Syllabus 1

1. Course Number & Title (Credit Hours, Required or Elective):

MATH -101 - Calculus I, (6.0, Required), (Basic)

1. **Course number & Title (Credits Hours, Required or Elective)**
   MATH-101, Calculus I (6 Credits, Required)

2. **Catalog description:**
   This course covers topics of differential and integral calculus including limits and continuity, higher-order derivatives, curve sketching, differentials, definite and indefinite integrals (areas and volumes), and applications of derivatives and integrals. In addition, students review and extend their knowledge of trigonometry and basic analytic geometry. Important objectives of the calculus sequence are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

3. **Prerequisites:**
   None

4. **Text book(s) and /or required materials:**
   - Calculus; Ross. L. Finney; George B. Thomas Jr.; Addison – Wesley publishing company ,8th edition, 1990.
   - Calculus and analytical geometry, George B. Thomas Jr. ; Addison – Wesley publishing company ,7th edition ,1988.
   - Calculus; James Stewart ,10th edition, 2003.

5. **Course Objectives:**

1) Understanding the basic properties of the inverse of a function and how to find it.
2) Understand how a function and its inverse are represented graphically and know the conditions of invertibility of a function.
3) Identify appropriate calculus concepts and techniques to provide mathematical models of real-world situations and determine solutions to applied problems.
4) Apply the formulas for the derivatives of the inverse hyperbolic functions and their associated integrals.
5) Identify a power series and represent a function.

6. **Topics:**
   Students will learn:
   - Transcendental Functions
   - Methods of Integration
   - Hyperbolic Function
   - Power Series

7. **Class/ laboratory Schedule:**
   - No lab

8. **Design Project:**
   - None
9. **Computer/software Use:**
   - None
10. **Evaluation Methods:**
    - Reports (5%), quizzes (5, 20%), online assignment (1, 5%), onsite assignment (5, 10%), Midterm exam (10%), final exam (50%)
11. **Contribution to Professional Component:**

- Help the engineer to solve engineering problems that requires complex mathematics.

12. **Relationship to Student Outcomes:**

Course Learning Objectives (related Student Outcomes 1-7):

1) Understanding the basic properties of the inverse of a function and how to find it. (1)
2) Understand how a function and its inverse are represented graphically and know the conditions of invertibility of a function. (1)
3) Identify appropriate calculus concepts and techniques to provide mathematical models of real-world situations and determine solutions to applied problems. (1)
4) Apply the formulas for derivatives and integrals of the hyperbolic functions. (1)
5) Apply the formulas for the derivatives of the inverse hyperbolic functions and their associated integrals. (1)
6) Identify a power series and represent a function. (1)

13. **Prepared by:**

Osama Hassan Ali , 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENG-102 - Engineering Mechanics, (5.0, Required), (Basic)

2. **Course description:** The course covers the following topics; statics of particles: forces in plane, forces in space, equilibrium, moment of a force, moment of a couple, equivalent systems of forces on rigid bodies, equilibrium in two dimensions, equilibrium in three dimensions, distributed forces: centroids and center of gravity, analysis of structures: trusses, frames and machines, internal forces in beams and cables, friction, moments of inertia of areas, moments of inertia of masses.
3. **Prerequistie(s):**
   None
4. **Textbook, title, author, and year**

"Engineering Mechanics¸Statics, sixth Edition" by J . L . Meriam & L.G. Krige

Reference: "Engineering Mechanics¸Statics, Twelfth Edition" by R.C. Hibbiler

5. **Course objectives**
   - To learn basic concepts and system of forces.
   - To enable students to understand relationship of physical processes, kinetics and kinematics.
   - To develop skills to use the basic principles of mechanics in engineering applications.

6. Topics:

Indicative content includes the following.

- Force Vectors (8 hrs)
- Force System Resultants (8 hrs)
- Equilibrium of a Rigid Body (8 hrs)
- Friction (8 hrs)
- Center of Gravity and Centroid (6 hrs)
- Moments of Inertia and virtual work (8 hrs)
- Structure (trusses and Frames) (10 hrs)

7.Class schedule

Week #	**Topics Covered**
Week 1	Chapter One: Force Resultant
Week 2	Chapter Two: Moment of Force
Week 3	Chapter Two: Moment of Force
Week 4	Chapter Three: Equilibrium
Week 5	Exam 1
Week 6	Chapter Four: Trusses and Frames
Week 7	Chapter Four: Trusses and Frames
Week 8	Chapter Five: Centroids
Week 9	Chapter Five: Centroids
Week 10	Chapter Sex: Moment of Inertia
Week 11	Chapter Sex: Moment of Inertia
Week 12	Exam 2
Week 13	Chapter seven: Friction
Week 14	Chapter seven: Friction
Week 15	Chapter eight: Dynamic

8. Design Project:

Problem based learning project (1).

