# NATIONAL UNIVERSITY

Second Year Syllabus
Department of Computer Science and Engineering

Four Year B.Sc. Honours Course
Effective from the Session : 2017–2018

# National University

**Subject: Computer Science and Engineering**
**Syllabus for Four Year B.Sc. Honours Course**
**Effective from the session: 2017-2018**

**Year wise courses and marks distribution**

**SECOND YEAR**

## Semester III

| Course Code | Course Title | Credit Hours |
|---|---|---|
| 520201 | Data Structure | 3.0 |
| 520202 | Data Structure Lab | 1.5 |
| 520203 | Object Oriented Programming | 3.0 |
| 520204 | Object Oriented Programming Lab | 1.5 |
| 520205 | Computer Architecture | 3.0 |
| 520207 | Ordinary Differential Equation | 3.0 |
| 520209 | Fundamental of Business Studies | 3.0 |
| | **Total Credits in 3rd Semester** | **18.0** |

## Semester IV

| Course Code | Course Title | Credit Hours |
|---|---|---|
| 520221 | Database Management System | 3.0 |
| 520222 | Database Management System Lab | 1.5 |
| 520223 | Microprocessor and Assembly Language | 3.0 |
| 520224 | Microprocessor and Assembly Language Lab | 1.5 |
| 520225 | Design and Analysis of Algorithms | 3.0 |
| 520226 | Design and Analysis of Algorithms Lab | 1.5 |
| 520227 | Numerical Analysis | 3.0 |
| | **Total Credits in 4$^{th}$ Semester** | **16.5** |

# Detailed Syllabus

## Third Semester

| Course Code : 520201 | Marks : 80 | Credits : 3 | Class Hours : 45 |
|---|---|---|---|
| **Course Title :** | **Data Structure** | | |

**Introduction:** Basic Terminology; Elementary Data Organization; Data Structures; Data Structure Operations; Control Structures; Algorithms: Complexity, Time-Space Tradeoff, Mathematical Notation and function, String Processing: String Operations, word processing, and Pattern Matching Algorithms.
**Arrays, Records and Pointers:** Linear Arrays; Representation of linear array in memory; Traversing linear arrays, Inserting and Deleting; Sorting; (Bubble sort), Searching (linear, binary), Multidimensional Arrays; Pointer Arrays; Record Structures; Matrices.

**Linked lists:** Representation of Linked lists in memory, Traversing a linked list, Searching a linked list, insertion, deletion; Header and two-way lists.
**Stacks, Queues, Recursion:** Array Representation of Stacks, Polish Notation; Quicksort, Recursive definition; Towers of Hanoi, Implementation of Recursive procedures, Queue Dequeue, Priority Queues.
**Trees:** Binary Trees; Representing Binary Trees in memory, traversing binary tree, Header Nodes; Threads , binary search trees, Heap tree, heap sort, Huffman's Algorithm.
**Graphs:** Sequential Representation of Graph; Adjacency Matrix; Path Matrix; Warshall's Algorithm; Linked representation of Graphs.

***Reference languages:*** *C/C++.*

***Reference Books:***


1) *Seymour Lipschutz* ( Schaum's outline series), Data Structure (International Edition)
2) *Ellis Horowitz & Sartaj Sahni*, Data Structure and Algorthm.
3) *Robers L Kruse*, Data Structure & Programming Design, 2nd Ed.
4) Nell Dale*, C++ Plus Data Structure, Published by Jones and Bartlett Publishers Inc, 5th Edition.*
5) Seymour Lipschutz*, Theory and Problems of Data Structure, Published by McGraw Hill Inc.*


| Course Code : 520202 | Marks : 40 | Credits : 1.5 | Class Hours : -- |
|---|---|---|---|
| **Course Title :** | **Data Structure Lab** | | |

Laboratory classes are based on course CSE 520201. Students will be able to implement different data structures, like array, string, linked list, tree and graph using C/C++ programming language. They will be introduced with different sorting algorithms and advanced data structures such as heap, Fibonacci heap, storage management.

| Course Code : 520203 | Marks : 80 | Credits : 3 | Class Hours : 45 |
|---|---|---|---|
| Course Title : | Object Oriented Programming | | |

Principles of Object-Oriented Programming; Beginning with C++; Tokens, Expressions and Control Structure; Functions in C++; Classes and objects; Constructors and Destructors; Operator Overloading and Type conversions; Inheritance: Extending classes; Pointers, Virtual Functions and Polymorphism; Managing console I/O operations; Working with Files; Exception Handling; Template functions and classes; Multi-threaded Programming.
Introduction to java, comparison between java and c++, Applets and Servlets, basic of java.lang, java.util and java.io;.

