2020-2021

UNIVERSITY OF SCIENCE AND TECHNILOGY OF HANOI

COURSE SYLLABUS

BACHELOR FIRST-YEAR PROGRAM (B1)

Table of Contents

PROGRAM OVERVIEW

No.	Code	Course title	ECTS	FST + PMAB + WEO	CHEM	MST	Energy + AMSN + EPE + MET	SA	ICT + CS + MATH
1	ENG1.1	Basic and advanced English skills	8	x	x	x	x	x	x
2	MS1.1	Law of Science and Technology of Vietnam	1	x	x	x	x	x	x
3	MS1.2	Foundation of economics	1	x	x	x	x	x	x
4	BIO1.1	Cellular biology	4	x	x	x	x	x	x
5	BIO1.2	Genetics	3	x	x	x	x	x	x
6	BIO1.3	Biochemistry	3	x	Option 1	Option 1			
7	BIO1.4	General micro-biology	3	x	Option 1	Option 1			
8	CHEM1.1	General Chemistry I	4	x	x	x	x	x	x
9	CHEM1.3	Organic Chemistry	4	x	x	Option 1	x		
10	CHEM1.2	General Chemistry II	4	x	x	Option 1	x	x	x
11	CHEM1.4	Practical chemistry	2	x	x	x	x		
12	ICT1.2	Basic programming	4	x	x	x	x	x	x
13	ICT1.1	Introduction to informatics	3	x	x	x	x	x	x
14	ICT1.4	Introduction to Algorithms	3			Option 2		x	x
15	ICT1.3	Computer Architecture	3						x
16	MATH1.2	Linear Algebra	4	x	x	x	x	x	x
17	MATH1.1	Calculus I	4	x	x	x	x	x	x
18	MATH1.3	Calculus II	3						x
19	MATH1.4	Discrete Mathematics	3			Option 2		x	x
20	PHYS1.1	Fundamental Physics I	4	x	x	x	x	x	x
21	PHYS1.2	Fundamental Physics II	4	x	x	x	x	x	x
22	PHYS1.3	Electromagnetism	4		Option 2	Option 2	x	x	
23	PHYS1.4	Practical physics	2		Option 2	Option 2	x	x	

ICT COURSES

ICT 1.3: COMPUTER ARCHITECTURE

I. Course description:

1. Credit points: 3 ECTS

2. Time commitment:

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	26	0	10	**36**

3. Prerequisites: None

4. Recommended background knowledge: Maths, Physics and C language

5. Subject description:

This course is an introduction to computer architecture for first-year students. In this course, you will study: (1) the mother-board & its components; (2) the arrangement of computer components (CPU, memory, peripherals (I/O) and system bus) and their relationship & (3) the instruction set architecture (ISA). More precisely, the topics cover the CPU structure (ALU, registers, decoder), ISA (instruction, interrupt, pipelining technique, memory addressing modes).

In addition, this course is essential for two further study directions: (1) Design & hardware implement a microprocessor and (2) develop a compiler for the microprocessor.

6. Objectives & Outcome:

- Basic knowledge of the architecture and operation inside of a computer.
- Ability to apply maths and physics and acquired basic knowledge to evaluate and interpret the constraints and trade-offs in computer design.
- Ability to understand and analyze the design concept of a processor for modern computer architecture.
- Ability to implement the future design concept of a processor for modern computer architecture.
- Mastering Verilog (HDL) and ModelSim (Simulator) in solving homework exercises and in realizing team project.
- Ability to work as a team to solve a given problem (team project).
- Ability to present the solution of their team to the whole class.

7. Assessment/ Evaluation

Component	Attendance	Exercises	Assignments	Reports	Midterm	Final
Percentage %	0	0	0	0	40	60

8. Prescribed Textbook(s)

[1]. Computer Organization and Design, 4th Edition, Patterson & Hennessy, © 2008, MK

II. Course content & schedule:

1. Chapter 1: Introduction (6hrs)

1.1. Computer Abstraction and

1.2. The role of performance

2. Chapter 2: Data representation

II.1 Signed and Unsigned Numbers

II.2 Floating-Point

II.3 Radix Conversion Algorithm

3. Chapter 2: Interfacing Hardware and

2.1 Computer Arithmetic

2.2 Instruction Set Architecture

2.3 RISC vs. CISC

2.4 MIPS

2.5 Compiler

4. Chapter 3: The Processor (8hrs)

3.1 Introduction

3.2 Enhancing

5. Chapter 4: Memory

4.1 Memory Hierarchy

4.2 The Basics of Caches

4.3 Improving Cache Performance

4.4 Virtual Memory

III. Reference Literature:

[1]. Computer Organization and Design, 4th Edition, Patterson & Hennessy, © 2008, MK

[2]. Fundamentals of Computer Organization and Architecture, M. Abd-El-Barr, H. El-Rewini, © 2005, John Wiley & Sons, Inc.

[3]. Computer Architecture and Organization, 7th Edition, Stallings, William, © 2006, Prentice Hall International.

ICT 1.2: BASIC PROGRAMMING

I. Course description:

1. **Credit points**: 4 ECTS
2. **Time commitment:**

Items	Lecture	Lab-work	Tutorial	**Total**
No. of hours	28	12	0	**40**

3. **Prerequisites**: No
4. **Recommended background knowledge**: No
5. **Subject description:**

The C programming language is one of the most popular programming languages. Despite being fairly old programming language, it is widely used for system and application software because of its efficiency and control.

This course is intended for beginners who do not have any prior knowledge or have very little knowledge of computer programming. All basic features of C programming language are included in detail such as basic syntax, data types, operators, control flow, functions, arrays, pointers, union, structure, and the standard c library.

In this course, you will not only learn the C programming language, but you also improve your computational skills beneficial to your major field of study.

The following list includes the main topics covered in the course:

a. Introduction to C programming language
b. Variables, data types, operators and expressions
c. Input and output functions
d. Control Flow: Decision and Loops
e. Functions
f. Array and String
g. Pointers
h. Structure

6. **Objectives & Outcome:**

Upon completion of this course, students will be able to:

- Understand the basic terminology used in computer programming
- Write, compile and debug programs in C language
- Use different data types in a computer program
- Manipulate various control flow constructs

- Utilize arrays and pointers to efficiently solve problems
- Use functions from the standard C library

7. Assessment/ Evaluation:

Component	Attendance	Exercises	Assignments	Reports	Midterm	Final
Percentage %	15	0	0	0	35	50

8. Prescribed Textbook(s):

[1] B. W. Kernighan and D. M. Ritchie, *The C Programming Languge, 2nd edition*, Prentice Hall, 1989.

