Course Title: **Operating System (3 Cr.)**
Course Code: **CACS251**
Year/Semester: **II/IV**
Class Load: **6 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1, Practical: 2 Hrs.)**

Course Description

This course includes the topics that help students understand operating system and it's functionality along with its types.

Course Objectives

The general objectives of this subject are to provide the basic feature, function and interface with the hardware and application software to run the computer smoothly.

Course Contents

Unit 1 Introduction to Operating System **2 Hrs.**

History, Introduction and Generation of Operating System, Objectives (Resource Manager and Extended Machine), Types of Operating system, Function of Operating system.

Unit 2 Operating System Structure **2 Hrs.**

Introduction, Layered System, Kernel, Types of Kernel (Monolithic/Macro Kernel and Micro / Exo-Kernel), Client-Server Model, Virtual Machines, Shell.

Unit 3 Process Management **15 Hrs.**

Process Concepts(3 Hrs.): Definitions of Process, The Process Model, Process States, Process State Transition, The Process Control Block, Operations on Processes (Creation, Termination, Hierarchies, Implementation), Cooperating Processes, System Calls (Process Management, File management, Directory Management).

Threads (1 Hr): Definitions of Threads, Types of Thread Process (Single and Multithreaded Process), Benefits of Multithread, Multithreading Models (Many-to-One Model, One-to-One Model, Many-to Many Model).

Inter-Process Communication and Synchronization(6 Hrs.): Introduction, Race Condition, Critical Regions, Avoiding Critical Region: Mutual Exclusion And Serializability; Mutual Exclusion Conditions, Proposals for Achieving Mutual Exclusion: Disabling Interrupts, Lock Variable, Strict Alteration (Peterson's Solution), The TSL Instruction, Sleep and Wakeup, Types of Mutual Exclusion (Semaphore, Monitors, Mutexes, Message Passing, Bounded Buffer), Serializability: Locking Protocols and Time Stamp Protocols; Classical IPC Problems (Dining Philosophers Problems, The Readers and Writers Problem, The Sleeping Barber's Problem)

Process Scheduling(5 Hrs): Basic Concept, Type of Scheduling (Preemptive Scheduling, Nonpreemptive Scheduling, Batch, Interactive, Real Time Scheduling), Scheduling Criteria or Performance Analysis, Scheduling Algorithm (Round-Robin, First Come First Served, Shortest-Job- First, Shortest Process Next, Shortest Remaining Time Next, Real Time, Priority Fair Share, Guaranteed, Lottery Scheduling, HRN, Multiple Queue, Multilevel Feedback Queue); Some Numerical Examples on Scheduling.

Unit 4 Deadlocks **4 Hrs.**

System Model, System Resources: Preemptable and Non-Preemptable; Conditions for Resource Deadlocks, Deadlock Modeling, The OSTRICH Algorithm, Method of Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm, Deadlock Detection: Resource Allocation Graph, Recovery from Deadlock.

Unit 5 Memory Management **7 Hrs.**

Basic Memory Management (3 Hrs.): Introduction, Memory Hierarchy, Logical Versus Physical Address Space, Memory Management with Swapping: Memory Management with Bitmaps and with Linked List; Memory Management without Swapping, Contiguous-Memory Allocation: Memory Protection, Memory Allocation, Fragmentation (Inter Fragmentation and External Fragmentation); Non-Contiguous Memory Allocation, Fixed Partitioning Vs. Variable Partitioning, Relocation and Protection, Coalescing and Compaction.

Virtual Memory (4 Hours): Background, Paging, Structure of Page Table: Hierarchical Page Table, Hashed Page Table, Inverted Page Table, Shared Page Table; Block Mapping Vs. Direct Mapping, Demand Paging, Page Replacement and Page Faults, Page Replacement Algorithms: FIFO,OPR,LRU, SCP; Some Numerical Examples on Page Replacement, Thrashing, Segmentation, Segmentation With Paging.