***Reference languages:*** *C++ or Java.*

***Reference Books:***


1) *E Balagurusamy* "Object- oriented programming with C++"

2) Robert Lafore, *Object Oriented Programming*, Published by MacMillan Computer Publishing, 3rd Edition.
3) Herbert Schildt, *Teach Yourself C++*, Published by McGraw Hill, 3rd Edition.
4) Paul Deitel and Harvey Deitel, *Java$^{TH}$ How to Program*, Published by Prentice Hall, 9th Edition.
5) Cay S. Horstmann and Gary Cornell, *Core Java$^{TH}$ Volume* 1 & 2, Published by Prentice Hall, 9th Edition.


| Course Code : 520204 | Marks : 40 | Credits : 1.5 | Class Hours : -- |
|---|---|---|---|
| Course Title : | Object Oriented Programming Lab | | |

Laboratory classes are based on course CSE 520203. The goal of this lab is to provide students with the skills needed to effectively design, develop, implement, debug, test, and maintain object oriented programs and more generally to solve problems using C++ or Java programming languages. They will exercise different advanced programming techniques of C++ and JAVA, like swing, socket programming, and windows programming. At the end of the course, students will have to develop a simple real-life programming project.

| Course Code : 520205 | Marks : 80 | Credits : 3 | Class Hours : 45 |
|---|---|---|---|
| Course Title : | Computer Architecture | | |

**Introduction:** Organisation and Architecture, Instruction sets- formats, cycle, timing etc; Addressing modes; Types of Instruction; RISC characteristics; CISC characteristics.
**Computer System:** System Buses, Components, Functions, Bus Interconnection,
**Computer Arithmetic:** Different types of data representation; Addition and Subtraction; Multiplication Algorithms; Division Algorithms.
**Memory Organization:** Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory management requirements and hardware.

**Input-Output Organization:** Input-Output Interfaces; Data transfer, Interrupts; Direct Memory Access (DMA); Input-Output channel.
**Central Processing Unit(CPU):** ALU, CPU structure and Functions
**Control Unit:** Control Unit operation, Micro-operation, Control of processor, Hardwired Implementation.

**Fundamentals of parallel processing:** Parallel processing; Pipelining; Vector processing; Multiprocessors; Array processor, Bit-slice processor Interconnection structures

**Reference Books:**


1. William Stallings, Computer Organisation and Architecture
2. V. Hamcher, Z.Vranesic and S.Zaky, Computer Organisation
3. J.P. Hayes, Computer Architecture and Organisation
4. Dr. M. Rafiquzzaman, Fundamentals of Computer System Architecture


| **Course Code : 520207** | **Marks : 80** | **Credits : 3** | **Class Hours : 45** |
|---|---|---|---|
| **Course Title :** | **Ordinary Differential Equation** | | |

**Ordinary differential equations and their solutions :** Classification of differential equations. Solutions. Implicit solutions. Singular solutions. Initial value problems, boundary value problems. Basic existence and uniqueness theorems (statement and illustration only). Direction fields. phase line.
**Solution of first order equations :** Separable equations and equations reducible to this form. Linear equations, exact equations, Special integrating factors, Substitutions and transformations.
**Modeling with first order differential equations:** Constructions of differential equations as mathematical models (exponential growth and decay, heating and cooling, mixture of solutions, series circuit, logistic growth, chemical reaction, falling bodies). model solutions and interpretation of results. orthogonal and oblique trajectories.
**Solutions of higher order linear differential equations :** Linear differential operators. Basic theory of linear differential equations. Solution space of homogeneous systems. Reduction of order. Homogeneous linear equations with constant coefficient. Non homogeneous equation. Method of undetermined coefficient. Variation of parameters. Euler-cauchy differential equations.
**Modeling with second-order equations:** Vibration of a mass on a spring, free and undamped motion, free and damped motion, forced motion, resonance phenomena, electric problems, motion of a rocker.

***Reference Books:***


1. Abu Yusuf, *Differential Equations.*
2. Dr. Abdul Matin, *Differential Equations.*
3. Kuddus, Hafiz, *Ordinary Differential Equation*, Titas Publications.

| Course Code : 520209 | Marks : 80 | Credits : 3 | Class Hours : 45 |
|---|---|---|---|
| Course Title : | Fundamental of Business Studies | | |

**The Business Enterprise:** Foundation of Business, Forms of Business Ownership, Entrepreneurship, Franchising and Small Business, International Business.