[2]. P. J. Plaugher, *The Standard C Library*, Prentice Hall, 1991.

[3]. Brian P. Flannery, Saul Teukolsky, William H. Press, and William T. Vetterling, *Numerical Recipes in C: The Art of Scientific Computing*, 2nd edition, 1992.

II. Course content & schedule:

1. Introduction to C Programming
- A Brief History of C
- Components of a C Program
- C Keywords and Identifiers
- Compiling and Executing a C Program
- Programming Tools: Compilers, Interpreters, Editors
- C Input and Output Functions
- C Preprocessors

2. Variables, Data Types, Operators and Expressions
- Variables and Constants
- Basic Data Types in C
- Programming Operators and Expressions

3. Control Flow I
- Statement and Blocks
- Logic Expressions
- Decision Making-If..Else
- Decision Making- Switch..Case

4. Control Flow II
- For Loops
- While Loops
- Do..While Loops
- Break and Continue

5. Functions
- Standard C Library's Basic Functions
- User-Defined Functions, Declaration, Definition, Value Returning and Parameter Passing

6. Arrays and Strings

- Array Introduction
- Multi-dimension Arrays
- Arrays as Arguments to Functions
- Strings, Arrays of Characters
- String Functions

7. Pointers

- Pointer Introduction,
- Pointer Operators and Operations
- Pointers and Arrays
- Pointers and Functions
- Dynamic Memory Allocation

8. Structure

- Structure Introduction
- A New Data Type
- Structures and Functions
- Arrays of Structures

III. Reference Literature: N/A.

ICT 1.1: INTRODUCTION TO INFORMATICS

I. Course description:

1. Credit points: 3 ECTS

2. Time commitment:

Items	Lecture	Practical	Tutorial	**Total**
No. of hours	18	15	0	**33**

3. Prerequisites: No

4. Recommended background knowledge: No

5. Subject description:

This course covers the following topics: History of Computing; Computer Architecture; Operating System; Software; File Structures and Data Presentation; Networks and the Internet; Programming; Information Security.

6. Objectives & Outcome:

This course is intended to give students a general picture and background of Information Technology today, and help them moving on to the further courses with a consistent level of knowledge. The fundamental knowledge of computing is better understood by extensively practicing and doing self-study exercises at the end of each chapter. Upon successful completion of this course students should: Know about the history of computing, understand general concepts of computer-based information processing, computer architecture, operating systems, software tools, networks, the Internet, data and file structures, programming and information security.

7. Assessment/ Evaluation:

Component	Attendance	Exercises	Assignments	Reports	Midterm	Final
Percentage %	10	0	0	0	30	60

8. Prescribed Textbook(s):

[1] Greg Anderson, David Ferro, Robert Hilton. Connecting to Computer Science. Thomson Course Technology (2005).

II. Course content & schedule:

1. History of Computing and Computer Architecture
    - Learn how computer process information.
    - Learn the convolution of computers.
    - Learn what a CPU is.
    - Learn about RAM, ROM, and storage devices.
    - Learn the input and output devices.
2. Operating System (OS)

- Learn what an operating system is.
- Identify the major functions of an operating system.
- Understand how operating systems manage resources.
- Understand how operating systems manage processes.
- Learn differences among OSs.

3. Software Tools for Techies
    - Introduction to accessory tools.
    - Introduction to file manager tools.
    - Introduction to office tools.
4. Data Presentation and File Structures
    - Learn how numbering systems are used.
    - Learn how to convert numbers between bases.
    - Learn how images and sounds are stored in the computer.
    - Learn how computer organizes and stores data.
5. Networks and the Internet
    - Learn how computers are connected.
    - Learn what the Internet is.
    - Understand how the TCP/IP protocols relate to the Internet; how IP addresses identify devices connected to the Internet; how a DNS server translates a URL into an IP address.
    - Practice using internet and cloud applications.
    - Learn about basic of information security.
6. Introduction to Programming and Software Engineering
    - Introduction to programming.
    - Introduction to software engineering.

III. **Reference Literature: N/A.**

ICT 1.4: INTRODUCTION TO ALGORITHMS

I. Course description:

1. Credit points: 3 ECTS

2. Time commitment:

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	22	0	8	**30**

3. Prerequisites: Basic programming

4. Recommended background knowledge: Structure programming

5. Subject description:

The course provides "Introduction to Algorithm" which is used for computer programming. The course helps the students, who take the first algorithm course, to imagine what/why/how is algorithms. Additionally, students will learn how to express an algorithm as pseudocode and diagram.

6. Objectives & Outcome:

Objective: This course will introduce the students:
- Theory: Basic algorithm
- Practice: Express algorithms

Outcome:
- Understand basic algorithms
- Know how to express algorithms.

7. Assessment/ Evaluation

Component	Attendance	Exercises	Assignments	Reports	Midterm	Final
Percentage %	10	20	20	0	0	50

8. Prescribed Textbook(s)

[1]. Jeff Erickson, Algorithms, Independently published. 2019.

[2] Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4th Ed., Pearson, 2014.

II. Course content & schedule:

1. Introduction:
   + Why to study algorithm?
   + A few simple examples
   + How to study algorithms
2. Writing down Algorithms:
   + How to write down algorithms
   + Pseudocode

3. Writing down algorithms
   + Flowcharts
   + Binary search
   + Selection sort
4. Algorithms analysis
   + Mathematical background
5. Algorithms analysis
   + What to analyze?
6. Algorithms analysis
   + Running-Time Calculations
7. Recursion
   + What is recursion?
   + Tower of Hanoi
8. Review and summarize

III. Reference Literature:

[1]. N.Wirth. Algorithms + Data Structures = Programs. Prentice Hall, 1976.

[2]. Cormen, Leiserson, Rivest, Introduction to Algorithms, 2nd Ed., MIT Press, 2001.