Unit6 Input/ Output Device Management **4 Hrs.**

Principle of I/O Hardware: I/O Devices, Device Controllers, Memory Mapped I/O, Direct Memory Access; Principle of I/O Software: Goals of I/O Software, Program I/O, Interrupt -Driven I/O, I/O Using DMA; I/O Software Layers: Interrupts Handler, Device Drivers, Device Independent I/O Software, User - Space I/O Software; Disk: Disk Hardware; Disk Scheduling: Seek Time, Rational Delay, Transfer Time; Disk Scheduling Algorithms: FCFS Scheduling, SSTF Scheduling, SCAN Scheduling, C-SCAN Scheduling, Lock Scheduling

Unit 7 File System Interface Management **2 Hrs.**

File Concept: File Naming, File Structure, File Type, File Access, File Attributes, File Operation and File Descriptors; Directories: Single-Level Directory Systems, Hierarchical Directory Systems, Path Names, Directory Operation; Access

Methods: Sequential, Direct; Protection: Types of Access, Access Control List, Access Control Matrix

Unit 8 Security Management **3 Hrs.**

Introduction, Security Problems, User Authentication: Passwords, password Vulnerabilities, Encrypted password, One Time Password and Biometrics password; User Authorization, Program Threats: Trojan Horse, Trap Door, Stack and Buffer Overflow; System Threats: Worms, Viruses, Denial of Services.

Unit 9 Distributed Operating System **4 Hrs.**

Introduction, Advantages of Distributed System over Centralized System, Advantages of Distributed System over Independent PCs, Disadvantages of Distributed System, Hardware and Software Concepts, Communication in Distributed Systems, Message Passing, Remote Procedure Call, Process in Distribution System, Clock Synchronization.

Unit 10 Case Study **2 Hrs.**

DOS and Windows Operating System, Unix Operating System, Linux Operating System

Laboratory Works

Lab works should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course. Project should be assigned on Individual Basis.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Books

1. Andrew S. Tanenbaum, "*Modern Operating System* 6/e", PHI, 2011/12
2. Silberschatz, P.B. Galvin, G. Gagne, "*Operating System Concepts 8/e* ", Wiley India, 2014 ISBN : 9788126520510

Reference Books

1. Andrew S. Tanenbaum, "*Distributed Operating System*", Pearson
2. D M Dhamdhere, "*System Programming and Operating System*", Tata McGraw-Hill, 2009
3. P. Pal Choudhury, "*Operating Systems Principles and Design*", PHI, 2011

Course Title: **Numerical Methods (3 Cr.)**
Course Code: **CACS252**
Year/Semester: **II/IV**
Class Load: **6 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1, Practical: 2 Hrs.)**

Course Description

This course covers solution of nonlinear equations, interpolation and approximation, numerical differentiation and integration and solution of linear algebraic equation, ordinary differential equations and partial differential equations. It provides knowledge for numerical analysis.

Course Objectives

The general objectives of this subject are to make students familiar with the theory of numerical analysis for solving algebraic and transcendental equations, solution of ordinary and partial differential equations, numerical differentiation and integration.

Course Contents

Unit 1 Solution of Nonlinear Equations **10 Hrs.**

Introduction, Types of Equation, Errors in Computing, The Bisection Method; The Method of False Position, Newton- Raphson Method, Solution of System of Nonlinear Equation, Fixed Point Iteration and Convergence

Unit 2 Interpolation and Approximation **8 Hrs.**

Introduction, Errors in Polynomial Interpolation, Lagrange's Polynomials, Newton's Interpolation using Difference and Divided Differences, Cubic Spline Interpolation, Least Squares Method for Linear and Non-linear Data.

Unit 3 Numerical Differentiation and Integration **5 Hrs.**

Introduction to Numerical Differentiation, Newton's Differentiation Formulas, Numerical Integration (Trapezoidal Rule, Simpson's 1/3 rule, 3/8 rule); Romberg Integration; Numerical Double Integration.

