SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

(NAAC Re-accredited with 'A' Grade)

School of Computational Sciences

स्वामी रामानन्द तीर्थ मराठवाडा विद्यापीठ, नांदेड

CURRICULUM FRAMEWORK AND SYLLABUS

FOR OUTCOME BASED EDUCATION IN

M.Sc. (C.N.) Degree Program

FOR THE STUDENTS ADMITTED FROM THE

ACADEMIC YEAR 2019-2020 ONWARDS

www.srtmun.ac.in

BOS meeting approved: __/__/2019

Approved in ____ Academic Council meeting on __/__/2019

Program Educational Objectives (PEO)

Post graduates of M.Sc.(CN) program will be

PEO1: Utilizing strong technical aptitude and domain knowledge to develop smart software solutions for the upliftment of society.

PEO2: Applying research and entrepreneurial skills augmented with a rich set of communication, teamwork and leadership skills to excel in their profession.

PEO3: Showing continuous improvement in their professional career through life-long learning, appreciating human values and ethics.

Graduate Attributes for M.Sc.(CN) Program (GA)

1. Computational Knowledge:

Apply domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

2. Problem Analysis:

Identify, formulate, research literature, and solve *complex* computing problems reaching substantiated conclusions using fundamental principles of computing sciences.

3. Design /Development of Solutions:

Design and evaluate solutions for *complex* computing problems that meet specified needs with appropriate consideration for cultural, societal, and environmental considerations.

4. Conduct Investigations of Complex Computing Problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern Tool Usage:

Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to *complex* computing activities, with an understanding of the limitations.

6. Professional Ethics:

Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

7. Life-long Learning:

Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

8. Project management and finance:

Demonstrate knowledge and understanding of the computing and management principles and apply these to one**'**s own work, to manage projects and in multidisciplinary environments.

9. Communication Efficacy:

Communicate effectively with the computing community, and with society at large, about *complex* computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

10. Societal and Environmental Concern:

Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

11. Individual and Team Work:

Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

12. Innovation and Entrepreneurship

Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Program Outcomes (PO) for M.Sc.(CN) (2019-2020)

On completion of M.Sc.(CN) program, the students are expected to

PO1: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

PO2: Identify, formulate, research literature, and solve complex computing problem searching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

PO3: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

PO6: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

PO7: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO8: Demonstrate knowledge and understanding of the computing and management principles and apply these to one**'**s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO9: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO10: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

PO11: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO12: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

CBCS Revised Syllabus w.e.f AY:2019-2020
Program: M.Sc.(Computer Network) – Campus School

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
First Semester						
1.	**Core Subjects**	NCN-101	Computer System Organization	2	2	4
2		NCN-102	Computer Network	2	2	4
3		NCN-103	Database Management System	2	2	4
Choose any one from below elective subjects						
4	**Elective Subject**	NCN-104 A	Programming Language Concepts	2	2	4
		NCN-104 B	System Analysis and Design			
Practical /Lab						
5	**Lab / Practical**	NCN-105	Lab-1: Computer Network	1	1	2
		NCN-106	Lab-2: DBMS	1	1	2
6	**Open Elective**	NCN-107A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		NCN-107 B	Data Communications			
7	**Skill based Activity**	NCN-108	SK-01	1	0	1
	Total credits					**25**

***NCN- Nanded Campus Computer Network**

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
Second Semester						
1.	**Core Subjects**	NCN-201	Operating System Concepts	2	2	4
2		NCN-202	Elementary Data Structures and Algorithms	2	2	4
3		NCN-203	Programming in Java	2	2	4
Choose any one from below elective subjects						
4	**Elective Subject**	NCN-204 A	Wireless Networking	2	2	4
		NCN-204 B	Distributed Systems			
Practical /Lab						
5	**Lab / Practical**	NCN-205	Lab-3: Data Structures	1	1	2
		NCN-206	Lab-4: Java programming	1	1	2
6	**Open Elective**	NCN-207A	University recognized MOOC (NPTEL / SWAYAM / Others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		NCN-207 B	Cyber Forensics and Information Security			
7	**Skill based Activity**	NCN-208	SK-02	1	0	1
	Total credits					**25**

CBCS Revised Syllabus w.e.f AY:2019-2020
Program: M.Sc.(Computer Network) – Campus School

CBCS Revised Syllabus w.e.f AY:2019-2020
Program: M.Sc.(Computer Network) – Campus School

