, **11.** Write a shell script to compare two files and if found equal asks the user to delete the duplicate file. **12.** Write a shell script to check whether the file have all the permissions or not. **13.** Simulate FCFS CPU scheduling algorithm in Python **14.** Simulate SJF CPU scheduling algorithm in Python. **15.** Simulate Priority CPU scheduling algorithm in Python. **16.** Simulate Round Robin CPU scheduling algorithm in Python. **17.** Simulate FIFO page replacement algorithm in Python. **18.** Simulate LRU page replacement algorithm in Python.	**60**

Suggested Continuous Evaluation Methods:

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

Internal Assessment	**Marks**
Record File	5
Viva Voce	5
Practical Assessment	15
Total	25

Subject: Computer Science			
Programme/Class: Bachelor (Research In Computer Science)		**Year:** 4th	**Semester:** VII
Course Code: CS401	**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.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

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.	8
II	Predicate Calculus: Predicates, Statement function, Variables, Free and bound variables, Quantifiers, Universe of discourse, Logical equivalences and implications for quantified statements, Theory of inference, The rules of universal specification and generalization, Validity of arguments.	12
III	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.	16
IV	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, Hashing functions, Recursive functions, Permutation functions.	12
V	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.	12

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: B.Sc. with Computer Science 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	10
Total	25

Course Prerequisites: B.Sc. with Computer Science as a major subject

Subject: Computer Science			
Programme/Class: Bachelor (Research In Computer Science)		**Year:** 4th	**Semester:** VII
Course Code: CS403	**Course Title:** Theoretical foundation of Computing		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Introduce the basic preliminaries and theoretical foundations of computer science.		
CO 2:	Understanding of the notion of a regular set and its representation by DFA's, NFA's, and regular expressions.		
CO 3:	Design of the notion of a context-free language and its representation by context-free grammars and push-down automata.		
CO 4:	Construction of the notion of a universal model of computation and its representation by a Turing machine.		
CO 5:	Basic understanding of the notion of an undecidable problem.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	FINITE AUTOMATA (FA): Introduction, Deterministic Finite Automata (DFA) - Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.	12
II	REGULAR EXPRESSIONS (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions. REGULAR GRAMMARS: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, Closure properties of regular languages.	12
III	CONTEXT FREE GRAMMER (CFG): Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG's, Minimization of CFG's, CNF, GNF, Pumping Lemma for CFL's, Enumeration of Properties of CFL (Proof's omitted).	12
IV	PUSHDOWN AUTOMATA: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA. TURING MACHINES (TM): Formal definition and behaviour, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs.	12
V	RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES (REL): Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability, Post's correspondence problem (PCP), undecidability of PCP.	12

Suggested Readings:

- John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages andComputation, 3rdedition, Pearson Education, India.
- Dexter C. Kozen, Automata and Computability, Springer Publishers, 2007.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/106/106106049/
- https://nptel.ac.in/courses/106/104/106104148/

- https://nptel.ac.in/courses/106/105/106105196/

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	10
Total	25

Course Prerequisites: B.Sc. with Computer Science as a major subject

Subject: Computer Science			
Programme/Class: Bachelor (Research In Computer Science)		**Year:** 4th	**Semester:** VII
Course Code: CS405	**Course Title:** Artificial Intelligence		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand the basics of Artificial Intelligence.		
CO 2:	Gain knowledge of the learning process and its models.		
CO 3:	Understand the AI applications in the design of expert systems.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Early work in AI, AI and related fields, Problem Solving Introduction, State space search, Production system, Breadth First Search, Depth First Search, Problem Characteristics, Heuristic Search-Generate and Test, Simple Hill climbing, Path Finding Algorithm	12
II	Knowledge representation, Definition and Importance of Knowledge, Knowledge based system, Representation of knowledge, Introduction of predicate logic, Well-formed formula, Interference rule and numerical, The Resolution principle, Representation using rule.	12
III	Natural Language Processing: Introduction, Problems in Natural Language Understanding, Overview of Linguistics, Grammars and Languages, Natural Language Generation, Natural Language Systems, Top-Down Parser, Bag of Words Model.	12
IV	Evolutionary Computation, Genetic Algorithms, Terminologies and Operators of GA, Ant Colony Optimization, Particle Swarm Optimization, GA Tool using MATLAB.	12
V	Introduction, Need and Justification of Expert System, Knowledge Acquisition, Knowledge System building tools, Basic steps of Expert System Development, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Decision Making	12