Unit 4 Solution of Linear Algebraic Equations **10 Hrs.**

Review of the existence of solutions and properties of matrices, Consistency of a Linear System of Equations, Gaussian Elimination Method, Gauss-Jordan Method, Inverse of matrix using Gauss Elimination Method, Method of factorization, Iterative Methods(Jacobi & Gauss-Seidel Iteration),Power Method.

Unit 5 Solution of Ordinary Differential Equations **7 Hrs.**

Introduction to Differential Equations, Initial Value Problem, Taylor Series Method, Picard's Method, Euler's Method and Its Accuracy, Heun's method,

Runge-Kutta Methods, Solution of Higher Order Equations, Boundary Value Problems, Shooting Method and Its Algorithm.

Unit 6 Solution of Partial Differential Equations **5 Hrs.**

Introduction to Partial Differential Equations, Deriving Difference Equations, Laplacian Equation and Poisson's Equation.

Laboratory Works

Laboratory works will consist of program development and testing of Non-linear Equations, Interpolation, Numerical Differentiation and Integration, Linear Algebraic Equations, Ordinary and Partial Differential Equations using C or C++Builder.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Books

1. C.F. Gerald and P.O. Wheatley, "*Applied Numerical Analysis*", 4th Edition, Addison Wesley Publishing Company, New York
2. S. S Sastry, "*Introduction to Methods of Numerical Analysis*",- Prentice- Hall India

Reference Books

1. W. Chency and D. Kinciad, "*Numerical Mathematics and Computing*", 2nd edition, Brooks/Cole Publishing Co., 1985
2. W.H. Press, B.P. Flannery et. al., "*Numerical Recipes in C*", 1st Edition, Cambridge Press, 1998.

3. S. Yakwitz and F. Szidarovszky, "*An Introduction to Numerical Computations*", 2nd Edition, Macmillan Publishing Co., New York.
4. S.S. Sastry, "*Engineering Mathematics Volume two*", Prentice-Hall of India.

Course Title: **Software Engineering (3 Cr.)**
Course Code: **CACS253**
Year/Semester: **II/IV**
Class Load: **4 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1)**

Course Description

This course includes the topics that provide fundamental concept and standard of software engineering so that students will be able to develop software and/or handle software project using the global standard of software.

Course Objectives

This Course is designed to provide the students with the basic competencies required to identify requirements, documents the system design and maintain a developed system. It presumes a general understanding of computers and programming which are covered in the first and second semester of the degree.

Course Contents

Unit 1 Introduction **4 Hrs.**

Definition of Software, Type of Software, Characteristic of Software, Attributes of Good Software, Definition of Software Engineering, Software Engineering Costs, Key Challenges that Software Engineering Facing, System Engineering and Software Engineering, Professional Practice.

Unit 2 Software Development Process Model **8 Hrs.**

Software Process, Software Process Model: The Waterfall Model, Evolutionary Development, Component-Based Software Engineering (CBSE); Process Iteration: Incremental Delivery, Spiral Development; Rapid Software Development: Agile Methods, Extreme Programming, Rapid Application Development, Software Prototyping; Rational Unified Process (RUP), Computer Aided Software Engineering (CASE): Overview of CASE Approach, Classification of CASE tools.

Unit 3 Software Requirement Analysis and Specification **10 Hrs.**

System and Software Requirements, Type of Software Requirements: Functional and Non-Functional Requirements, Domain Requirements, User Requirements; Elicitation and Analysis of Requirements: Overview of Techniques, View Points, Interviewing, Scenarios, Use-Case, Ethnography, Requirement Validation, Requirement Specification, Feasibility.

Unit 4 Software Design **10 hrs.**

Design Concept: Abstraction, Architecture, Patterns, Modularity: Cohesion, Coupling; Information Hiding, Functional Independence, Refinement; Architectural Design: Repository Model, Client Server Model, Layered Model, Modular Decomposition; Procedural Design Using Structured Methods, User

Interface Design: Human-Computer Interaction, Information Presentation, Interface Evaluation; Design Notation.

