Tribhuvan University

**Institute of Science and Technology**

Three year B. Sc. Computer Science Course of Study

2054

**Course Title:** Computer System and Programming **Full Marks:** 100

**Course No.:** CS 311 **Pass Marks:** 35

**Nature of the Course:** Theory **Year:** I

**Course Objectives:**

It is intended that, on completion of the course, the students will be able to:

- describe fundamentals of computer including evolution, classification and architecture.
- understand the basics of digital electronics
- understand the functional block diagram of various systems and peripherals.
- get familiarized with the computer networking concepts.
- develop algorithms
- write programs in C language.

**Part A: Introduction to Computers:**

1. Introduction: history and evolution of computers, classification of computers, typical computer architecture. **(6hrs.)**
2. Review of digital systems, number system, Boolean algebra, logic gates, flip-flops, address and subtractors. **(8 hrs.)**
3. Digital computer system and architecture.
   3.1 Microprocessor, processing organization, register organization, general assembly languate system addressing and formats. **(6 hrs.)**

3.2 Control unit: hardware control, software control, micro programmed control **(6 hrs.)**

3.3 Memory system: memory organization and types, memory devices, static and dynamic RAM, ROM, PROM, EPROM's their speed and optical memory. **(6 hrs.)**

3.4 I/O System, I/O types, I/O processors, bus system **(6 hrs.)**

3.5 Architecture: modern computer architectures, RISC and CISC architecture **(6 hrs.)**

3.6 Introduction to storage systems. **(8 hrs.)**

4. Computer network, overview, topologies, LNA, WAN **(8 hrs.)**
5. System software:

5.1 Operating system, terminologies, services, file concepts, allocation. CPU scheduling concept memory management, multiprocessing and multitasking. **(6 hrs.)**

5.2 Compliers and linkers **(2 hrs.)**

5.3 Programming languages **(1 hrs.)**

5.4 System utilities **(2 hrs.)**

5.5 Multi-media systems **(2 hrs.)**

**Part B: Computer Programming:**

1. Review of computing, idea of software and programming, text edition and file concepts, operating systems **(6 hrs.)**
2. Algorithm development, flow chart and pseudocodes, deterministic and non-deterministic techniques, series methods, terative techniques, recursive procedures and search techniques, requirement analysis, system design, implementation and execution **(6 hrs.)**
3. Review of structured programming principles. **(1 hrs.)**

4. The C language

   Data types, variables and constants: simple statements, structured statements, logical and conditional expressions, arrays, function-recursive and non-recursive, strings, structures and unions, pointers, bit-oriented instructions, C-preprocessors, C libraries, error and debugging, syntax, runtime errors and debugging, overflow/ underflow errors, user inter faces.

5. Introduction to data structures **(1 hrs.)**
6. Programming project and software management **(2 hrs.)**
   - 6.1 Bottom up and top down design **(1 hrs.)**
   - 6.2 Testing sub programs, test of module boundaries, test of boundary conditions. **(2 hrs.)**
   - 6.3 Documentation- structure chart and program description sheets **(3 hrs.)**

**Text Books:**


1. Morries Mano, ***Computer System Architecture***, 3rd Edition, Prentice Hall International.
2. Kelly and Pohl, ***A Book on C***, Benjamin Cummings.


**Reference Books:**


1. Tenenbaum, ***Structured Computer Organization***, 3rd Edition, Prentice Hall.
2. Tracy Laowey and Jeanne C. Rudder, ***Internet Companion: A Beginners Guide to Global Networking***, Addison Wesley.
3. Hughes C.J., Michtom, ***Structured Approach to Programming***, Prentice Hall International.

**Course Title:** Computer Practical I **Full Marks:** 50
**Course No.:** CS 312 **Pass Marks:** 20
**Nature of the Course:** Practical **Year:** I

**Course Objectives:**
It is intended that, on completion of the course, the students will be able to:

- use operating systems and application softwares.
- write programmes in C language.