9. Computer/software Use:

None

10. Evaluation Methods:

- Quizzes: 3, 15%, Online assignment: 3, 15%, Onsite assignment: 5, 5%, Project: 1, 5%, Midterm 10%, Final exam, 50%

11. Contribution to Professional Component:

Students will learn the basic concepts of Engineering Mechanics and will apply them in different cases of static and dynamic analysis of objects.

12. Relationship to Student Outcomes:

The course learning objectives of this course are as follow:

- To learn basic concepts and system of forces.

- To enable students to understand relationship of physical processes, kinetics and kinematics.
- To develop skills to use the basic principles of mechanics in engineering applications and justify the design according to public health, safety, and welfare as well as economic factors.

They are related to Students Learning Outcomes 1 and 2.

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

13. Prepared by:
Naser A. Hassan, 2023

1. Course Number & Title (Credit Hours, Required or Elective):

UOT-003 – Computer I, (3.0, Required), (Basic)

2. Course Description:

This module aims to provide students with a comprehensive understanding of the key concepts and principles of computer science. Through the study of topics such as history, data representation, computer components, algorithms, programming languages, operating systems,

applications, internet and networking, and cybersecurity, students will gain a broad understanding of computer science and how it has evolved.

3. Prerequisite(s):

None.

4. Textbook(s) and/or other required materials:

- Computer Science Illuminated, by Dale, N and Lewis, J, 7th Ed, Jones & Bartlett Learning, 2020- Principles of grammar: by Murphy.

5. Course Objectives:

Upon completion of this course, the student will earn information on:

1. Historical development of computing,
2. Data representation, computer components, algorithms,
3. Programming languages, operating systems, applications, internet and networking, and cyber-security.

4. A broad perspective on the field and its significance in contemporary society.
5. Theoretical knowledge and practical applications
6. Foundations to pursue further studies or careers in computer science

6. Topics:

- Historical Introduction: Evolution of computer science, pioneers, and important milestones
- Data representation: Binary numbers, hexadecimal, character sets, ASCII and Unicode
- Computer components: CPU, memory, input/output devices, storage devices
- Algorithms: Definition, representation, complexity, searching, sorting, optimization
- Programming languages I
- Programming languages II
- Midterm
- Operating systems I
- Operating systems II
- Applications I: Information Systems
- Applications II: artificial intelligence
- Applications III: computer graphics, human-computer interaction
- Networking
- Internet
- Cybersecurity: Threats, attacks, prevention, detection, mitigation
- Final Exam

7. Class/laboratory Schedule:

- Lab 1: Computer Operating System (e.g. Microsoft Windows)
- Lab 2: Document Processing I (e.g. Microsoft Word)
- Lab 3: Document Processing II (e.g. Microsoft Word)
- Lab 4: Data Processing I (e.g. Microsoft Excel)
- Lab 5: Data Processing II (e.g. Microsoft Excel)
- Lab 6: Presentation Slides I (e.g. Microsoft PowerPoint)
- Lab 7: Presentation Slides II (e.g. Microsoft PowerPoint)

8. Design Project:

None

9. Computer/software Use:

- Provide students with hands-on experience in programming, algorithms, and data representation.

10. Evaluation Methods:

- Quizzes: 3, 15%, Online assignment: 3, 15%, Onsite assignment: 5, 5%, Project: 1, 5%, Midterm 10%, Final exam, 50%

11. Contribution to Professional Component:

The students will earn the skill of basic computing programming and will be able to Analyze and represent data.

12. Relationship to Student Outcomes:

The course learning objectives of this course are as follows:

- To learn basic concepts and systems of computer science.
- To enable students to understand Data representation, computer components, and applications.

They are related to Students' Learning Outcomes 6.

6- An ability to recognize the ongoing need to acquire new knowledge, choose appropriate learning strategies, and apply this knowledge.