Suggested Readings:

- Russel and Norvig, "AI: A modern approach", Pearson Education
- Elian Rich and Kelvin Knight, "AI", TMH
- Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems"
- K M FU," Neural Network in Computer Intelligence", Mc Graw Hill

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	10
Total	25

Course Prerequisites: B.Sc. with Computer Science as a major subject		

Subject: Computer Science			
Programme/Class: Bachelor (Research In Computer Science)		**Year:** 4th	**Semester:** VII
Course Code: CS407	**Course Title:** Design and Analysis of Algorithms		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Learn the basic and advanced design and analysis procedures.		
CO 2:	Gain knowledge of advanced and sophisticated data structures, their mechanism, operations, and interconnection with algorithms.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Algorithms, Analysis of Algorithm, Design of Algorithms, Time and space complexities, Asymptotic notations, Growth+ of Functions, Recurrences. Sorting in Polynomial Time: Insertion Sort, Merge Sort, Heap sort and Quick Sort. Sorting in Linear Time: Counting Sort, Radix Sort, Bucket Sort	12
II	Elementary Data Structure: Stacks, Queues, Linked List, Binary Search Tree, Hash Table, Red Black Trees, AVL Tree, Splay Tree, Augmenting Data Structure Advanced Data Structure: Binomial Heap, B-tree, Fibonacci Heap, and Data Structure for Disjoint sets.	12
III	Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithm, Backtracking, Branch- and- Bound. Huffman Coding.	12
IV	Graph Algorithms: Elementary Graph Algorithm, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithm, Prim's Algorithm, Single Source Shortest Path, All Pair Shortest Path, Maximum Flow and Travelling Salesman Problem.	12
V	Randomized Algorithm: String Matching, NP-Hard and NP- Completeness, Approximation Algorithms.	12

Suggested Readings:

- T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein. Introduction to Algorithms, MIT Press, 3rd edition, 2009. ISBN 0-262-03384-4
- Horowitz Sahni, "Fundamentals of Computer Algorithm", Galgotia.
- M.T. Goodrich etal, "Algorithms Design", John Wiley and Sons.

Suggested equivalent online courses:

- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-introduction-to-algorithms-sma-5503-fall-2005/
- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/index.htm
- https://nptel.ac.in/courses/106/106/106106131/
- https://nptel.ac.in/courses/106/101/106101060/

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	10
Total	25

Course Prerequisites: B.Sc. with Computer Science as a major subject		

Subject: Computer Science			
Programme/Class: Bachelor (Research In Computer Science)		**Year:** 4th	**Semester:** VII
Course Code: CS409	**Course Title:** Lab: Design and Analysis of Algorithms		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Design and implement various algorithms in an effective manner.		
CO 2:	Implement various Searching and Sorting algorithm and understand their performance in term of Space and Time complexity.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
	Write a program to implement: 1. Insertion sort 2. Merge sort 3. Heap sort 4. Quick sort 5. Counting sort 6. Radix sort 7. Bucket sort 8. Stack 9. Queue 10. Binary Search tree 11. AVL tree 12. Red black tree 13. Breadth first search 14. Depth first search 15. Topological ordering of vertices 16. Minimum Cost Spanning Tree using Prim's algorithm 17. Minimum Cost Spanning Tree using Kruskal's algorithm 18. Implement 0/1 Knapsack problem using Dynamic Programming. 19. N Queen's problem using Back Tracking. 20. Dijkstra's algorithm	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	15
Total	25

Subject: Computer Science			
Programme/Class: Bachelor (Research In Computer Science)		**Year:** 4th	**Semester:** VIII
Course Code: CS402	**Course Title:** Compiler Design		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand fundamentals of compiler and identify the relationships among different phases of the compiler.		
CO 2:	Understand the application of finite state machines, recursive descent, production rules, parsing, and language semantics.		
CO 3:	Analyze & implement required module, which may include front-end, back-end, and a small set of middle-end optimizations.		
CO 4:	Use modern tools and technologies for designing new compiler.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			