**Part A: Operating System / Application Softwares:**

| | |
|---|---|
| DOS | **(6 hrs.)** |
| Windows | **(3 hrs.)** |
| Word Processing | **(6 hrs.)** |
| Spread Sheet | **(6 hrs.)** |
| Data base Management | **(6 hrs.)** |

**Part B: Programming:**

| | | |
|---|---|---|
| 1. | Simple Programming:- Declaration, data type, I/O commands preprocessor | **(9 hrs.)** |
| 2. | Arithmetic expression | **(6 hrs.)** |
| 3. | Logical and conditional expression | **(9 hrs.)** |
| 4. | Compound Statements | **(9 hrs.)** |
| 5. | Arrays | **(9 hrs.)** |
| 6. | Modular Programming | **(15 hrs.)** |
| 7. | String Processing | **(9 hrs.)** |
| 8. | Pointers | **(12 hrs.)** |
| 9. | Structures and unions | **(9 hrs.)** |
| 10. | Project | **(30 hrs.)** |

[Instructor should prepare individual projects for students encompassing all the above features of programming]

**Course Title:** Information System and Design Data Structure **Full Marks:** 100
**Course No.:** CS 321 **Pass Marks:** 35
**Nature of the Course:** Theory **Year:** II

**Course Objectives:**
It is intended that, on completion of the course, the students will be able to:

- described the basic concepts of information system
- assimilate conceptual information system design implementation and evaluation.
- list the steps of structural design approach of IS
- state the different system design techniques
- understand different data structure
- develop and test algorithm.

**Part A: Information System and Design:**

1. Introduction to information system
   1.1 Sources and types of information
   1.2 Manual and computer based information system **(6 hrs.)**
2. Feasibility assessment
   2.1 Problems and needs of information system development
   2.2 Preliminary application requirements
   2.3 Feasibility assessment: economic, technical, operational and schedule feasibility **(6 hrs.)**
3. Planning of information system
   3.1 Need for planning
   3.2 Planning techniques
   3.3 Project planning
   3.4 Reporting and controlling **(6 hrs.)**
4. Conceptual system design and implementation of IS

- 4.1 Conceptual system design
  - 4.1.1 Define the problems
  - 4.1.2 Constraints
  - 4.1.3 Alternative conceptual design
  - 4.1.4 Select and document the best design
  - 4.1.5 Prepare the conceptual design report
- 4.2 Detailed system design
  - 4.2.1 Establish project management
  - 4.2.2 Investigative preparation
- 4.3 Implementation, evaluation and maintenance of IS
  - 4.3.1 Implementation alternatives
  - 4.3.2 Plan for implementation
  - 4.3.3 Cut over
  - 4.3.4 Document the system
  - 4.3.5 Evaluate the system
  - 4.3.6 Control and maintain the system
- 4.4 M.I.S. Planning, design and implementation. **(18 hrs.)**

5. Structured Systems analysis
   - 5.1 Steps in structured system analysis
   - 5.2 Standard tool and techniques and related documentation
   - 5.3 Problem analysis **(21 hrs.)**
6. System design methodology
   - 6.1 Check list methodology
   - 6.2 Process-oriented methodology
   - 6.3 Application generation
   - 6.4 Structured design **(18 hrs.)**

Bart B: Data Structure and Algorithm:

1. Introduction to data structures **(3 hrs.)**
   - 1.1 Abstract data types (ADT)
   - 1.2 Review of C data types
   - 1.3 Review of arrays in C