13. Prepared by:

Mohammed J.Abed , 2023

1. Course Number & Title (Credit Hours, Required or Elective):

ENG-101 – Engineering Drawing (6.0, Required), (Supplement)

2. Course Description:

An engineering drawing course focuses on usage of drawing instruments, lettering, construction of geometric shapes, etc. Students study use of dimensioning, shapes and angles or views of such drawings. Dimensions feature prominently, with focus on interpretation, importance and accurate reflection of dimensions in engineering drawing. Other areas of study in this course may include projected views and development of surfaces.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- Engineering Drawing, Abdul-Rassul Abdul-Hussain, University of Technology, 1986.
- SIMMONS, C., MAGUIRE, D., PHELPS, N., 2021. Manual of engineering Drawing Technical product specification and Documentation to British and International Standards, 4 ed, Elsevier Ltd:Oxford
- REDDY, K. 2008. Textbook of Engineering Drawing. 2ed, Adithya Art Printers:Hyderabad
- SHAH, M. B. , RANA, B. C. , 2007. Engineering Drawing. 2ed, Dorling Kindersley(India) Pvt. Ltd :India

5. Course Objectives:

Upon completion of Engineering drawing course students will be able to:

- Define and explain the uses of different drawing equipment.
- Identify the different drawing equipment.
- Layout of drawing papers and, prepares a title block.
- Practically distinguish the types of dimensioning.
- Carry out geometrical construction of different shapes.
- Carry out isometric and orthographic drawing of objects.

6. Topics:

Students will learn:

- Prepare and understand drawings.
- Identify various curves used in Engineering Drawing and their applications.
- Use the principles of orthographic projections.
- By studying about isometric projections students will be able to visualize three-dimensional objects and that will enable them to design new products.
- Design and fabricate surfaces of different shapes.
- Represent the objects in three dimensional appearances.

7. Class/laboratory Schedule:
Delivery Plan (Weekly Syllabus)

Week	**Material Covered**
Week 1	Introduction to engineering drawing
Week 2	Primary elements of drawings
Week 3	Geometrical Construction
Week 4	Tangency
Week 5	Loci applications
Week 6	Tangency and loci applications
Week 7	Dimensioning and **Midterm Exam**
Week 8	Theory of Projection
Week 9	Orthographic Projections
Week 10	Orthographic Projections
Week 11	Sections and Sectional views
Week 12	Sections and Sectional views
Week 13	Isometric Projections
Week 14	Isometric Projections
Week 15	Isometric Projections
Week 16	**Final Exam**

8. Design Project:
One design project

9. Computer/software Use:
None

10. Evaluation Methods:
(Two hours Mid-Exams exam 10%, 3 quizzes 15 %, Onsite Assignments 10, 10%, Online assignment 10, 10%, and one project 5%. three hours final exam 50%)

11. Contribution to Professional Component:
The engineering drawing is cover the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected practical drawings.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 6):

- **An ability to recognize the ongoing need to acquire new knowledge, to choose appropriate learning strategies, and to apply this knowledge.**

13. Prepared by:

Qusay Oglah Salih, 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG-101–Environmental Chemistry (6.0, Required), (Core)

2. Course Description:

This course aims to establish fundamental knowledge of environmental chemistry. Presentation of the course starts by introducing the most important environmental problems of today. The most crucial topics that aid in understanding and solving these problems are then studied.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- Chemistry for Environmental Engineering and Science. Fifth Edition by Clair N. Sawyer, Perry L. McCarty, Gene F. Parkin, 2003 Publisher: McGraw – Hill.
- Engineering Thermodynamics, Third Edition By R .K. Rajput, 2007, Laxmi Publications (P) Ltd.

5. Course Objectives:

For Environmental Chemistry students will learn:

- The basic Concepts of Environmental Chemistry.
-The difference between Heat and Work, Enthalpy, Entropy, and Free energy.
-Apply the chemical concepts to find the first ionization constant and solubility product at different temperatures.
-Learn the principle of membrane processes, electrochemistry, chemical kinetics and isotherms.