Unit	Topic	No. of Lectures
I	Introduction to compilers – Analysis of the source program, Phases of a compiler, grouping of phases, compiler writing tools – bootstrapping Lexical Analysis:The role of Lexical Analyzer, Input Buffering, Specification of Tokens using Regular Expressions, Review of Finite Automata, Recognition of Tokens.	12
II	Syntax Analysis: Review of Context-Free Grammars – Derivation trees and Parse Trees, Ambiguity. Top-Down Parsing: Recursive Descent parsing, Predictive parsing, LL(1) Grammars.	12
III	Bottom-Up Parsing: Shift Reduce parsing – Operator precedence parsing (Concepts only) LR parsing – Constructing SLR parsing tables, Constructing, Canonical LR parsing tables and Constructing LALR parsing tables.	12
IV	Syntax directed translation: Syntax directed definitions, Bottom- up evaluation of Sattributed definitions, L- attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes. Type Checking : Type systems, Specification of a simple type checker	12
V	Run-Time Environments: Source Language issues, Storage organization, Storage allocation strategies. Intermediate Code Generation (ICG): Intermediate languages – Graphical representations, ThreeAddress code, Quadruples, Triples. Assignment statements, Boolean expressions.	12
VI	Code Optimization:Principal sources of optimization, Optimization of Basic blocks Code generation: Issues in the design of a code generator. The target machine, A simple code generator.	12

Suggested Readings:

- Compilers Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman., Pearson.
- Compiler Design, K. Muneeswaran., Oxford University Press, 2012

Suggested equivalent online courses:

- **https://nptel.ac.in/courses/106/105/106105190/**

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	10	
	Total	25	
Course Prerequisites: B.Sc. with Computer Science as a major subject			

Subject: Computer Science			
Programme/Class: Bachelor (Research In Computer Science)		**Year:** 4th	**Semester:** VIII
Course Code: CS404	**Course Title:** Research trends in Computer Science		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Understand the fundamentals of latest trends in Computer Science Research.		
CO 2:	Learn about the workings of latest technologies like web3 & IoT.		
CO 3:	Analyze problems related to soft computing.		
CO 4:	Solve statistical data problems using R.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	

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

Unit	Topic	No. of Lectures
I	Introduction to Research Oriented AI: Introduction to AI, Modern Research Trends in AI, Introduction to, Deep Learning, NLP, Computer Vision, Big Data Analysis, Applications of AI, AI for Healthcare, AI for Education, AI for Commerce.	12
II	Introduction to Blockchain and Web3: Introduction to Blockchain, Blockchain design principle, Blockchain ecosystem, Implementation challenges, Applications of Blockchain Systems, Cryptocurrency, Decentralization, Introduction to Web3.	12
III	Introduction to Soft Computing: Introduction to fuzzy logic, Fuzzy Sets and Membership, Chance versus Ambiguity. Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets., Introduction to Genetic Algorithm and its application.	12
IV	Introduction to IoT: What is IoT, Genesis of IoT, IoT and Digitization, IoT Architecture, IoT Impact, Convergence of IT Iot, IoT Challenges, IoT Network Architecture and Design, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	12
V	Introduction to R: Introduction to R interpreter, R data structures like vectors, matrices, arrays, list and data frames, Control Structures, vectorized if and multiple selection, functions, Statistical analysis of data for summarizing and understanding data, Visualizing data.	12

Suggested Readings:

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Suggested equivalent online courses:

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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	10
Total	25

Course Prerequisites: B.Sc. with Computer Science as a major subject

Subject: Computer Science			
Programme/Class: Master in Computer Science		**Year:** 4th	**Semester:** VIII
Course Code: CS406	**Course Title:** Machine Learning with Python		
Course outcomes:	On completion of the course, the student will be able to:		
CO 1:	Develop an appreciation for what is involved in Learning models from data		
CO 2:	Understand a wide variety of learning algorithms		
CO 3:	Understand how to evaluate models generated from data		
CO 4:	Apply the algorithms to a real world problem.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	

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

Unit	Topic	No. of Lectures
I	Introduction: Machine Learning Definitions, Application of Machine Learning, Problems, Data and Tools, Python for Machine Learning, Data Pre-processing in Python	12
II	Regression: Linear Regression-Simple, Multiple, Polynomial Regression, Support Vector Regression, Regression Trees, Evaluating Regression Models Performance	12
III	Classification: Logistic Regression, K-Nearest Neighbors (K-NN), SVM, Naïve Bayes, Decision tree and Random Forest, Artificial Neural Network, The Neuron, The Activation Function, Neural Networks Working, How Neural Networks Learn, Gradient Descent, Stochastic Gradient Descent, Backpropagation,	12
IV	Convolution Neural Networks: What is Convolutional Neural Network, Foundation of Convolutional Neural Network, ResNet Case Study, Object Detection, Application: Face Recognition and Style Transfer	12
V	Neuro - Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Rule base Structure Identification, ANFIS Applications.	12