MATHEMATICS COURSES

MATH 1.2: LINEAR ALGEBRA

I. Course description:

1. Credit points: 4 ECTS

2. Time commitment:

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	24	24	0	**48**

3. Prerequisites: None

4. Recommended background knowledge: College algebra.

5. Subject description:

Linear algebra is a fundamental mathematical tool used extensively in science and engineering disciplines. This course provides students with fundamental concepts of linear algebra: vectors, matrices, and the four important matrix subspaces, solving linear equations, matrix projection and diagonalization. Students will also be introduced to different applications of linear algebra.

6. Objectives & Outcome:

- Have a good understanding of the fundamental concepts of linear algebra, especially linear combinations, and the relationship among four matrix subspaces.
- Be able to solve linear equations for a complete solution
- Be able to use matrix projection to perform least square approximation and matrix orthogonalization
- Be able to perform singular value decomposition and understand its important in science and engineering
- Be exposed to some key applications of linear algebra.

7. Assessment/ Evaluation

Component	Attendance	Exercises	Assignments	Reports	Midterm	Final
Percentage %	10	0	0	0	40	50

8. Prescribed Textbook(s)

[1]. Ron Larson, Elementary Linear Algebra, 8th edition, Cengage Learning, 2016 (IBSN-10: 9781305658004, ISBN-13: 978-1305658004).

II. Course content & schedule:

1. Matrices and Gauss Eliminations
   - Linear Equations and elimination
   - Matrices and operations

- Applications

2. Linear Equations
   - Inverse and Transpose matrices
   - Vectors Spaces and Subspaces
   - Linear Equations
3. Vector spaces
   - Linear Independence, Basis, Dimension
   - Four fundamental subspaces
4. Vector Spaces
   - Linear Transformations
   - Matrices of Linear Transformation
5. Orthogonality
   - Orthogonal Vectors and Subspaces
   - Orthonormal basis, Gram-Schmidt
6. Determinant
   - Properties, calculations
   - Applications
7. Mid-term exam
8. Eigenvalues and eigenvectors
   - Diagonalization of a Matrix
   - Symmetric Matrices
9. Positive Definite Matrices
   - Minima, Maxima, saddle points
   - Singular Value Decomposition (SVD)
10. Some computations
    - Computation of Eigenvalues
    - Iterated Methods for Solving Linear Equations
11. Some applications
    - Linear inequalities
    - Game theory
12. Review

III. Reference Literature:

[1] Gilber Strang, Introduction to Linear Algebra, 4th edition, Wellesley-Cambridge Press, MA, 2009

MATH 1.1: CALCULUS I

I. Course description:

1. **Credit points**: 4 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	24	24	0	**48**

3. **Prerequisites**: High School Mathematics.
4. **Recommended background knowledge**: N/A.
5. **Subject description:**

   This is the first of the two courses in Calculus which concentrates on basic aspects of single-variable functions, numerical sequences and series.

6. **Objectives & Outcome:**

This course aims to provide an introduction to the fundamental mathematical concepts (functions, limits, continuity, derivatives and integrals), the applications of derivatives to optimization problems and related rates of change problems, and the applications of definite integrals to find areas and volumes. The Fundamental Theorem of Calculus, tests for convergence and divergence of sequences and series, interval and radius of convergence of power series, differentiation and integration of power series, and Taylor series are also studied.

This course lays the foundation for more advanced studies in mathematics, physics, engineering, and other related subjects.

By the end of this course, students would be able to:

• Interpret the basic concepts in calculus, such as functions, limits, continuity, derivatives and integrals.

• Use the basic calculus techniques, such as chain rules, curve sketching, and optimization.

• Select the right mathematical concepts and models for real problems, such as those related to velocity and curve properties.

• Apply the calculus techniques to solve related rate and optimization problems, to real-world problems such as finding the area between curves, and the volume of a solid of revolution.

• Evaluate the limit of a sequence using formal definition, determine the convergence of a sequence and perform appropriate convergence tests for series.

• Describe how a function can be expressed as a power series, determine radius and interval of convergence of a power.

7. **Assessment/ Evaluation**

Component	Attendance	Exercises	Assignments	Reports	Midterm	Final

Percentage %	10	0	0	0	30	60

8. Prescribed Textbook(s):

[1] Thomas G.B. Jr., Weir M.D. & Hass J., Thomas' Calculus, 11th Edition, Pearson, 2005.

[2] Giáo trình Toán cao cấp I, II, III, Nguyễn Đình Trí, NXB Giáo dục 2005.

II. Course content & schedule:

- Limit and Continuity
- Derivatives, differentiation formulas, chain rules, implicit differentiation
- Applications of derivatives (extreme values, Mean Value Theorem, Optimization and Newton's method)
- Antiderivatives and definite integral, Fundamental Theorem of Calculus
- Improper integrals, integration rules
- Applications of integration (area, volume)
- Limit of sequences
- Convergence of series, tests
- Power series, radius and interval of convergence, Taylor and Maclaurin series

III. Reference Literature:

[1] Kreyszig E., Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.

MATH 1.3: CALCULUS II

I. Course description:

1. **Credit points**: 3 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	18	18	0	**36**

3. **Prerequisites**: Calculus I.
4. **Recommended background knowledge**: N/A.
5. **Subject description:**

   This is the second of the two courses in Calculus which deals with basic aspects of functions of several variables. Ordinary differential equations of first- and second-order.

6. **Objectives & Outcome:**

   This course extends concepts and techniques developed in Calculus I to the case of functions of several real variables. In other words, we try to do the same things as in Calculus I, but in higher dimensions. We discuss the notions of limits, continuity, derivatives and integrals of real-valued and vector-valued functions of many variables. Most of the time, extending these familiar notions from one to several variables requires some degree of ingenuity, and we are going to have to spice up the material from Calculus I with a little bit of geometry and linear algebra.

   Techniques learned in Calculus III are essential for financial analysts, engineers, and for further study in mathematics.