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
Third Semester						
1.	**Core Subjects**	NCN-301	Network Design and Analysis	2	2	4
2		NCN-302	Internetworking Protocols	2	2	4
3		NCN-303	Cloud Computing	2	2	4
Choose any one from below elective subjects						
4	**Elective Subject**	NCN-304 A	Switching and Routing	2	2	4
		NCN-304 B	Linux and Network Administration			
Practical /Lab						
5	**Lab / Practical**	NCN-305	Lab-5: Network Design and Analysis	1	1	2
		NCN-306	Lab-6: Linux Administration	1	1	2
6	**Open Elective**	NCN-307A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		NCN-307 B	Mobile Communications			
7	**Skill based Activity**	NCN-308	SK-03 : Seminar Presentation Activity	1	0	1
	Total credits					**25**

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
Fourth Semester						
1.	**Core Subjects**	NCN-401	Mobile Application Development	2	2	4
2		NCN-402	Introduction to Web Technologies	2	2	4
3		NCN-403	Major Project development Activity	0	4	4
Choose any one from below elective subjects						
4	**Elective Subject**	NCN-404 A	Internet of Things (IoT)	2	2	4
		NCN-404 B	Advanced Operating Systems			
Practical /Lab						
5	**Lab / Practical**	NCN-405	Lab-7: Mobile Application Development	1	1	2
		NCN-406	Lab-8: Web Technology	1	1	2
6	**Open Elective**	NCN-407A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		NCN-407 B	Client and Server Technology			
7	**Skill based Activity**	NCN-408	SK-04	1	0	1
	Total credits					**25**

CBCS Revised Syllabus w.e.f AY:2019-2020
Program: M.Sc.(Computer Network) – Campus School

Course Code:	**NCN-101**	**Course Name:** Computer System Organization	**Credits: 4**
Course Objectives:			

Student need to be understood by looking inside how computer architecture is build. Study of various components as building block Architecture of different configuration for different requirement or problem size Memory and IO related interfacing	
Course Outcome:	
Solve problems based on computer arithmetic Explain processor structure and its function Understating micro programming Understand concepts related to memory and IO mapping Design and analysis of memory and IO system	
Unit-1:	Basic Structure of Computers
Functional units, basic operational concepts, Bus structures, Software performance, Memory locations and addresses, Memory operations, Instruction and instruction sequencing Addressing modes, Assembly language, Basic I/O operations, Stacks and queues.	
Unit-2:	Arithmetic Unit
Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Signed operand multiplication and fast multiplication, Integer division, Floating point numbers and operations.	
Unit-3:	Basic Processing Unit
Fundamental concepts, Execution of a complete instruction, Multiple bus organization, Hardwired control, Micro programmed control	
Unit-4:	Advance Control unit Design techniques
Pipelining, Basic concepts, Data hazards Instruction hazards, Influence on Instruction sets, Data path and control consideration Superscalar operation.	
Unit-5:	Memory System
Basic concepts, Semiconductor RAMs, ROMs , Speed, size and cost, Cache memories Performance consideration, Virtual memory, Memory Management requirements, Secondary storage.	
Unit-6:	I/O Organization
Accessing I/O devices, Interrupts, Direct Memory Access, Buses, Interface circuits, Standard I/O Interfaces (PCI, SCSI, USB).	
Text Books:	
1.	Computer Organization - Carl Hamacher, ZvonkoVranesic and SafwatZaky, 5th Edition McGraw- Hill, 2002.
Reference Books	
1.	Computer Organization and Architecture Designing for Performance- William Stallings, 6th Edition, Pearson Education.
2.	Computer Organization and Design: The hardware / software interface- David A. Patterson and John L. Hennessy, 2nd Edition, Morgan Kaufmann Press.
3.	Computer Architecture and Organization- John P. Hayes, 3rd Edition, McGraw-Hill