2. Stacks **(6 hrs.)**
   - 2.1 Stacks as an abstract data type (ADT)
   - 2.2 Implementation of Stacks in C
   - 2.3 Typical application of stacks
     - 2.3.1 Evaluation of expressions (Infix, Postfix and Prefix)
3. Recurion **(9 hrs.)**
   - 3.1 Recursive definition of processes (factorial function, multiplication of natural numbers, fibonacci sequence, binary search etc.)
   - 3.2 Writing recursive program in C (Towers of Hanoi problems etc.)
   - 3.3 Efficiency of recursions
4. Queues **(9 hrs.)**
   - 4.1 The queues and its sequential representation
   - 4.2 Queues as an ADT
   - 4.3 Implementation of queues in C
   - 4.4 Priority of queues (arrays implementation)
5. Lists **(12 hrs.)**
   - 5.1 Liked list
   - 5.2 Implementation of lists in C
     - 5.2.1 Array implementation
     - 5.2.2 Dynamic implementation
     - 5.2.3 Header nodes
   - 5.3 Other lists structures
     - 5.3.1 Circular list
     - 5.3.2 Doubly linked lists
   - 5.4 List implementation of stacks, queues, priority queues.
6. Trees **(6 hrs.)**
   - 6.1 Binary trees
     - 6.1.1 Operation and applications
     - 6..1.2 Binary tree representation

- 6.1.3 Binary tree traversals (pre-order, post-order and in-order)
- 6.1.4 The huffma algorithm

6.2 Trees and their applications
- 6.2.1 Representation of Trees in C
- 6.2.2 Tree traversals
- 6.2.3 Game tree

7. Sorting **(9 hrs.)**

7.1 Types of sorting (internal and external)

7.2 Efficiency considerations
- 7.2.1 Big O notation

7.3 Exchange sorts
- 7.3.1 Bubble and quick sort and their efficiency

7.4 Selection and tree sorting
- 7.4.1 Straight selection sort
- 7.4.2 Binary tree sort
- 7.4.3 Heapsort

7.5 Insertion sorts
- 7.5.1 Simple insertion
- 7.5.2 Shel sort

7.6 Merge and Radix sorts

8. Search **(6 hrs.)**

8.1 Basic search techniques

8.2 Tree searching

8.3 General search trees

8.4 Hashing

9. Graphs and their applications **(12 hrs.)**

9.1 Graphs
- 9.1.1 Application and representation of graphs
- 9.1.2 Transitive closure
- 9.1.3 Warshall's algorithm

9.2 Graph traversal and spanning frorests
- 9.2.1 Transversal methods for graphs
- 9.2.2 Spanning forests

9.2.3 Depth-first traversal and breadth-first traversal
9.2.4 Minimum spanning trees
9.2.5 Kruskal's and Round-Robin algorithms

10. Types of algorithm **(3 hrs.)**
    10.1 Divide and conquer algorithms
    10.2 Dynamic programming
    10.3 Greedy algorithms
    10.4 Backtracking
    10.5 Local search algorithms

**Text Book:**


1. Bruch, E.R. Strater and Grundnitki, ***Information System: Theory and Practice***, 3rd Edition, Wiley-Eastern Publication, 1983.
2. ***Data Structure and Algorithms*** by Alfred V. Aho, John #. Hopcroft, Jeffrey D. Ullman.


**References:**


1. Collins and G. Blay, ***Structured System Development Techniques: Strategic Planning to System Testing***, Pit.
2. Davis and G.C. Everest, ***Reading in Management Information Systems***, McGrew Hill.
3. Ganes and T. Sarson, ***Structured System Analysis: Tools and Techniques***, Prentice Hall, Englewook Clift, N.J.
4. Murdick, Ross and Clagget, ***Information System for Modern Management***, McGraw Hill.
5. Tenenbau,, Langsam, Augensten, ***Data Structure Using C***, Prentice Hall, Kruse, Leung and Tondo, ***Data Structured and Program Design in C***, Prentice Hall.
6. J. Nivergelt, K. Hinrichs, ***Algorithms and Data Structures with Application to Graphic and Geometry***, Prentice Hall.