   By the end of this course, students would be able to:

   - Parametrize curves and their tangents
   - Approximate and optimize multivariate functions; Apply the chain rule to multivariate functions
   - Find volumes of geometrical objects in higher dimensions
   - Parametrize surfaces and their tangent planes
   - Recognize when it is appropriate to use cylindrical and spherical coordinates; Determine the div and curl of a vector field and recognize the physical interpretations of these quantities
   - Apply multivariate calculus to real-world problem

7. **Assessment/ Evaluation**

Component	Attendance	Exercises	Assignments	Reports	Midterm	Final
Percentage %	0	0	0	0	40	60

8. **Prescribed Textbook(s):**

[1] Thomas G.B. Jr., Weir M.D. & Hass J., Thomas' Calculus, 11th Edition, Pearson, 2005

[2] Giáo trình Toán cao cấp I, II, III, Nguyễn Đình Trí, NXB Giáo dục, 2005

II. Course content & schedule:

1. Parametric equations, polar coordinates.
2. Vector-valued functions, calculus of vector-valued functions.
3. Functions of more than one variable, limits, continuity, partial derivatives, differentiability and total differential, chain rule, directional derivatives, gradients, Lagrange multipliers.
4. Double integrals, area of a surface, triple integrals. Line integrals, Green's Theorem, surface integrals, Gauss' divergence theorem, Stokes' Theorem
5. First-order differential equations (separable, homogeneous, Bernoulli, exact equations, applications)
6. Second-order differential equations (homogeneous and non-homogeneous linear equations with constant coefficients).

III. Reference Literature:

[1] Kreyszig E., Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011

MATH 1.4: DISCRETE MATH

I. Course description:

1. **Credit points**: 3 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	18	18	0	**36**

3. **Prerequisites**: High school mathematics.
4. **Recommended background knowledge**: High school mathematics.
5. **Subject description:**

   This core course aims to develop your understanding of fundamental mathematical concepts such as basic counting principles, recurrence relations and basic graph theory concepts. We will cover various combinatorial aspects of graph theory and introduces some of the tools used to tackle graph theoretical questions. These concepts are essential for future mathematics courses

6. **Objectives & Outcome:**

   Students will be able to understand and apply basic counting principles, and to model practical problems using graph models and apply graph algorithms to solve them.

7. **Assessment/ Evaluation**

Component	Attendance	Exercises	Assignments	Reports	Midterm	Final
Percentage %	10	0	0	0	40	50

8. **Prescribed Textbook(s):**

   [1] Kenneth H. Rosen: Discrete Mathematics and Its Applications, (7th edition), McGraw Hill

II. Course content & schedule:

1. Counting
   - inclusion-exclusion principle
   - permutations and combinations
   - binomial theorem
   - combinatorial proof
   - generalized permutations and combinations
   - permutations around a cycle
   - permutations/combinations with repetitions
2. Recurrence Relations
   - linear homogeneous recurrence
   - linear non-homogeneous recurrence

3. Graph Theory
    - paths and circuits
    - trees
    - spanning trees
    - isomorphisms
    - Euler paths/circuits
    - Hamilton paths/circuits
    - planar graphs
    - graph colorings
    - graph algorithms
        - Breadth-First Search
        - Traversal of a tree: pre-order, in-order, post-order
        - Prim's algorithm
        - Kruskal's algorithm
        - Bellman-Ford algorithm

III. Reference Literature:

[1] Kenneth H. Rosen: Discrete Mathematics and Its Applications, (7th edition), McGraw Hill

PHYSICS COURSES

PHYS1.1: FUNDAMENTAL PHYSICS I

I. Course description:

1. **Credit points**: 4 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	26	18	0	**44**

3. **Prerequisites:** Mathematic Analysis
4. **Recommended background knowledge:** Basic knowledge in high school level
5. **Subject description:**

The course consists of the following topics: linear motion and force, Newton's laws, balance of forces, energy and work, conservation law, momentum, rotational motion.

6. **Objectives & Outcome:**

- *Understanding of fundamental concepts and mechanisms* involving motion, force, energy, momentum, heat, entropy that are needed for further studies in physics, engineering and technology.
- *Build skills in formulating and solving problems*: improve thinking process and intuition through understanding fundamentals and applying that to solving practical problems.
- *Increase mathematical and computational ability*: develop capability to find analytical solutions for some problems, while in others where such solutions are difficult or impossible to find, develop numerical/computational methods. These are the "hard" skills to prepare for any future science and technology career.

7. **Assessment/ Evaluation**

Component	Attendance	Exercises	Midterm	Final
Percentage %	10	0	30	60

8. **Prescribed Textbook(s):**

[1] Halliday and Resnick, Fundamentals of PHYSICS 10th Edition, Jearl Walker.

[2] Young and Freedman, Sears and Zemansky's UNIVERSITY PHYSICS with Modern Physics, 13th Edition, Pearson-Addison Wesley.

[3] Serway and Jewett, PHYSICS for Scientists and Engineers with Modern Physics, 6th Edition, Thomson-Brooks/Cole.

II. Course content & schedule:

Part I: Mechanics

1. Kinematics : How to describe motions ?

1.a Scalar and vectorial physical quantities

1.b Position and trajectory in a reference frame

1.c Velocity and acceleration

2. From force to motion

2.a The Newton's laws of motion

2.b Some particular forces

2.c How to apply the laws of motion ?

3. Conservation of the mechanical energy

3.a Kinetic energy, mechanical work, and power

3.b The work-kinetic energy theorem

3.c Potential and mechanical energies

Part II: Thermodynamics

4. How to describe a thermodynamics system

4.a Mass, volume, pressure, temperature

4.b Equation of state of pure matter

5. Energy transfers and the first law of thermodynamics

5.a Internal energy and enthalpy

5.b Mechanical work

5.c Heat absorption

5.d. The first law of thermodynamics

6. Entropy, the second law of thermodynamics, and heat engines

6.a Entropy and Irreversible processes

6.b The second law of thermodynamics

6.c Heat engines and heat pumps

III. Reference Literature:

[1] Halliday and Resnick,Fundamentals of PHYSICS 10th Edition, Jearl Walker

PHYS1.3: ELECTROMAGNETISM

I. Course description:

1. **Credit points:** 4 ECTS

2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	26	14	0	**40**

3. **Prerequisites:**

Mathematical analysis, fundamental physics

4. **Recommended background knowledge:**

Knowledge in basic science including physics and mathematics after semester 1 in undergraduate.

5. **Subject description:**

Electromagnetism deals with charges and their interactions, both statically and dynamically. Required intuition in both mathematics and physics, its formalism is influential and is a standard for many branches of modern physics. From this foundation, we derive important applications in a wide range of subjects.