Course Code:	NCN-102	Course Name: Computer Network	Credits: 4
Course Objectives:			
To understand the basic concepts of computer network and firm foundation for understanding how data communication occurring using computer network. It is based around the OSI Reference Model which deals with the major issues and related protocol studies in the various layers (Physical, Data Link, Network, Transport, Session, Presentation and Application) of the model.			
Course Outcome:			
1.analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies; 2.specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols; 3.analyze,specify and design the topological and routing strategies for an IP based networking infrastructure 4.Have a working knowledge of datagram and internet socket programming			
Unit-1:	Introduction to computer networks and Internet		
Understanding of network and Internet, The network edge, The network core, Understanding of Delay, Loss and Throughput in the packet-switching network, protocols layers and their service model, History of the computer network			
Unit-2:	Application Layer		
Principles of computer applications, Web and HTTP, E-mail, DNS, Socket programming with TCP and UDP			
Unit-3:	Transport Layer		
Introduction and transport layer services, Multiplexing and Demultiplexing, Connection less transport (UDP), Principles of reliable data transfer, Connection oriented transport (TCP), Congestion control.			
Unit-4:	Network Layer		
Introduction, Virtual and Datagram networks, study of router, IP protocol and addressing in the Internet, Routing algorithms, Broadcast and Multicast routing			
Unit-5:	The Link layer and Local area networks		
Introduction and link layer services, error-detection and correction techniques, Multiple access protocols, addressing, Ethernet, switches.			
Unit-6:	Introduction to LAN		
Devices, Topologies, Tools, Cables, Configuration			
Text Books:			
1.	Computer Networking-A Top-Down approach, 5thedition, Kurose and Ross, Pearson		
Reference Books			
1.	Computer Networks (4th edition), Andrew Tanenbaum, Prentice Hall		
2.	Computer Networking and the Internet (5thedition),Fred Halsall, Addison Wesley		
3.	Data Communications and Networking (4th edition), Behrouz Forouzan, McGraw Hill		

Course Code:	NCN-103	Course Name: Database Management System	Credits: 4

Course Objectives:

1. To understand the features of Relational database.
2. To describe data models and schemas in DBMS.
3. To use SQL- the standard language of relational databases for database operations.
4. To understand the functional dependencies and design of the databases.

Course Outcome:

1: To study the basic concepts of relational databases
2: Learn and practice data modelling using the entity-relationship and developing database designs.
3: Understand the use of Structured Query Language (SQL) and learn SQL syntax for writing queries.
4: Apply normalization techniques to normalize the databases.

Unit-1:	Introduction

Problems in Traditional file oriented approach, Three level architecture of DBMS, basic database components like schema, views, instances, General Architecture of DBMS, Roles of DBA, Data Dictionary, Advantages and Disadvantages of DBMS.

Unit-2:	DATA Models

Concepts of Abstraction and Data Model, Discussions on data modeling using Entity Relationship model, Discussions on data modeling using Relational Model, E-R to Relational Conversion.

Unit-3:	Relational Algebra

Basics of Relational Algebra, selection, projection, division, cross product Operators Set Operators, Join and its types, writing Relational Algebra notations for user queries.

Unit-4:	Basic Normalization

Introduction to attributes, Keys, relationships and their types, Anomalies in databases, understanding Functional Dependencies(Determinant, partial, full, transitive, multi valued, etc), normalization process, First Normal form, Second Normal Form, Third Normal Form etc.

Unit-5:	Advance Normalization

Boyce-Codd Normal Form, Fourth Normal Form, Fifth Normal Form.

Unit-6:	SQL

Introduction to data retrieval languages like QBE, QUEL, SQL Discussions on SQL, Table , View Definitions ,DDL Statements, DML Statements, DCL Statements , TCL statements , SQL Functions ,Introduction to PL/SQL , Cursors.

Text Books:

1.	Database Management Systems- Raghu Ramakrishnan, Johannes, Gehrke, Tata McGraw Hill.
2	Database System Concepts- Silber Schatz Korth, Tata McGraw Hill.

Reference Books

1.	Fundamental of Database System- Sham Kanth B. Navathe, Pearson Education.
2.	Introduction to Database management System- Bipin Desai, Galgotia Publications.
3.	Oracle Development Language Oracle PL/SQL Programming, Steven Feuerstein , O'Reilly
4.	ORACLE documentations on ORACLE PRESS / Internet.

Course Code:	NCN-104 A	**Course Name:** Programming Language Concepts	**Credits: 4**

Course Objectives:

1.To help the students understand the fundamental concepts of programming Languages.
2.To prepare students about the need and use of data structures
3.To prepare students to identify and apply data structures for problem solving

Course Outcome:

Understanding the concepts of evolution of programming languages.
Understanding the concepts of object oriented languages, functional and logical programming languages
Analyzing the methods and tools to define syntax and semantics of a languages
Analyzing the design issues involved in various constructs of programming languages

Unit-1:	The role of Programming Languages

Introduction to Languages, Basic types of languages (Machine, Assembly, High level Languages), Toward Higher-Level Languages, Programming Paradigms, Language Implementation: Bridge the Gap.

Unit-2:	Language Description: Syntactic Structure

Expression Notations, Abstract Syntax Trees, Lexical Syntax: Tokens and Spellings, Context-Free Grammars, Grammars for Expressions, Handling Associativity and Precedence.

Unit-3:	Statements: Structured Programming

Need for Structured Programming, Syntax-directed Control Flow (conditional, Looping Construct, for, Selection Case) Design considerations: Syntax, Programming with Invariants.