**Course Title:** Computer Practical II **Full Marks:** 50
**Course No.:** CS 322 **Pass Marks:** 20
**Nature of the Course:** Theory **Year:** II

**Course Objectives:**

It is intended that, on completion of the course, the students will be able to:

- learn different data structures
- develop and test algorithm
- analyse and design information system

**Part A: Data Structure and Algorithm:**

1. Implementation of stacks in C language **(9 hrs.)**
2. Writing recursive programs in C language **( hrs.)**
3. Implementation queues in C language **(9 hrs.)**
4. Implementation of lists in C language **(12 hrs.)**
5. Representation of trees in C language **(15 hrs.)**
6. Writing sorting program in C language **(12 hrs.)**
7. Implementation of search in C language **(9 hrs.)**
8. Implementation of different types of algorithms **(15 hrs.)**

**Part B: Information System and Design:**

1. Project works **(60 hrs.)**

[Instructor should assign individual projects for students encompassing all the features of information systems]

1.2 Presentation of Data: Textual, tabular and diagrammatic presentation (bar, multiple bar and pie diagram).**(10 hrs.)**

1.3 Classification of data, chrocal, spatial and arrays.**(2 hrs.)**

1.4 Variable: Discrete, continuous and attributes, notation used for summation. **(3 hrs.)**

1.5 Frequency distribution: Frequency (weights), ordering of data, cumulative frequency, less than type, more than types, construction of class intervals, definition of intervals, conversion of discrete case to continuous one. **(10 hrs.)**

1.6 Table: Features of table, types of tables (simple and multiple). **(5 hrs.)**

1.7 Contingency table, test of consistency of data, measurement of association. **(10 hrs.)**

1.8 Curves: Frequency curve, polygon and histogram.**(5 hrs.)**

**Unit 2: Descriptive Measure:**

2.1 Central Tendency: Mathematical means (AM, GM, HM) partion values (quartiles, deciles, percentiles, median) **(20 hrs.)**

2.2 Dispersion: Range, mean, deviation, standard deviation, coefficient of variation. **(10 hrs.)**

2.3 Skewness, kurtosis and their statistical measures

**Unit 3: Relation Between Variables:**

3.1 Correlation and regression up to 3 variables. **(10 hrs.)**

3.2 Fitting of Models (Linear, exponential and parabola).

**Unit 4: Inference and Hypothesis Testing:**

4.1 Point and interval estimation, testing of hypothesis, concept of sampling distribution, standard error, level of significance, and degree of freedom, type I and type II errors. **(10 hrs.)**

4.2 T, F and $X^2$ test and their applications, analysis of variances and co-variance, coefficient of determination, $R^2$. **(10 hrs.)**

**Unit 5: Sampling:**

5.1 Sampling, purposive and random sampling, simple, startified andy systematic sampling (description only). **(10 hrs.)**

5.2 Sampling techniques used in ecological surveys. Estimation of totals, means of biological variables. **(10 hrs.)**

**Unit 6: Probability in Biological Science:**

6.1 Concept, events, relationships between variables, basic laws of probability application of probability theory in biological problem. **(10 hrs.)**

6.2 Quantitative Genetics

Gene and genotype frequencies, hardy weign equilibrium theory, effects of mutations, selection and migration in gene frequencies. **(10 hrs.)**

**Text Books:**

M.L. Sing, Statistical Methods.

**Reference Books:**

Youle and Kendall, ***An Introduction to Theory of Statistics***, Griffin.

D.S. Falconer, ***Introduction to Quantitative Genetics***, Oliver and Boyd, London.

**Course Title:** Programming in Java (T+P) **Full Marks:** 100
**Course No.:** CS 311 E **Pass Marks:** 35
**Nature of the Course:** Theory **Year:** III

**Courses Description:**
Overview of JAVA programming language, applets and stand-alone applications, Programming and machine independence, code reusability.

**Course Objectives:**

- Introduce JAVA programming language. The importance of programming by using web brower.
- Object oriented programming and JAVA, using JAVA for development and maintenance of application programs. Extensive programming using JAVA.