6. **Objectives & Outcome:**

The course starts with the elements of a static field: charge, field, and potential, as reflected in Coulomb's law and Gauss' law. We then describe dynamics phenomena, such as motion of charge, especially in conductors, which leads to important applications in everyday life. Magnetic field is then presented in the light of a moving charges. We will show that the two fields are inseparable. Induction and its application as AC current are explained. The whole formalism is unified within the Maxwell equations. The course concludes with the fields inside materials.

7. **Assessment/ Evaluation:**

Component	Attendance	Exercises	Assignments	Lab-work	Midterm	Final
Percentage %	10	0	0	0	30	60

8. **Prescribed Textbook(s):**

[1] E. M. Purcell, Electricity and magnetism, 2nd edition, Cambridge university press, IBSN 978-1-107-01360-5 (2011).

[2] R. Shankar, Fundamental of physics II: electromagnetism, optics and quantum mechanics, Yale university press, IBSN 978-0-300-21236-5 (2016).

[3] J. Parker, D. Halliday, R. Resnick, Fundamentals of physics 10th Edition, Wiley, IBSN 978-1-118-23072-5 (2007).

[4]. D. J. Griffiths, Introduction to electrodynamics, 4th edition, Pearson, IBSN 978-1-108-42041-9 (2013).

II. Course content & schedule:

1. Electrostatics: Charges and fields. Potential.
2. Electric field around conductors. Currents.
3. The field of moving charge. Magnetic field.
4. EM induction. AC current. Maxwell equations.
5. Fields in matter.

III. Reference Literature:

[1] E. M. Purcell, Electricity and magnetism, 2nd edition, Cambridge university press, IBSN 978-1-107-01360-5 (2011).

PHYS1.4: PRACTICAL PHYSICS

I. Course description:

1. **Credit points**: 2 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours			24	**24**

3. **Prerequisites:** Mechanics, Electromagnetism, Optics
4. **Recommended background knowledge:** Basic knowledge in General Physics,
5. **Subject description:** Practice of experiments on PHYWE platform, provides some idea and methods under taking into full account linking general physics experiment and independent opening experiments. It is not only improve students' ability of practice, analyzing and solving problems but also develop students' creative thinking and increase their experimental ability. It provides the convenient to students and provides the chance to students of review and makes innovation.
6. **Objectives & Outcome:** Students understand deeply in theory and provide them many skills in practical thinking in electromagnetism fields
7. **Assessment/ Evaluation:**

Component	Attendance	Exercises	Assignments	Lab-work	Midterm	Final
Percentage %	20			80		

8. **Prescribed Textbook(s):**

[1]. TESS expert Handbook Laboratory Experiments Physics, PHYWE

II. Course content & schedule:

1. Charging curve of a capacitor
2. Electrical field strength
3. Dielectric constant of different materials
4. Determination of the earth's magnetic field
5. The Hall effect

III. Reference Literature: N/A

PHYS1.2: FUNDAMENTAL PHYSICS II

I. Course description:

1. **Credit points:** 4 ECTS

2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	26	14	0	**40**

3. **Prerequisites:** Mathematical analysis, mechanics

4. **Recommended background knowledge:** Basic knowledge at high school level

5. **Subject description:**

This course will provide practical knowledge of electricity and optics. After describing the most important concepts and fundamental laws, it will focus on the applied side which is needed for a broad range of field in natural science, such as biology, geology, or medicine.

6. **Objectives & Outcome:**

The course teaches two related subjects: electricity and optics.

In electricity, we start with most important concepts such as charge, field, and potential. After reviving the basic laws: Coulomb laws and Gauss laws, we focus on the applied side, which deals with current, circuit, and its elements. We will also describe magnetic field, induction, AC current and electromagnetic oscillations.

For Optics, students study the properties and behaviors of light. First, students revisit classical optics, which deal with light as a ray. From the simple laws of reflection and refraction, we construct almost all optical instrument surround us, such as mirrors, lenses, cameras, human eyes, magnifiers, microscopes and telescopes. From Huygen's principle, optics can be described using both geometrical and wave approaches. Then we will treat light as a wave, for this behavior light interferes and diffracts. The optical instrument related to the interference phenomena, i.e., the Michelson interferometer is introduced. From photoelectric effect, they will learn the duality of light.

7. **Assessment/ Evaluation:**

Component	Attendance	Exercises	Assignments	Lab-work	Midterm	Final
Percentage %	10	0	0	0	30	60

8. **Prescribed Textbook(s):**

[1] Young and Freedman – Sears and Zemansky's UNIVERSITY PHYSICS with Modern Physics, 13 th Edition, Pearson-Addison Wesley (2012)

[2] J. Parker, D. Halliday, R. Resnick, Fundamentals of physics 10th Edition, Wiley, IBSN 978-1-118-23072-5 (2007).

II. Course content & schedule:

1. Coulomb's law and Gauss law. Field and potential
2. Capacitance, resistance, current, and circuit (DC)
3. Magnetic field and Induction
4. EM oscillation and AC current
5. The nature and propagation of light
6. Geometric optics
7. Interference
8. Diffraction
9. Photons: Light wave behaving as particles

III. Reference Literature:

[1] Young and Freedman – Sears and Zemansky's UNIVERSITY PHYSICS with Modern Physics, 13th Edition, Pearson-Addison Wesley (2013).

BIOLOGY COURSES

BIO1.1: CELLULAR BIOLOGY

I. Course description:

1. **Credit points**: 4 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	32	3	6	**41**

3. **Prerequisites**:

- Lab Assignments: Students should keep track of all protocols, material and methods that will be use; write down results obtained in the lab and be able to explain them.
- Mid-term and Final exams will include all material given during lectures, exercises and labs.

4. **Recommended background knowledge**: Basic cellular biology and molecular biology
5. **Subject description:**

- The focus of Cell Biology is the study of the structure and function of the cell. This course will focus on Eukaryotic cell biology and will cover topics such as structure and composition of membrane, transport mechanism; the cytoskeleton and cell movement; bioenergetics and cellular metabolism; and the integration of cells into tissues. The important cellular processes such as cell division, signal transduction, apoptosis and cancer cell biology will be focused also.

6. **Objectives & Outcome:**

Objectives: The aim of this course is to provide students with

- Understand general areas in cell biology, cell structure and how it relates to cell functions
- Understand how cells grow, divide, and die and how these important processes are regulated.
- Understand cell signaling and how it regulates cellular functions.