Unit 5 Coding **2 Hrs.**

Programming Language and Development Tools, Selecting Languages and Tools, Good Programming Practices

Unit 6 Software Testing and Quality Assurance **6 Hrs.**

Verification and Validation, Techniques of Testing: Black-box and White-box Testing, Inspections; Level of Testing: Unit Testing, Integration Testing, Interface Testing, System Testing, Alpha and Beta Testing, Regression Testing; Design of Test Cases, Quality Management Activities, Product and Process Quality, Standards: ISO9000, Capability Maturity Model (CMM);

Unit 7 Software Maintenance **3 Hrs.**

Evolving Nature of Software, Different Types of Maintenance: Fault Repair, Software Adaptation, Functionality Addition or Modification; Maintenance Prediction, Re-Engineering, Configuration Management (CM): Importance of CM, Configuration Items, Versioning;

Unit 8 Managing Software Projects **2 Hrs.**

Needs for the Proper Management of Software Projects, Management Activities: Project Planning, Estimating Costs, Project Scheduling, Risk Management, Managing People;

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
40	-	60 (3 Hrs.)	-	100

Tribhuvan University

Faculty of Humanities and Social Science

Bachelor of Computer Application (BCA)

Course Title: **Project I** **Course Code: CACS256**
Credit Hours: 2 **Year/Sem.: II/IV**
Class Load: 4 Hrs./Week (Practical: 4Hrs.) **FM: 100/ PM: 40**

Course Description: This is fully practical course and expects the practical implementation of the concept learnt by students during first two years of their study. However, it should not be limited to the boundary of syllabus. So, the students can go beyond this and make their project work more realistic and technically sophisticated.

Course Objectives: The general objectives of this project work are to make student able in implementing concepts learnt by fourth semester so that they will be able to develop applications of their own choice. The specific objectives are to make students able to

- lead a software project development
- work in team
- use CASE tools
- write programs and improve programming skill
- write test cases for software testing and improve QA skill
- improve problem solving skill
- improve report writing skill
- improve presentation skill

Thematic Details:

Phases of Project: The students should work individually or in pairs (two people) on minor project of their choice, mostly related to the development of a computer application for a real life situation. The following are the three phases which students have to go though;

1. **Proposal Submission and Defence:** Students must submit and present project proposal with in 20 days from their first class day of the fourth semenster.

2. **Mid-Term Defense:** Students must submit progress report and defend midterm progress of their project work in the 12^{th} week of the fourth semester.

3. **Final Submission and Defense:** Students must submit and orally defend the project work during last week of the fourth semester, before final board examination. Students must have to submit the project final report to their respective department before 10 days of final defence date. The report should be submitted in standard format as prescribed. The report should be made available to the external expert before a week of presentation date. The final presentation will be followed by the demonstration session, where students have to illustrate/simluate the project. A viva voice will be conducted by evaluation committee.

Nature of Project: Students should write programs to build some applications/system. Students should be encouraged to develop desktop based, web based, or mobile based applications using the language technologies of their expertise and comfort. The students can rely on the appropriate language technologies that they have learnt till 4th semester; however it is not limited. Students can develop the applications containing CRUD opertaions or any other sophisticated algorithms, if applicable. Students should use appropriate CASE Tools. Students may work on projects like Information Systems, E-Commerce Portals, Game Applications, etc. While implementing the project, students should be encouraged to write their own modules rather than relying on APIs or Plugins (except in some unavoidable circumstances).

Focus of the Study: Each student in a group should have equal participation in every phase of the project. The students should focus on the following different software development phases during the development of their project work;

1. Problem Identification
2. System Analysis
    a. Feasibility Study
    b. System Requirement Specification (SRS)
3. System Design
    a. Architecture Design
    b. Interface Design
    c. Database/Procedure/Algorithm Design
4. Implementing and Testing

Provision of Supervision: There should be a regular faculty assigned as a supervisor. The role of supervisor is to guide the students through out the project and provide constructive suggestions. The supervisor should also evaluate the project as part of evaluation committee.