**Course contents:**

**Unit 1:**

1.1 Introduction and historical development of JAVA programming. Language, objects and primitive data, string literals, primitive data types and expression, object creation, class libraries and packages **(12 hrs.)**

1.2 Applets and their execution on the web, writing classes, instance data, anatomy of a class, method overloading, method decomposition, graphical methods. **(9 hrs.)**

1.3 Enhancing classes, passing objects as parameters, the static modifier, inner classes, polymorphism via interfaces. **(12 hrs.)**

**Unit 2:**

2.1 Arrays and vectors, string objects, command-line arguments, the Vector class, arrays and graphics.**(8 hrs.)**

2.2 Inheritance: derived classes, protected modifier and super reference, multiple inheritance, the object class, abstract classes, event adapter classes. **(15 hrs.)**

2.3 Graphical user interfaces, AWT and swings, container, components, layout managers. **(7 hrs.)**

**Unit 3:**

3.1 Exceptions and I/O streams, input/output streams, exception propagation, class stream, byte stream, data stream, processing stream, reading writing text files **(8 hrs.)**

3.2 Software development models, life cycles, process models, prototypes, walkthroughts, evolutionary developments. **(9 hrs.)**

3.3 Collections, separating interface from implementation. Classic data structures (queues, stacks, etc.), collection classes. **(10 hrs.)**

**Recommended Book:**

1. John Lewis and Willam Loftus, ***JAVA Software Solutions: foundations of Program Design***, Second Edition, Addison Wesley. ISBN: 0-201-72597-5

**Note:** Full marks in the theory course will be 60 and that in the practical course will be 40.

**Course Title:** **Full Marks:** 40
**Course No.:** OPT 311 E1 **Pass Marks:** 16
**Nature of the Course:** Practical **Year:** III

**Courses Description:**

Laboratory practice of JAVA programming language, applets and stand alone application code reusability.

**Course Objectives:**

- Laboratory practice on JAVA programming language.
- Laboratory practice on object oriented programming and JAVA.

**Note:** In this course, there will be two days laboratory class of three hours duration each. The laboratory will be based on the material covered in the theory and teacher concerned will have to take responsibility in developing laboratory practical. (60 hrs.)

**Course Title:** Interment Programming
(Theory + Practical) **Full Marks:** 100
**Course No.:** OPT 311 F **Pass Marks:** 35
**Nature of the Course:** Theory **Year:** III

**Courses Description:**

Web page design, searching and indexing. Interactive web pages, electronic publishing. Capturing utilities. Multimedia systems.

**Course Objectives:**

- Introduce tools for creating and maintaining web sites.
- Introduce search/index utilities, electronic publishing and authorising systems.

**Course Contents:**

**Unit 1:**

1.1 Fundamentals of web page design, use of environment and SSI variables. **(15 hrs.)**
1.2 Scripting languages, interpreted and compiled languages, creation of advanced form application **(10 hrs.)**
1.3 Design of search/index utilities, web databases. **(8 hrs.)**

**Unit 2:**

2.1 Design and implementation of interactive web sites. Each student is expected to design and implement and interactive web site starting from the scratch. **(9 hrs.)**

2.2 Electronic publishing, network communication cybermedia authoring systems. **(10 hrs.)**

2.3 Virtual reality, development of digital multimedia, content selection. **(9 hrs.)**

**Unit 3:**

3.1 Nature and development of digital multimedia, content selection. **(9 hrs.)**

3.2 Scripting, editing, transforming and production of multimedia systems. **(8 hrs.)**

3.3 Screen capture utilities, analog and digital video capture environment, motion development programs. **(12 hrs.)**

**Note:** Full marks in the theory course will be 60 and that in the practical course will be 40.

**Course Title:** **Full Marks:** 40
**Course No.:** OPT 311 F1 **Pass Marks:** 16
**Nature of the Course:** Practical **Year:** III

**Courses Description:**

Laboratory practice on web page design, scripting, recording and indexing, interactive web page, electronic publishing capturing utilities and multimedia systems.

**Course Objectives:**

- Laboratory practice on web page design and creating and maintaining web sites.
- Laboratory practice on multimedia systems.

Note: In this course, there will be two days laboratory class of three hours duration each. The laboratory will be based on the material covered in the theory and teacher concerned will have to take responsibility in developing laboratory practical.