Out-Come:

- The students will gain general and specialized knowledge in Cellular Biology,
- The course will include lectures, exercises, videos and laboratory practices that will assist students to the field of cellular biology.
- The laboratory contents will provide students an opportunity to culture cancer cells, to assess some activities of cancer cells

7. **Assessment/ Evaluation**

Component	Attendance	Exercises	Assignments	Lab-work	Midterm	Final
Percentage %	10	0	0	20	20	50

8. Prescribed Textbook(s):

[1] CELLS, 2nd edition, Lewin

[2] Molecular cell biology, 6th edition, Lodish, Berk, Kaiser, Krieger, Scott, Bretscher, Ploegh, Matsudaira.

II. Course content & schedule:

1. Topic 1: Introduction
2. Topic 2: The chemical components of the cells
3. Topic 3: Membranes and transport mechanism
4. Topic 4: The nucleus
5. Midterm test
6. Topic 5: The cytoskeleton
7. Topic 6: Cell cycle
8. Topic 7: Cell communication
9. Topic 8: Apoptosis and cancer
10. Topic 9: Prokaryotic and plant cells
11. Lab work: Carry out practical work to use a microscope to examine and identify the cells; Observe mitosis in root tips.

III. Reference Literature:

[1]. "Cell Biology- A short course" 2nd Edition from Stephen R. Bolsover, Jeremy S. Hyams, Elizabeth A. Shephard, Hugh A. White, Claudia G. Wiedemann.

BIO1.2: GENETICS

I. Course description:

1. **Credit points**: 3 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	18	10	4	**32**

3. **Prerequisites:** Basic cell biology, basic biochemistry, mathematics (probability)
4. **Recommended background knowledge:** N/A
5. **Subject description:**

   This course is an introduction to genetics for students in the fields of biotechnology and pharmacy.

6. **Objectives & Outcome:**

   After this course, students will acquire basic knowledge in the following fields:

   - DNA structure and function
   - mechanisms of RNA and protein synthesis
   - gene inheritance
   - genetic differences between individuals
   - genetic differences between species
   - biotechnology applications
   - introduction to epigenetics

   In addition, students will be able to solve simple problems regarding the genetic code, protein synthesis and gene inheritance.

7. **Assessment/ Evaluation**

Component	Attendance	Exercises	Assignments	Reports	Midterm	Final
Percentage %	10	0	0	0	30	60

8. **Prescribed Textbook(s): N/A**

II. Course content & schedule:

1. Introduction to the genetic revolution: from Mendel to genome sequencing, a historical perspective
2. DNA

   [1] DNA structure, chromatin structure

[2] Chromosomes and karyotype

[3] Definition of the gene and the genome

[4] DNA replication in prokaryotes and eukaryotes

3. From genes to proteins:

    [1] the genetic code

    [2] RNA synthesis (transcription)

    [3] protein synthesis (translation)

    [4] control of gene expression

4. Genetic variations:

    [1] Metagenomics: gene and genome structure in bacteria, plants and animals, genetic differences and similarities between species

    [2] Genetic variations, mutations and polymorphisms

    [3] Somatic gene variations and cancer

5. Inheritance (part I):

    [1] Reproduction of cells and organisms, meiosis

    [2] Mendel laws

6. Inheritance (part II): particular cases

    [1] Sex chromosomes

    [2] Linkage (Morgan law)

    [3] Mitochondrial inheritance

7. Introduction to population genetics: Hardy-Weinberg law
8. Epigenetics

    [1] DNA methylation

    [2] chromatin regulation

9. An introduction to gene technologies:

    [1] DNA sequencing

    [2] bioinformatics: sequence comparison using BLAST, databases

    [3] Polymerase Chain Reaction

    [4] artificial genes and protein production

    [5] transgenesis in animals and plants

10. Conclusion and discussion

III. Reference Literature:

[1]. Biology. Campbell & Reece. 8th Ed. Pearson

[2]. Introduction to genetic analysis. Griffiths et al. 9th Ed. Freeman.

BIO1.3: BIOCHEMISTRY

I. Course description:

1. **Credit points**: 3 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	26	0	4	**30**

3. **Prerequisites:** Organic Chemistry, General biology
4. **Recommended background knowledge:** English reading and comprehension
5. **Subject description:**

The course covers the following:
- Composition, structures, characteristics and biological roles of proteins, carbohydrates, lipids, and nucleic acids (DNA and RNA).
- The digestion of carbohydrates, fats, proteins in the body.

- Principles of bioenergetics, metabolism and energy formation, including substrate level phosphorylation and oxidative phosphorylation associated with electron transfer chain.

6. **Objectives & Outcome:**

Upon completion of the course, the student should achieve an understanding of the following:
- The composition, structure, characteristics, localization and functions of 4 main biological compounds.
- The digestion of carbohydrates, fats, proteins in the body.

- How energy is produced and used in the living cell.

7. **Assessment/ Evaluation**

Component	Attendance	Exercises	Midterm	Reports	Labwork	Final
Percentage %	0	0	30	0	20	50

8. **Prescribed Textbook(s):**

[1] David L. Nelson and Michael M. Cox, Lehn Inger Principles of Biochemistry, 5th edition, W.H. Freeman and Co., NY, 2008 (http://www.filestube.com/9REtDlO7wUOSMBadRoFFkh/Principles-of-Biochemistry-5e-Lehninger.html; http://www.worthpublishers.com/lehninger/con_index.htm?99bwl);

II. Course content & schedule:

1. Basic Concepts of Biochemistry: The Foundations of Biochemistry
2. Amino Acids, Peptides, and Proteins
3. Protein Structure, Functions, Purification and Characterization

4. Nucleotides and Nucleic Acids; DNA-Based Information Technologies
5. Carbohydrates and Glycobiology: Monosaccharides; Disaccharides; Polysaccharides; structure and function of biologically important sugar derivatives.
6. Lipids: Building blocks of lipids; Storage lipids; Structural lipids in membranes; structure, distribution and role of membrane lipids
7. Principles of bioenergetics, metabolism and energy formation, including substrate level phosphorylation and oxidative phosphorylation associated with electron transfer chain.
8. The digestion of carbohydrates, fats and proteins in the body
9. Introduction to Biochemical Laboratory
10. Lab-work: Determination of the Protein Concentration by Bradford assay