Evaluataion Scheme:

a. Term wise marks distribution:

- **First Stage (Proposal Defense)** of 10%. of total marks based on project proposal and presentation.

- **Second Stage** of 70% of total marks based on;
    - **Work Done 50%**
        - System Analysis and Design
        - Implementaion
        - Understanding of methods used in project
        - Ability to work with others
        - Ability to identify problems
        - Amount of work performed
    - **Documentation 20%**
        - Report Organization
        - Writing Style
        - Completeness of Report
        - Readability
        - Organization and analysis of data and results

- **Third Stage (Viva-Voice)** of 20% of total marks based on presentation and project demonstration and viva-voice. Each group member should present about the project followed by the demonstration of project developed.

The 10 marks (first stage of evaluation) will be evaluated by the research committee formed by HOD/Coordinator as a part of proposal defense. The 70 marks (second stage of evaluation) will be evaluated by the supervisor and internal examinar as a part of midterm defense and final defense. Out of the 70 marks, the supervisor will evaluate for 50 marks and internal examinar will evaluate for 20 marks. The remaining 20 marks (third stage of evaluation) will be evaluated by the external examinar from the university.

Out of 100 marks, the 80 marks (First stage evaluation + Second Stage Evaluation) will be considered as internal assessment while the 20 marks (Third Stage Evaluation) will be considered as external assessment. Individual student in the project should get passed in each of the internal and external assessments separately. Any student failing to pass each of the assessments will be counted as fail.

b. Evaluation committee

- Project Supervisor
- HOD/Coordinator
- Internal Examinar (Regular Faculty)
- External Examinar

c. Focus of the evaluation

- Presentation Skills
- Viva/Question Answer
- Project Demonstration
- Project Report
- Level of Work
- Teamwork and Contribution

Report Contents:

1. Prescribed content flow for the project proposal

1. Introduction
2. Problem Statement
3. Objectives
4. Methodology
    a. Requirement Identification
        - Study of existing system
        - Requirement Collection
    b. Feasibility Study
        - Technical
        - Operational
        - Economic

c. High Level Design of System (system flow chart/ methodology of the proposed system/ working mechanism of proposed system)

5. Gantt Chart (showing the project timeline)
6. Expected Outcome
7. References

2. Prescribed content flow for the project report

1. Cover & Title Page
2. Certificate Page
   i. Supervisor's Certificate
   ii. Internal and External Examiners' Approval
3. Abstract Page
4. Acknowledgement
5. Table of Contents
6. List of Abbriviations, List of Figures, List of Tables
7. Main Report
8. Appendices (Screen Shots/ Source Codes/ *Supervisor Visit Log Sheets*)
9. References
10. Bibliography (if any)

3. Prescribed Chapters in Main Report

1. Chapter 1: Introduction

1.1. Introduction
1.2. Problem Statement
1.3. Objectives
1.4. Scope and Limitation
1.5. Report Organization

2. Chapter 2: Background Study and Literature Review

2.1. Background Study (Description of fundamental theories, general concepts and terminologies related to the project)
2.2. Literature Review (Review of the similar projects, theories done by other researchers)

3. Chapter 3: System Analysis and Design

3.1. System Analysis
   3.1.1. Requirement Analysis
      i. Functional Requirements (Illustrated using use case diagram/list)
      ii. Non Functional Requirements
   3.1.2. Feasiblity Analysis
      i. Technilical
      ii. Operational
      iii. Economic
      iv. Schedule
   3.1.3. Data Modelling (ER-Diagram)