6. Topics:

Students will learn:

- Introduction to Engineering and pollution
- Fundamentals of Chemistry for Environmental Engineering and Science
- Basic concepts for thermodynamics, heat and work, enthalpy, entropy, free energy, Binary mixtures
- Membrane Processes, electrochemistry and chemical Kinetics
- Adsorption

7. Class/laboratory Schedule:

7.1: Class Schedule:

Week	**Material Covered**
Week 1	Introduction of Environmental chemistry

Week 2	Thermodynamics,
Week 3	Reaction heat
Week 4	Changing In Enthalpy ΔH
Week 5	Calculations involving reaction enthalpy
Week 6	Thermal chemistry equation
Week 7	Thermal chemistry equation
Week 8	Type of enthalpies
Week 9	Med term exam
Week 10	Calculation methods of standard reaction enthalpy
Week 11	Hees law method
Week 12	Using of standard formation enthalpy values
Week 13	Using of standard formation enthalpy values
Week 14	Auto processes
Week 15	Entropy

7.2: Lab schedule

Week	Material Covered
Week 1	Lab 1: Volumetric measurement Glassware
Week 2	Lab 2: Laboratory safety
Week 3	Lab 3: Determination of pH
Week 4	Lab 4: Determination of PO_4
Week 5	Lab 5: Determination of SO_4
Week 6	Lab 6: Determination of Acidity
Week 7	Lab 7: Determination of Alkalinity
Week 8	Lab 8: Determination of Alkalinity, Continued
Week 9	Lab 9: Determination of NO_3
Week 10	Lab 10: Determination of Iron and Manganese in Water
Week 11	Lab 11: Determination of Iron and Manganese in Water, Continued
Week 12	Lab 12: Determination of Sulphate and Sulphide in Water
Week 13	Lab 13: Determination of Sulphate and Sulphide in Water, Continued
Week 14	Lab 14: Determination of Conductivity
Week 15	Lab 15: Adsorption of methylene blue on activated carbon

13. Prepared by:

Ahmed Khaleel Ibrahim**, 2024**

1. Course Number & Title (Credit Hours, Required or Elective):

UOT-004 – Human Rights and Democracy, (2.0, Required), (Supplement)

. Catalog Description:

Human Rights: These are rights enjoyed by all human beings simply because we are human beings. These rights are inherent to all human beings, regardless of their race, gender, nationality, or sect, and are not granted by any state. They include human rights

and children's rights in ancient civilizations and Islam, international conventions, sources and guarantees of human rights, laws and constitutions, the Human Rights Council, globalization, technological progress and its impact on human rights.

Democracy: The term democracy dates back to ancient Greek civilization. It is a term composed of two parts: "Cratia," meaning rule, and "Demo," meaning "people," thus becoming the concept of "rule by the people." Democracy includes an exploration of its concept and an understanding of its historical roots, components, characteristics, advantages, guarantees, the relationship of democracy to (the constitution, civil society institutions, human rights, good governance, elections), and contemporary democracy.

3. Basic Requirements:
None
4. Textbooks and/or other required materials:
"Human Rights and Democracy" book. Authored by Prof. Dr. Maher Saleh Alawi Al-Jubouri, Prof. Dr. Riyad Aziz Hadi, Prof. Dr. Raad Naji Al-Jeddah, Asst. Prof. Dr. Kamel Abdul-Ankoud, Asst. Prof. Dr. Ali Abdul-Razzaq Muhammad, Prof. Dr. Hassan Muhammad Shafiq, (2009)
- Democracy, by Charles Tilly, translated by Muhammad Fadel Tabakh, Egyptian General Book Authority, (2010).
- The book "Basic Human Rights and the Security Role in Their Protection," by Dr. Mubarak Alawi Muhammad, (2019).

5. Objectives:
1. To be able to understand the basic concepts of human and children's rights and democracy.
2. To be able to understand the historical origins of the two concepts and to know the positives and negatives of human rights and democracy.
3. To gain insight into human and children's rights and democracy in Islam.
4. To identify the sources of human and children's rights and the characteristics and features of democracy.
5. To understand the impact of technological development on human and children's rights and democracy.
6. Addressing concepts related to the two terms, such as (globalization, civil society institutions, elections and referendums, good governance, crimes against humanity, and the constitution).
7. Reviewing the guarantees that guarantee human and child rights, as well as the democratic system and public rights and freedoms.

6. Topics:
Students will learn:
1. Human and child rights and democracy in ancient civilizations and Islam (8 hours).
2. Sources of global and local human rights, characteristics and features of democracy (4 hours).
3. Guarantees of global and local human rights and guarantees of the democratic system (4 hours).