III. Reference Literature:

[1]. Dr. Henry Jakubowski, Biochemistry Online: An Approach Based on Chemical Logic, http://employees.csbsju.edu/hjakubowski/classes/ch331/bcintro/default.html
[2]. The ExPASy (**Expert Protein Analysis System**), http://www.expasy.org
[3]. Richard J. Simpson, Proteins and Proteomics: A Laboratory Manual, Cold Spring Harbor Laboratory (2002)
[4]. Reiner Westermeier, Tom Naven, **Proteomics in Practice**: A Laboratory Manual of Proteome Analysis, Wiley-VCH, 2002

BIO1.4: GENERAL MICROBIOLOGY

I. Course description:

1. **Credit points**: 3 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	22	0	12	**34**

3. **Prerequisites:** English reading and comprehension
4. **Recommended background knowledge:** Fundamental Genetic, Fundamental Biochemistry.
5. **Subject description:**

   Provides foundations of microbiology for students including all major groups of microorganism viruses, bacteria, fungi, algae, and protozoa, the relationships of microorganisms to other organisms, human and the environment.

6. **Objectives & Outcome:**

   After the course the students will have principal knowledge of:
   - The microbial cell structure and function, growth and microbial metabolism, genetic and reproduction.
   - Control of microorganism by physical and chemical agents.

7. **Assessment/ Evaluation**

Component	Attendance	Exercises	Midterm	Reports	Lab-work	Final
Percentage %	0	0	0	0	30	70

8. **Prescribed Textbook(s):**

   [1] Lansing M. Prescott, John P. Harley, Donald A. Klein, Microbiology, Fifth Edition 2002, McGraw-Hill Publishers.

   [2] John P. Harley and Lansing M. Prescott, Laboratory Exercises in Microbiology, Fifth Edition 2002, McGraw-Hill Publishers

II. Course content & schedule:

1. Introduction to microbiology
   Prokaryotic cell organization
2. Eukaryotic cell organization
3. Microbial nutrition
4. Microbial growth
5. Microbial metabolism
6. The Fungi, Algae and Protozoa
7. The Viruses

8. Practical courses
   - Culture media, solution and instruments preparation and sterilization
   - Simple staining and Gram stain, Microscopy (observing microbes)
   - Isolation, cultivation and storage of microorganism (Examination of a sample for microbes)
   - Skin microbes

III. Reference Literature:

[1]. Lansing M. Prescott, John P. Harley, Donald A. Klein 2002, Microbiology, Fifth Edition, McGraw-Hill Publishers.

[2]. John P. Harley and Lansing M. Prescott 2002, Laboratory Exercises in Microbiology, Fifth Edition, McGraw-Hill Publishers.

CHEMISTRY COURSES

CHEM1.1: GENERAL CHEMISTRY I

I. Course description:

1. **Credit points**: 4 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	28	12	0	**40**

3. **Prerequisites**: High-school Chemistry
4. **Recommended background knowledge**: N/A
5. **Subject description:**

The General Chemistry I course provides fundamental knowledge on chemical composition and structure of matters.

6. **Objectives & Outcome:**

The students will learn the following concepts:

- Critical role of chemistry in modern fundamental and applied sciences, specially those are currently proposed at USTH.
- Electronic structure of atoms
- Periodic properties of elements
- Chemical bonds
- Structure of molecules and materials

7. **Assessment/ Evaluation**

Component	Attendance + Homeworks	Exercises	Assignments	Practical	Midterm	Final
Percentage %	10	0	0	0	30	60

8. **Prescribed Textbook(s):**

[1] Brown, LeMay, Bursten, Murphy, Woodward, Stoltzfus, Chemistry: The Central Science, 2015, 13th Edition, Pearson Education.

[2] Petrucci, Herring, Madura, Bissonnette, General Chemistry: Principles and Modern Application, 2011, 10th Edition, Pearson Canada

II. Course content & schedule:

1. Introduction: Role of chemistry in modern sciences (with focus on those are currently proposed at USTH)
2. Matter and Measurement

   + Classification of matter

   + Physical and chemical changes, separation of mixtures

   + Units of measurement

3. Atoms

   + The atomic theory of Matter

   + The discovery of Atomic structure

   + The modern view of atomic structure (atomic number, mass, isotopes)

4. Electronic structure of atoms

   + The wave nature of light

   + Quantized energy and photons

   + Line spectra and the Bohr model

   + Quantum mechanics and atomic orbitals

   + Representations of orbitals

   + Many electron atoms

   + Electron configurations

   + Electron configurations and the periodic table

5. Periodic properties of the elements

   + Development of the periodic table

   + Effective nuclear charge

   + Sizes of Atoms and Ions

   + Ionization energy

   + Electron affinity

6. Basic concepts of chemical bonding

   + Lewis symbols and the octet rule

   + Ionic bonding

   + Covalent bonding

   + Bond polarity and electronegative

   + Drawing Lewis structure

   + Resonance structure

   + Exception of the octet rule

+ Strength and Lengths of covalent bonds

7. Molecular geometry and bonding theories

+ Molecular shapes

+ VSEPR Model

+ Molecular shape and molecular polarity

+ Covalent bonding and orbital overlap

+ Hybrid orbitals

+ Multiple bonds

+ Molecular orbitals

8. Chemical reaction

+ Theory of solutions and Solubility Rules

+ Molecular and Ionic equations

+ Types of chemical reactions : Precipitations; acid-base reactions; Oxidation – Reduction reactions

+ Working with solution: Molar concentration; Diluting solution

+ Quantitative analysis: Gravimetric analysis; Volumetric analysis

III. **Reference Literature: N/A**

CHEM1.3: ORGANIC CHEMISTRY

I. Course description:

1. **Credit points**: 4 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	26	14	0	**40**

3. **Prerequisites**: N/A
4. **Recommended background knowledge**: N/A
5. **Subject description:**

   This course is designed to help USTH's 1st year students with understanding Organic chemistry—a science—which began as a tentative attempt to understand the chemistry of life. It has grown into the confident basis of vast multinational industries that feed, clothe, and cure millions of people.