Unit-4:	Types: Data Representation

The role of types, Basic types, Arrays: Sequence of elements, Records: Name Fields, Union and Variant Records, Sets, Pointers.

Unit-5:	Procedure Activations

Introduction to Procedures, Parameter-Passing Methods, Scope Rules for Names, Nested Scopes in the Source Text, Activation Records, Lexical Scope.

Unit-6:	Logic Programming

Computing with relations, Introduction to Prolog, Data Structure in Prolog, Programming Techniques, Control in Prolog, cuts.

Text Books:

1.	Programming Languages Concepts and constructs- Ravi Sethi, Pearson Education.
2.	Concepts of Programming Languages- Robert .W. Sebesta, Pearson Education.
3.	Programming Language Design Concepts- D. A. Watt, Wiley Dream Tech.

Reference Books

1.	Programming Languages- A. B. Tucker, R. E. Noonan, 2nd Edition, TMH.
2.	Programming Languages- K. C. Louden, 2nd Edition, Thomson Press.

Course Code:	NCN-104 B	**Course Name:** System Analysis and Design	**Credits: 4**

Course Objectives:

System analysis helps in discovering means to design systems where sub-system may have apparently conflicting objectives. It helps in achieving inter compatibility and unity of purpose of sub-systems. It offers a means to create understanding of the complex structures

Course Outcome:

After successfully completing this course, students will understand concepts of Analysis and Designing Information Systems. Students will understand writing system proposals, system development scheduling, and cost-benefits analysis etc. also dealing with quality assurance.

1: To learn basic things of systems, System development Life cycle, and System Analyst.
2: To determine specific needs of system.
3: Discuss approaches and tasks of system. Planning for developing system
4: Evaluate tools and techniques.
5: Use appropriate methods and techniques to design software.
6: Implementation of Developed System, Evaluation and Testing of system.

Unit-1: Introduction

System Definition, Characteristics, Elements and Types of system, Need of System Analysis and design, Role and Qualities of System Analyst, System Development Life Cycle.

Unit-2: Feasibility Study

Project Initiation, Feasibility study, Ascertaining HW/SW needs, Criteria for HW/SW selection, Make v/s Buy Decision, Cost Benefit Analysis.

Unit-3: Decision Modules

Structured Analysis tools- DFD, Data Dictionary, Decision Tree, Decision Table, Structured English, Activity planning control, Activity Diagrams, Case modeling, UML, Class Diagram.

Unit-4: Scheduling

System Proposal, Project Scheduling, Information Gathering Tools- Interviews, Questionnaire, JAD, Prototyping.

Unit-5: Design

System Design, Input/output Design, From Design, Database Design, File organization.

Unit-6: Implementation

System Implementation Plan, Activity Network for Conversion, Combating Resistance to Change, System Testing, Test Plan AND test data, Types of System Test, Quality Assurance, Documentation.

Text Books:

1.	System Analysis and Design- Kendall and Kendall, Pearson Education, Inc., Prentice Hall.

Reference Books

1.	System Analysis and Design- E. M. Awad, Galgotia Publications Pvt. Ltd
2.	Modern System Analysis and Design - Jeffrey A. Hoffer, Prentice-Hall, Inc.

Course Code:	NCN-105	**Course Name:** Lab-1:Computer Network	**Credits: 2**

Course Objectives:

This course provides students with hands on training regarding the design, troubleshooting, modeling and evaluation of computer networks. In this course, students are going to experiment in a real test-bed networking environment, and learn about network design and troubleshooting topics and tools such as: network addressing, Address Resolution Protocol (ARP), basic troubleshooting tools (e.g. ping, ICMP), IP routing (e,g, RIP), route discovery (e.g. traceroute), TCP and UDP, IP fragmentation and many others. Student will also be introduced to the network modeling and simulation, and they will have the opportunity to build some simple networking models using the tool and perform simulations that will help them evaluate their design approaches and expected network performance

Course Outcome:

1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of Network Devices in Detail.
3. Study of network IP.
4. Connect the computers in Local Area Network.
5. Study of basic network command and Network configuration commands.

Course Code:	NCN-106	**Course Name:** Lab-2:DBMS	**Credits: 2**

Course Objectives:

This course aims at giving adequate exposure to students on the Database design and E-R modeling. The course also facilitates students with hands on training on SQL and programming language extension to SQL within the RDBMS environment.