**The Environment of Business:** Social responsibility and Business Ethics, Business Law and Government.

**Management and Organization:** Fundamentals of Management, Organization of Business, Managing production and operation.

**Human Resources:** Human Relations and Motivation, Managing Human Resources, Labor Management Relations.

**Marketing:** Marketing Strategies, Product and Price, Distribution and Promotion,

**Financial Management:** Money and Banking, Financial Management, Investment and Personal Finance, Risk Management and Insurance.

**Accounting and Information Systems:** Accounting Fundamentals, Computer and Management Information Systems.

***Reference Books:***


1. Harman, Edwards and Maher, *Accounting a Business Perspective.*
2. Prof. Md. Khalequzzaman and Prof. Mosharraf H Chowdhury, *Introduction to Business.*
3. Md. Hafiz Uddin, *Basic Accounting* (English Version), The Angel Publications.

# Fourth Semester

| Course Code : 520221 | Marks : 80 | Credits : 3 | Class Hours : 45 |
|---|---|---|---|
| Course Title : | Database Management System | | |

**Introduction:** Database system concept, Purpose of Database system; View of data: Data abstraction; Data models: Relational model, Network model, Hierarchical model; Database languages: DDL, DML; Conventional file processing; Transaction management; Storage management; Database Administrator; Database users; Overall system structure.
**Database model:** Entity-Relationship model; Attributes; Mapping Cardinalities; Existence Dependencies; Weak entity set & Strong entity set; Relational model and its language (Relational algebra and SQL).
**Database design:** Decomposition; Normalization; Object-oriented Databases; Centralized systems; Distributed Databases; Data Fragmentation; Parallel Databases.
**Integrity Constraints:** Domain constraints, Referential constraints, Functional Dependencies.
**Indexing:** Basic concept; Ordered index; Primary index; Dense index and Sparse index; Multilevel index; Secondary index.

***Reference Books:***


1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts.*
2. R. Ramakrishnan, *Database Management System.*
3. James Martin, *Principles of Database Management*.


| Course Code : 520222 | Marks : 40 | Credits : 1.5 | Class Hours : -- |
|---|---|---|---|
| Course Title : | Database Management System Lab | | |

**Objectives:** Database labs are based on the theory course CSE 520208. One large or several small database applications will be developed in the lab. Student will be given the ER model or description of a real problem. Based on the description they will design the ER model or convert the ER model to relational model using the features of relational database design(such as functional dependency, normalization etc) and finalize the relational model. After finalizing the relational model, student will go for implementation. In the implementation phases they should design the sql statements, stored procedure, trigger, views etc. whatever is required to complete the implementation. In the implementation phase should also be the main concern about query optimization, transaction, recovery and backup. Any database such as Oracle/MySql/PostGress SQL can be used.

| Course Code : 520223 | Marks : 80 | Credits : 3 | Class Hours : 45 |
|---|---|---|---|
| Course Title : | Microprocessor and Assembly Languages | | |

**Microprocessors:** Evolution of microprocessors, register base and accumulator based microprocessor, programmable logic devices; main memory array design, memory management concepts, input/ Out techniques, internal architecture of microprocessor: 8085, 8086, addressing mode, instruction format, instruction set, pin configuration and function, maximum/ minimum mode, read/write cycle, memory bank, interrupt and interrupt handling, interrupt controller, DMA.

**Advanced microprocessors**:Internal architecture, memory management, protection, an overview of Intel 80186, 80286, 80386, 80486, Pentium microprocessors, RISC processor, Coprocessor, Alpha processor.

**Assembly Language**: Programming with 8086 instruction, conditional and unconditional jump, string instruction, stacks operation, procedure, reentrant and recursive procedure, macro.

***Reference Books:***


1. D.V Hall, *Microprocessors and Interfacing*, McGraw-Hill
2. M. Rafiquzzaman, *Microprocessors and Microprocessor Based System Design*
3. Y. Liu and G.A. Ginson, *Microcomputer System: 8086/8088 Family*


| Course Code : 520224 | Marks : 40 | Credits : 1.5 | Class Hours : -- |
|---|---|---|---|
| Course Title : | Microprocessor and Assembly Languages Lab | | |

**Objectives:** Laboratory classes are based on **CSE 520210**. Firstly, students will be introduced with Assembly Language and Assembler (NASM, TASM and/or MASM). Several experiments will be performed with the assemblers: I/O operations, Integer programming, String programming, Graphics programming, etc.