Suggested Readings:

- Machine Learning Algorithms by Giuseppe Bonaccorso
- Hands-on Machine Learning with Scikit-Learn, Keras& TensorFlow
- Make Your Own Neural Network by Tariq Rashid
- Neural Networks Math A Visual Introduction for Beginners by Michael Taylor

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	10
Total	25

Course Prerequisites: B.Sc. with Computer Science as a major subject

Subject: Computer Science			
Programme/Class: Bachelor (Research In Computer Science)		**Year:** 4th	**Semester:** VIII
Course Code: CS408	**Course Title:** Software Engineering		
Course outcomes:	After successful completion of course the student should be able to :		
CO 1:	Learn the concepts of software development life cycle models.		
CO 2:	Develop correct and robust software products by gathering requirements.		
CO 3:	Analyze various metrics for estimation of software.		
CO 4:	Manage and maintain Software Project to ensure good quality software with high reliability.		
CO 5:	Gain knowledge in different Key Process Areas like planning and estimation of software projects, the implementation issues, validation and verification procedures.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	

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

Unit	Topic	No. of Lectures
I	**Introduction**: Software Engineering vs. Traditional Programming, System Development Life Cycle (Software Production Process, Conception, Initiation, Analysis Design, Construction, Testing, Implementation). Waterfall Model, Evolutionary Model. Factors affecting Software Development and Maintenance.	12
II	**Software Project Management**: Defining the Problem, developing a Solution Strategy, Planning the Development Process, Measurement of Software Productivity and Quality.	12
III	**Software Engineering Principles &Tools**: Tools of Design (Data Flow Diagrams, Data Dictionary, Decision Tree, Decision Tables), Modularization (Coupling).	12
IV	**Testing**: Testing fundamentals, Unit testing, Blackbox testing, Whitebox testing, Basic Path testing, Control Structure testing, Integration testing.	12
V	**Software maintenance**: Introduction to Software Maintenance, Enhancing Maintainability DuringDevelopment (analysis Activities, Standards and Guidelines, Design activities, Implementation Activities, Supporting Documents) Managerial Aspects of Software Maintenance (Change Control Board, Change Request summaries, Quality Assurance Activities, Organizing Maintenance Programs).	12

Suggested Readings:

- R.S.Press Man , "Software Engineering A Practitioners Approach" McGraw Hill.
- R.F.Fairley,, "Software Engineering Concepts", McGraw Hill

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/105/106105087/

This course can be opted as an elective by the students of following subjects: 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	10
Total	25

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

Subject: Computer Science			
Programme/Class: Master in Computer Science		**Year:** 4th	**Semester:** VIII
Course Code: CS410		**Course Title:** Lab: Machine Learning with Python	
Course Outcomes:	On completion of the course, the student will be able to:		
CO 1:	Solve Data Analysis Problems using various Machine Learning algorithms.		
CO 2:	Analyze and Implement Digital Image Processing Techniques.		
Credits: 4		**Core Compulsory**	
Max. Marks: 25+75		**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4			

Unit	Topic	No. of Lectures
	Lab Experiment List	
	1. Apply Data Preprocessing Techniques of Encoding, Scaling and Imputation using Python Libraries in a given Data Set. 2. Apply Simple Linear Regression and Predict Values for a Given Dataset using Python Libraries. 3. Apply Multiple Regression and Predict Values for a Given Dataset using Python Libraries. 4. Apply Polynomial Regression and Predict Values for a Given Dataset using Python Libraries. 5. Apply Support Vector Regression and Predict Values for a Given Dataset using Python Libraries. 6. Compare Results of previous Regression Models. 7. Apply Logistic Regression to Solve Classification problem for the given dataset. Generate Confusion Matrix and Calculate Accuracy. 8. Apply KNN Classifier to Solve Classification problem for the given dataset. Generate Confusion Matrix and Calculate Accuracy. 9. Apply Naive Bayes Classifier to Solve Classification proble for a given dataset. Generate Confusion Matrix and Calculate Accuracy. 10. Apply Decision Tree and Random Forest Classifiers o Solve Classification problem for a given dataset. Generate Confusion Matrix and Calculate Accuracy. 11. Compare Results of previous Classification Models. 12. Write a Program in Python to Implement ANN from Scratch and test the model on NIMST Handwriting Dataset. 13. Use a CNN model to Classify Images of Cats and Dogs.	**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	15
Total	25