Course Outcome:

1: Model Entity Relationship with E-R diagrams
2: Design database schema considering normalization and relationships within database
3: Write SQL queries to user specifications
4: Develop triggers, procedures, user defined functions and design accurate and PLSQL programs in Oracle and DB2.
5: Use the database from a front end application
6: Prepare technical report on the observations of the experiments

6. Creating database objects
7. Modifying database objects
8. Manipulating the data
9. Retrieving the data from the database server
10. Performing database operations in a procedural manner using pl/sql
11. Performing database operations (create, update, modify, retrieve, etc.,) using front-end tools
12. Design and Develop applications like banking, reservation system, etc.,
13. To create a DDL to perform creation of table, alter, modify and drop column.
14. To create a view for the purpose of display in order to hide the data.
15. Study of DCL extensive feature in order to safeguard information stored in its tables from unauthorized viewing and damage. The rights that allow the user of some or all oracle resources on the server are called privileges.
16. To create a single row functions.
17. Study of PL/SQL features
18. To Perform Banking Operations Using Procedures
19. To carryout payroll application using procedures
20. To write an algorithm to perform database connectivity using MS Access.

Course Code:	NCN-107A	**Course Name:** University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School	**Credits: 4**
Course Objectives:			
Course Outcome:			

Course Code:	NCN-107 B	**Course Name:** Data Communications	**Credits: 4**

Course Objectives:

At the end of the course, students will be able to understand basic computer network technology. Understand and explain various components of computer networks. Identify the different types of network topologies and protocols. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer. Identify the different types of network devices and their functions within a network. Understand and build the skills of routing mechanisms.

Course Outcome:

1: Describe the building blocks of Computer Networks
2: Explain the functionalities and protocols of various layers in ISO/OSI Network model.
3: Implement a suitable routing strategies for a given network
4: Use suitable transport/application layer protocol based on application requirements

Unit-1: Introduction

Introduction to Communications Model, Data Communications, Networks, The Internet, An Example Configuration, The Need for a Protocol Architecture, The TCP/IP Protocol Architecture, The OSI Model, Standardization Within a Protocol Architecture, Traditional Internet-Based Applications, Multimedia.

Unit-2: Data Transmission

Data transmission, Concepts and Terminology, Analog and Digital Data Transmission Transmission Impairments, Channel Capacity.

Unit-3: Transmission Media

Transmission media, Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission.

Unit-4: Digital Data Communication Techniques

Digital Data communication techniques, Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations.

Unit-5: Data Link Control Protocols

Data link Control protocols, Flow Control, Error Control, High-Level Data Link Control (HDLC).

Unit-6: Multiplexing

Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing, Asymmetric Digital Subscriber Line,xDS.

Text Books:

1. Data and Computer Communications- William Stallings, 8th Edition Pearson Publication.

Reference Books

1. Data Communications and Networking, Behrouz A. Forouzan, 2nd Edition, McGraw Hill Publication.

Course Code:	NCN-108	**Course Name:** SK-01	**Credits:** 1
Course Objectives:			
Course Outcome:			

Course Code:	NCN-201	**Course Name:** Operating System Concepts	**Credits: 4**

Course Objectives:

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication
3. To learn the mechanisms involved in memory management in contemporary OS
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols

Course Outcome:

Students will be able to:

- Analyze the structure of OS and basic architectural components involved in OS design
- Analyze and design the applications to run in parallel either using process or thread models of different OS
- Analyze the various device and resource management techniques for timesharing and distributed systems

Unit-1:	Overview of Operating System

Operating system objectives and functions, Evolution of OS, Characteristics of modern OS, Basic concepts: Processes, Files, System calls, Shell, Kernel architectures: Monolithic, Micro-kernel, Layered, Kernel mode of operations.

Unit-2:	Process Management

Process description: Process, Process States, Process Control Block (PCB), Threads, Thread management. Process Scheduling: Types, Comparison of different scheduling policies.

Unit-3:	Process Co-ordination

Principles of Concurrency, Race condition and critical section, Mutual Exclusion, Semaphores, Message Passing, Deadlock: Principles of Deadlock, Deadlock Detection, Deadlock Avoidance, Deadlock Prevention.

Unit-4:	Memory Management

Memory Management Requirements, Memory Partitioning, Virtual memory: Paging; Segmentation; Page replacement policies.

Unit-5:	File System

File concept, Access methods, Directory and disk structure, File system mounting, File sharing, Protection.

Unit-6:	Input Output Management

I/O Devices, Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling and disk scheduling algorithms.