6. **Objectives & Outcome:**

   - Students will be able to solve problems from various areas of Organic chemistry, including stereochemistry, reactivity patterns and synthesis
   - Student will also develop learning strategies, critical-thinking, and problem-solving skills

7. **Assessment/ Evaluation**

Component	Attendance + Homeworks	Exercises	Assignments	Practical	Midterm	Final
Percentage %	10	0	0	0	30	60

8. **Prescribed Textbook(s):** N/A

II. Course content & schedule:

1. Summary on fundamentals of organic chemistry
2. Alkanes and cycloalkanes
3. Alkenes and alkynes
4. Alcohols and ethers
5. Aromatic compounds
6. Aldehydes and ketones
7. Carboxylic acids and their derivatives
8. Phenols and aryl halides

III. Reference Literature:

[1]. Selected reading paragraphs together with presentation handouts will be sent to students.

[2]. Bruice, Organic Chemistry, 4th edition

CHEM1.2: GENERAL CHEMISTRY II

I. Course description:

1. **Credit points**: 4 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	26	14	0	**40**

3. **Prerequisites:** High school chemistry
4. **Recommended background knowledge:** High school physics
5. **Subject description:**

   The General Chemistry II is the continuation of the beginning course in the principles of chemistry, with emphasis on theory and its applications to structure and reactions. The course will cover topics including solution chemistry, thermodynamics, equilibrium, kinetics, acid-base chemistry and electrochemistry.

6. **Objectives & Outcome:**

   Objectives:
   The objective of the course is to provide the key knowledge base of chemistry to prepare students for further study of properties and applications of materials in chemistry, biology, or various different fields.

   Out-Come:

   Students will gain and understanding of:

   a. the basic (colligative) properties of solutions
   b. the fundamentals of acid/base equilibria, including pH calculations, buffer behavior, acid/base titrations
   c. the thermodynamic and kinetic forces involved in chemical reactions which determine how much and how soon products are formed
   d. the basics of electrochemistry
   e. general chemical equilibria

7. **Assessment/ Evaluation:**

Component	Attendance + Homeworks	Exercises	Assignments	Practical	Midterm	Final
Percentage %	10	0	0	0	30	60

8. **Prescribed Textbook(s):**

[1] Martin S. Silberberg, *Principles of General Chemistry*, 3rd Edition, 2013 (McGraw-Hill). ISBN: 9780073402697;

[2] Steven S. Zumdahl, Susan A. Zumdahl, *Chemistry*, 9th Edition, 2014 (Brooks Cole). ISBN: 9781133611097.

II. Course content & schedule:

[1] Thermochemistry - Energy Flow and Chemical Change
- 1.1 Forms of Energy and Their Interconversion
- 1.2 Enthalpy: Chemical Change at Constant Pressure
- 1.3 Calorimetry: Measuring the Heat
- 1.4 Hess's Law: Finding ΔH of Any Reaction
- 1.5 Standard Enthalpies of Reaction ($\Delta H^o rxn$)

[2] Thermodynamics - Direction of chemical reactions
- 2.1 The Second Law of Thermodynamics: Predicting Spontaneous Change
- 2.2 Calculating Entropy Change of a Reaction
- 2.3 Gibbs Free Energy

[3] Chemical Kinetics
- 3.1 Reaction Rate
- 3.2 The Rate Law and Reaction Order
- 3.3 Theories of Chemical Kinetics
- 3.4 Reaction Mechanisms
- 3.5 Catalysis: Speeding Up a Reaction

[4] Chemical Equilibrium
- 4.1 The Equilibrium State and the Equilibrium Constant
- 4.2 The Reaction Quotient
- 4.3 How to Solve Equilibrium Problems
- 4.4 Le Châtelier's Principle

[5] Solutions
- 5.1 The Formation of Solutions
- 5.2 Solubility as an Equilibrium Process
- 5.3 Solution Composition and Stoichiometry
- 5.4 Colligative Properties of Solutions

[6] Acids and Bases
- 6.1 Acids and Bases in Water
- 6.2 The pH Scale
- 6.3 Acid-Base Properties of Salt Solutions
- 6.4 Applications of aqueous equilibria

[7] Electrochemistry
- 7.1 Oxidation-Reduction (Redox) Reactions
- 7.2 Voltaic (Galvanic) Cells
- 7.3 Electrochemical Processes in Batteries
- 7.4 Corrosion: An Environmental Voltaic Cell
- 7.5 Electrolysis and Electrolytic Cells

III. Reference Literature: N/A

CHEM1.4: PRACTICAL CHEMISTRY

I. Course description:

1. **Credit points**: 2 ECTS
2. **Time commitment:**

Items	Lecture	Tutorial	Practical	**Total**
No. of hours	0	0	24	**24**

3. **Prerequisites:** General Chemistry I (Copper Sulfate Crystallization, General Chromatography), General chemistry II (Gravimetric analysis of a compound, Vinegar Analysis, Galvanic Cell) and Organic Chemistry I (Organic compound Synthesis)
4. **Recommended background knowledge:** N/A
5. **Subject description:**

This short (24 hour) course provides first-year students with the basic chemistry laboratory skills they will need before embarking on more specialist experiments offered at the 2nd-year level. The emphasis of the course is on general experimental procedures that can be carried over to all branches of chemistry, with particular emphasis placed on communicating scientific experimental results in the form of written reports.

6. **Objectives & Outcome:**

Students will learn how to:

- work safely in a chemistry laboratory;
- handle potential hazardous chemical reagents;
- handle basic chemistry laboratory glassware and other equipment;
- collect data/observations on designated variables without previously studying the relationship between variables. Students are also guided to the logical organization, comparison, analysis, and interpretation of data.
- write experimental reports.

7. **Assessment/ Evaluation:**

Component	Attendance + Homeworks	Practical Exercises	Assignments	Practical	Midterm	Final
Percentage %	10	90	0	0	0	0

8. **Prescribed Textbook(s):** 1st year Practical Chemistry for USTH Student

II. Course content & schedule:

1 Gravimetric analysis of a compound

2 Vinegar Analysis

3 Copper Sulfate Crystallization

4 General Chromatography

5 Galvanic Cell

6 Organic Compound Synthesis

III. Reference Literature:

[1]. 1st year Practical Chemistry for USTH Student

[2]. Experiments in General Chemistry 2nd Edition, B. Stanton et al.

[3]. Laboratory Manual for Principles of General Chemistry 9th Edition, J.A.Beran et al.

[4].Safety-Scale Laboratory Experiments for Chemistry for Today 7th Edition, S. L. Seager