3.1.4. Process Modelling (DFD)

3.2. System Design

3.2.1. Architectural Design

3.2.2. Database Schema Design

3.2.3. Interface Design (UI Interface / Interface Structure Diagrams)

3.2.4. Physical DFD

4. Chapter 4: Implementation and Testing

4.1. Implementation

4.1.1. Tools Used (CASE tools, Programming languages, Database platforms)

4.1.2. Implementation Details of Modules (Description of procedures/functions)

4.2. Testing

4.2.1. Test Cases for Unit Testing

4.2.2. Test Cases for System Testing

5. Chapter 5: Conclusion and Future Recommendations

5.1. Lesson Learnt / Outcome

5.2. Conclusion

5.3. Future Recommendations

While writing above chapters students should avaoid basic definitions. They should relate and contextualize the above mentioned concepts with their project work.

Referencing and Citation:

The listing of references should be listed in the references section. The references contain the list of articles, books, urls that are cited in the document. The books, articles, and others that are studied during the study but are not cited in the document can be listed in the bibliography section.

The citation and referencing standard should be IEEE referencing standard. The text inside the document should be cited accordingly. The IEEE referencing standard can be found in the web.

Report Format Standards

A. Page Number

The pages from certificate page to the list of tables/figures should be numbered in roman starting from i. The pages from chapter 1 onwards should be numbered in numeric starting from 1. The page number should be inserted at bottom, aligned center.

B. Page Size and Margin

- The papersize must be a page size corresponding to A4. The margins must be set as

  Top = 1; Bottom = 1; Right = 1; Left 1.25

C. Paragraph Style

- All paragraphs must be justified with spacing of 1.5.

D. Text Font of Entire Document

- The entire document should be in Times New Roman font
- The font size in the paragraphs of document should be 12

E. Section Headings

- Font size for the headings should be 16 for chapter title, 14 for section headings, 12 for the sub-section headings. All the headings should be bold faced.

F. Figures and Tables

- Position of figures and tables should be aligned center. The figure caption should be centred below the figure and able captions should be centred above the table. All the captions should be of bold face with 12 font size.

Final Report Binding and Submission:

No of Copies: 3 (College Library + Self + Dean Office)

Look and Feel: Golden Embracing with Black Binding

A final approved signed copy of the report should be submitted to the Dean Office, Exam Section, FOHSS.

(A typical Specimen of Cover Page & Title Page)

Tribhuvan University
Faculty of Humanities and Social Science

TITLE OF PROJECT REPORT

A PROJECT REPORT

Submitted to
Department of Computer Application
Name of the College

In partial fulfillment of the requirements for the Bachelors in Computer Application

Submitted by

Names and Roll of the Candidates

Month and Year

Under the Supervision of

Supervisor Name

(A typical Specimen of Certificate)

Tribhuvan University
Faculty of Humanities and Social Science
College Name

Supervisor's Recommendation

I hereby recommend that this project prepared under my supervision by NAME OF THE STUDENT entitled "T**ITLE OF THE PROJECT……..**" in partial fulfillment of the requirements for the degree of Bachelor of Computer Application is recommeded for the final evaluation.

<<Signature of the Supervisor>>

SIGNATURE

<<Name>>

SUPERVISOR

<<Academic Designation>>

<<Department>>

<<Full address of the Dept & College >>

(A typical specimen of Approval)

Tribhuvan University
Faculty of Humanities and Social Science
College Name

LETTER OF APPROVAL

This is to certify that this project prepared by NAME OF THE STUDENT entitled "**TITLE OF THE PROJECT……..**" in partial fulfillment of the requirements for the degree of Bachelor in Compuer Application has been evaluated. In our opinion it is satisfactory in the scope and quality as a project for the required degree.

SIGNATURE of Supervisor Name and Academic designation Department name and full address of the college	**SIGNATURE of HOD/ Coordinator** Name and Academic Designation Department name and full address of the college
SIGNATURE of Internal Examinar **Internal Examinar**	**SIGNATURE of External Examinar** **External Examinar**