Text Books:

1. Operating Systems Concepts- Silberschatz A., Galvin P., Gagne G, Wiley Publication.

Course Code:	NCN-202	**Course Name:** Elementary Data Structures and Algorithms	**Credits: 4**

Course Objectives:

- IT will demonstrate familiarity with major algorithms and data structures.
- Analyze performance of algorithms.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs.
- Use various data structures effectively in application programs.
- Understand and apply fundamental algorithmic problems including Tree traversals, Graph traversals, and shortest paths.

Course Outcome:

- Explain the organization and operations of data structures Stack, Queues, Trees, Graphs, Heaps and Hash tables.
- Compare and contrast the functionalities and applications of different data structures
- Demonstrate specific search and sort algorithms using data structures given specific user requirements.
- Apply the operations of data structures in designing software procedures based on specific requirements

Unit-1:	Introduction to Algorithm

Data, Variables (Local and Global), Data types, arrays Introduction to Algorithm, The efficiency of Algorithms, Analysis of Algorithms, overview of Space and Time Complexities, some fundamental algorithms for exchange , counting , summation .

Unit-2:	Introduction to data structures

Introduction to data structures, Basic terminology, Primitive data structure operations
Overview of STACKS, QUEUES, LINKED LISTS, BINARY TREES and GRAPHS (Basic Definition , Representations, Characteristics , Types, Applications)

Unit-3:	Tree and Graph

Minimum Spanning Trees, Growing a minimum spanning tree, The algorithms of Kruskal and Prim Graphs: DFS and BFS algorithms associated with Graphs, Single-source shortest Paths, The Bellman-ford algorithm.

Unit-4:	Sorting and Searching

Introduction to searching and sorting problems, Linear search , Binary search, Selection sort , Bubble sort , Insertion sort , Merge sort, Complexities of searching and sorting algorithms.

Unit-5:	Divide and Conquer Techniques

Divide and conquer, General method, Binary search, Merge sort, Strassen's matrix multiplication.

Unit-6:	Advanced Data Structure

Introduction to Greedy method, The general method, Container loading knapsack problem, Introduction to Dynamic Programming, General method, Introduction to NP Theory.

Text Books:

1.	Fundamentals of Computer Algorithms- Ellis Horowitz, Satraj Sahani,

Reference Books

1.	Data Structures, Lipschutz , Tata McGraw Hills.
2.	How to solve it by Computers- R.G. Dromey , 8th Edition , Pearson Education.

Course Code:	NCN-203	**Course Name:** Programming in Java	**Credits: 4**

Course Objectives:

The objective of this course is to create Java programs that leverage the object-oriented features of the Java language, such as encapsulation, inheritance and polymorphism, use data types, arrays and other data collections, implement error-handling techniques using exception handling, create and event-driven GUI using Applet.

Course Outcome:

To design, write, compile, test and execute straightforward programs using a high level language.
To implement, compile, test and run Java programs comprising more than one class, to address a particular software problem
To demonstrate the ability to use simple data structures like arrays in a Java program.

Unit-1:	Introduction to Java

History, Features, How java differ from C and C++?, Java program structure, Java tokens, Java Statements, Java virtual machine, Command line arguments, Constants, Variable, Data types, Type casting.

Unit-2:	Operators and Expression

Decision making and branching, Decision making and looping, Class, Methods, Objects, Constructors, Method overloading, Static members, nesting of methods.

Unit-3:	Inheritance

Overriding methods, Final variables, Final methods, Final Classes, Finalizer method, Abstract methods, Abstract Classes, Visibility Control, Interface, Arrays, Strings, Vectors, Wrapper Classes.

Unit-4:	System Packages

Naming conventions, Creating and accessing packages, Introduction to multithreaded programming, Creating and extending threads, Life cycle of thread, Thread exception, Thread priority, Synchronization, Implementing Runnable interface, Types of errors, Exceptions, Exception handling code, Multiple catch statements, finally statement, Throwing our own exceptions, Exception for debugging.

Unit-5:	Introduction to Applet

How applet differ from application?, Applet code, Applet life cycle, Creating an executable applet, designing a web page, Applet tag, Passing parameter to applet.

Unit-6:	The Graphic Class

Lines, Rectangles, Circles, Ellipses, Arcs, Polygons, Line graphs, Bar charts, Control loops in applet.

Text Books:

1.	Programming with Java A Primer – E.Balaguruswamy, McGraw Hill.
2.	Java 7 Programming Black Book -Kogent Learning Solutions Inc,DreamTech press.

Reference Books

1.	Java Fundamentals A comprehensive introduction- Herbert Schildt, Dale Skrien, McGraw Hill Education.
2.	The Complete Reference, Java 2 -, Herbert Schild, (Fourth Edition) - TMH.
3.	Core Java Volume-I Fundamentals- Horstmannand Cornell, - Pearson Education.