Display message (n) times in different line; simple arithmetic operation; Convert a lowercase letter to an uppercase letter and vice versa; Display all alphabetic characters; Input two numbers, compare them and display the smaller one and vice versa; Accept a string from keyboard and display the string in reverse order; Find the largest element from an array and vice versa; perform bubble sort; display first ten numbers by Fibonacci Series; Calculate sum and average of few numbers; Convert hexadecimal number to binary equivalent; If a character is "y" or "Y", Display it, otherwise terminate; Calculate the following expression=M+N-P+1(Using Subroutine); Calculate following operation: if x>y then (M/N) +P else (M-N)*P ;(IF-ELSE Statement).

***Reference Books:***


1. Marut, *Assembly Language Programming*
2. Richard C. Detmer, *Assembly Language Programming*
3. Vanugopal, *Assembly Language Programming*
4. Alan R. Miller, *Techniques for the IBM PC*

| Course Code : 520225 | Marks : 80 | Credits : 3 | Class Hours : 45 |
|---|---|---|---|
| Course Title : | Design and Analysis of Algorithms | | |

**Introduction to algorithm**: Analysis of algorithm, design of algorithm, mathematical foundation of algorithm, asymptotic notations, summations, recurrences, sets etc.

**Divide and Conquer:** General method, Binary Search, Finding the Maximum and Minimum, Quick Sort, Selection.
**The Greedy method:** General method, Knapsack problem, Minimum cost spanning trees, Single Source Shortest path.
**Dynamic programming:** General method, Multistage Graphs, All pair's shortest paths, Single Source Shortest path, Knapsack problem, Optimal Binary search Tree, Traveling salesperson.
**Basic Traversal & Search technique:** Techniques for Binary trees, Techniques for Graphs
**Backtracking:** General method, The 8-Queens problem, Sum of subsets, Graph Coloring
**Branch and Bound:** The method, 0/1 Knapsack problem, Traveling salesperson
**NP-hard and NP-complete problems:** Basic concept, NP-hard graph problems, NP-hard scheduling problems, NP-hard code generation problems.

***Reference Books:***


1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, *Fundamentals of Computer Algorithms*, Published by Galgotia Publications Pvt. Ltd, 2nd Edition.
2. How to Solve it by Computer, R.G.Dromey.
3. Data Structure & Programming Design, Robert L. Kruse.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, *Introduction to Algorithms*, Published by The MIT Press, 3rd Edition.


| Course Code : 520226 | Marks : 40 | Credits : 1.5 | Class Hours : -- |
|---|---|---|---|
| Course Title : | Design and Analysis of Algorithms Lab | | |

Laboratory classes are based on the course **CSE 520212**. Students will be given various algorithmic problems on different domains. By solving those problems students will gain knowledge on algorithmic techniques and their relative performances.

**Divide and conquer:** Binary Search, finding the maximum and minimum.
**Performance measurement using time Function**: quick sort and marge sort, marge sort and Bubble sort, Quick sort and Heap sort.
**Greedy Method:** Knapsack problem, Minimum cost spanning tree, Prim's algorithm, Single source shortest path.
**Dynamic Programming**: All pair shortest path, 0/1 kanpsack problem, the traveling salesperson problem.
**Backtracking**: the 8 Queens Problem, Graph coloring problem.

| Course Code : 520227 | Marks : 80 | Credits : 3 | Class Hours : 45 |
|---|---|---|---|
| Course Title : | Numerical Analysis | | |

**Solutions of equation in one variable:** Bisection algorithm. Method of false position. Fixed point iteration, Newton-Raphson method, Error Analysis iteration for iterative method, Accelerating limit of convergence.
**Interpolation and polynomial approximation :** Taylor polynomial, interpolation and Lagrange polynomial. Iterated Interpolation. Extrapolation.
**Differentiation and Integration :** Numerical differentiation. Richardson's extrapolation. Elements of Numerical integration. Adaptive quadrature method, Romberg's integration, Gaussian quadrature.
Solutions of linear system, pivoting strategies, L U decomposition method.

***Reference Books:***


1) Vatista, *Numerical Analysis*
2) S. S. Sastry, *Introductory Methods of Numerical Analysis*
3) J.H. Mathews, *Numerical Methods for Computer Science, Engineering and Mathematics, Prentice-Hall, 1987*.
4) B. Irons and N.G. Shrive, *Numerical Methods in Engineering and Applied Science, Ellis Horwood, 1987*.