Course Code:	NCN-204 A	**Course Name:** Wireless Networking	**Credits: 4**

Course Objectives:

Introduction to planning and design of wireless networks
Introduction to HSPA systems
To study emerging technologies like Bluetooth, zigbee, Wimax
Understanding the wireless sensor network architecture and the protocol stack and WSN applications.

Course Outcome:

The students will be able to:
Describe the phases of planning and design of mobile wireless networks
List and compare personal area network (PAN) technologies such as Zigbee, Bluetooth etc
Students will details of sensor network architecture, traffic related protocols , transmission technology etc
Understand middleware protocol and network management issues of sensor networks

Unit-1: Overview of Cellular Systems

Mobile telephony, introduction to GSM, Universal mobile telecommunication system, Introduction to HSPA, Advanced Antenna Systems for HSPA + and LTE

Unit-2: Planning and Design of Wide-Area Wireless Networks

Basics of indoor RF planning, Three phases of wireless network design, Indoor coverage from the macro layer, Link budgets for GSM, CDMA, CDMA2000, HSDPA systems, indoor UMTS/HSPA challenge, common UMTS rollout mistake

Unit-3: Emerging Wireless Technologies

Bluetooth: Concepts of Pico net, scatter net etc., protocol stack, link types, security, network connection establishments, usage models, etc.
ZigBee: Components, architecture, network topologies, protocol stack etc.
UWB and RFID: Technical requirements, components and characteristics, applications
WiMAX: 802.16 based protocol architecture, physical layer, fixed and mobile WiMAX

Unit-4: Overview of Wireless Sensor Network 1

Background of sensor network technology, sensor network architectural elements, historical survey of sensor networks, Applications of wireless sensor network, range of applications, examples of category 1 and 2 WSN Applications

Unit-5: Overview of Wireless Sensor Network 2

Technologies for wireless sensor network, sensor node technology, hardware and software, sensor taxonomy, Wireless network, operating environment, wireless network trends, transmission technology

Unit-6: Middleware for Sensor Networks & Network Management

Middleware principles, Middleware architecture, existing middleware, Network management, requirements, Network management models, design issues

Text Books:

1.	Indoor Radio Planning: A Practical Guide for GSM, DCS, UMTS, HSPA and LTE, 2nd Edition Morten Tolstrup ISBN: 978-0-470-71070-8 480 -July 2011 -Wiley
2.	Vijay K. Garg, —Wireless Communication and Networking‖, Morgan -Kaufmann Series in Networking—Elsevier

Reference Books

1.	Kazem Sohraby, Daniel Minoli, and Taieb Znati, —Wireless Sensor Networks: Technology, Protocols, and Applications‖, Wiley Student Edition
2.	Feng Zhao andLeonidas Guibas, —Wireless Sensor Networks, An Information Processin

	Approach‖,--Morgan Kaufmann		
Course Code:	NCN-204 B	**Course Name:** Distributed System	**Credits: 4**

Course Objectives:

- Understand foundations of Distributed Systems.
- Introduce the idea of peer to peer services and file system.
- Understand in detail the system level and support required for distributed system.

Course Outcome:

- Discuss trends in Distributed Systems.
- Apply network virtualization.
- Apply remote method invocation and objects.

Unit-1:	Introduction

Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

Unit-2:	Communication in Distributed System

System Model – Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI – Group communication – Publish-subscribe systems – Message queues – Shared memory approaches – Distributed objects – Case study: Enterprise Java Beans -from objects to components.

Unit-3:	Peer to Peer Services and File System

Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry- Distributed File Systems –Introduction – File service architecture – Andrew File system. File System: Features-File model -File accessing models – File sharing semantics Naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

Unit-4:	Synchronization And Replication

Introduction – Clocks, events and process states – Synchronizing physical clocks- Logical time and logical clocks – Global states – Coordination and Agreement – Introduction – Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic Commit protocols - Distributed deadlocks – Replication – Case study – Coda.

Unit-5:	Process & Resource Management

Process Management: Process Migration: Features, Mechanism – Threads: Models, Issues, Implementation.

Unit-6:	Resource Management

Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

Text Books:

1.	George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2.	Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.

Reference Books

1.	Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.

Course Code:	NCN-205	**Course Name:** Lab-3: Data Structures	**Credits: 2**

Course Objectives:

- To develop skills to design and analyze simple linear and nonlinear data structures
- To strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To gain knowledge in practical applications of data structures

Course Outcome:

- To learn elementary data structures such as stacks, queues, linked lists, trees and graphs
- To design and analyze the time and space efficiency of the data structure
- To identity the appropriate data structure for given problem
- To have practical knowledge on the application of data structures
- To discuss different data structures to represent real world problems
- To design algorithms to solve the problems.

List of Experiments

1. Array implementation of List Abstract Data Type (ADT)
2. Linked list implementation of list ADT
3. Array implementations of stack ADT
4. Linked list implementations of stack ADT

The following three exercises are to be done by implementing the following source files

a) Program for 'Balanced parenthesis'
b) Array implementation of stack ADT
c) Linked list implementation of stack ADT
d) Program for 'Evaluating Postfix Expressions'

An appropriate header file for the stack ADT should be # included in (a) and (d)

5. Implement the application for checking 'balanced parenthesis' using array Implementation of stack ADT (by implementing files (a) and (b) given above)
6. Implement the application for checking 'Balanced Parenthesis' using linked list Implementation of stack ADT (by using file (a) from experiment 6 and implementing file (c))
7. Implement the application for 'Evaluating Postfix Expressions' using array and linked list implementations of Stack ADT (by implementing file (d) and using file (b), and then by using files (d) and (c))
8. Queue ADT
9. Search Tree ADT – Binary Search Tree
10. Heap Sort, Quick Sort

Lecture: 0; Practical: 45; Total: 45

Course Code:	NCN-206	**Course Name:** Lab-4: Java Programming	**Credits: 2**
Course Objectives:			
To enable the students practice the concepts of java programming language and develop solutions for real world problems.			
Course Outcome:			
1: Understand the enabling technologies for building internet applications. Understand 2: Write Java programs for techniques and features of the networking and remote method development to Construct a internet application 3: Implement packages, access specifiers and interfaces in a program 4: Implement Program for Events and interactivity using Layout Manager. 5: Generate program for network chatting Analyze 6: Write technical report on the observations from the experiments			
1. Use of Objects 2. Using classes and inheritance 3. JNI concepts 4. Multithread applications 5. Exception handling 6. Implementing packages, access specifiers and interfaces 7. Streams 8. JDBC program using different statements 9. Applet program for Animation text, images and sounds 10. Events and interactivity using Layout Manager. 11. Socket program for network chatting 12. Client server application using RMI techniques			

Course Code:	NCN-207A	**Course Name:** University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School	**Credits: 4**
Course Objectives:			
Course Outcome:			

Course Code:	NCN-207 B	**Course Name:** Cyber Forensics and Information Security	**Credits: 4**

Course Objectives:

Securing vital resources and information in the network is the most challenging feat for system enterprise. Develop an understanding of information assurance as practised in computer operating systems, networks and representative applications. Gain familiarity with prevalent attacks, defenses

Course Outcome:

- Understand the importance of network security in today's world and apply security services and mechanisms in evaluating networked systems and also while creating new applications.
- Analyze and uses apply best suited Network Security mechanisms and standards in various applications.

Unit-1:	Security Principles and Practices

Information system security principles, Threats and attacks, Classification of threats and assessing damages, Protecting information systems security, Information system security engineering process

Unit-2:	Security Threats

Types of security threats- worms, viruses, Trojan horse, malware, malicious spyware, adware, botnet, spam, phishing, stack and buffer overflow

Unit-3:	Operating System Security

Role of operating systems in information systems applications, Operating systems security, Patched operating systems, Protected objects and methods of protection, Memory address protection, File protection mechanism

Unit-4:	Wireless Networks Security

Overview of wireless technology, Wireless security protocols - Wired Equivalent Privacy (WEP), Wi-Fi Protected Access (WPA), WPA2, Attacks on wireless networks.

Unit-5:	Understanding Cyber Forensics

Computer forensics, Cyber forensics and Digital evidence, rules of evidence, Forensics analysis of e-mail- RFC282, Digital forensics life cycle, Chain of custody concept, Network forensics, Setting up a computer forensics laboratory, Computer forensics and steganography, Rootkits, Information hiding, relevance of the OSI 7 layer model to computer forensics, Forensics and social networking sites: The security/privacy, Threats.

Unit-6:	Challenges in Cyber Forensics

Technical challenges: understanding the raw data and its structure, The legal challenges in computer forensics and data privacy issues , Special tools and techniques - digital forensics tools, Special technique: data mining used in cyber forensics, Forensics auditing, Anti forensics.

Text Books:

1.	
2.	

Reference Books

1.	

M.Sc. CN.

Course Code:	NCN-208	Course Name: SK-02	Credits: 1
Course Objectives:			
Course Outcome:			

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