4. Human and child rights, democracy, and the impact of technological progress on them (4 hours).
5. Globalization, civil society institutions, elections and referendums, the constitution (4 hours).
6. Crimes against humanity and their types, good governance (2 hours).
7. International documents related to children's rights and contemporary democracy (4 hours).
7. Class/Lab Schedule:
No lab.
8. Design Project:
None. 9. Computer/Software Use:
10. Assessment Methods:
Exams (two-hour midterm exam, 10%; three-hour final exam, 50%)
11. Contribution to the Professional Component:
12. Relationship to Student Outcomes:
Course Learning Objectives (Relevant Student Outcomes 3-5-7):
13. Prepared by:
Assistant Lecturer: Abdulrahman Zidan Ahmed

1. Course Number & Title (Credit Hours, Required or Elective):

UOT-001 – Arabic Language I, (2.0, Required), (Supplement)

2.وصف المادة الدراسية:

خلال هذا المقرر الدراسي سيتعلم الطالب كيفية النطق السليم لمخارج الحروف و الاصوات و سيتم تطوير قابليات الطالب في صياغة جمل و فقرات و تقارير بلغة عربية سليمة و ذلك من خلال استعراض مجموعة مواضيع في قواعد اللغة العربية و الادب العربي.

3 .المتطلبات المسبقة:

لا يوجد

4 .الكتب المدرسية و/أو المواد الأخرى المطلوبة:

مختصر "العربية العامة لاقسام غير الاختصاص": اعداد د. صباح علي السليمان و د. حبيب احمد علي العزاوي/كلية التربية للعلوم الانسانية/جامعة تكريت

5 .أهداف المادة الدراسية :

1. تطوير المهارات اللغوية وحفظ بعض السور القرآنية وتعزيز حب اللغة لدى الطلبة .
2. فهم كيفية تطبيق القواعد اللغوية في الحياة اليومية ، ومعرفة المصطلحات اللغوية في مجالات الهندسة والعلوم.
3. أهمية اللغة العربية في مجالات الحياة اليومية .
4. استخدام القواعد اللغوية في كتابة التقارير والأبحاث العلمية بشكل صحيح.
5. تعزيز التعلم الذاتي والأستقلالية في التعلم وتشجيع الطلاب على أخذ مبادرة في تعلم اللغة العربية .

6 .المواضيع:

يتضمن المحتوى الارشادي ما يأتي:

1. سورة الضحى (3 ساعات) .
2. قصة ذي القرنين (3 ساعات).
3. قصة النبي موسى عليه السلام مع سيدنا الخضر (4 ساعات).
4. معلقة عمرو بن كلثوم (4 ساعات).
5. قصيدة المتنبي "شعب بوان" (4 ساعات).
6. قصيدة محمد مهدي الجواهري "يا دجلة الخير" (4 ساعات).
7. أنواع الهمزات (4 ساعات).

8. علامات الترقيم (4 ساعات).
7 .جدول الفصل/المختبر:
لا يوجد مختبر
8 .مشروع التصميم:
لا يوجد.
9 .استخدام الكمبيوتر/البرمجيات: لا يوجد
10 .طرق التقييم:
الامتحانات (ساعتان منتصف الامتحان 10%، ثلاث ساعات امتحان نهائي 50%)
الكوزات عدد (5) درجتها 10%
تقرير (1) درجته 10%
واجب بيتي 10%
حضور و انشطة صفية ومشاركات 10%
11 .المساهمة في المكون المهني:
ستمكن الطالب من صياغة الكتب و التقارير و كذلك التحدث بلغة عربية سليمة.
12 .العلاقة بمخرجات الطلاب:
1. تطوير المهارات اللغوية وحفظ بعض السور القرآنية وتعزيز حب اللغة لدى الطلبة (3).
2. فهم كيفية تطبيق القواعد اللغوية في الحياة اليومية ، ومعرفة المصطلحات اللغوية في مجالات الهندسة والعلوم (3،5).
3. معرفة أهمية اللغة العربية في مجالات الحياة اليومية .
4. استخدام القواعد اللغوية في كتابة التقارير والأبحاث العلمية بشكل صحيح (3،5).
5. تعزيز التعلم الذاتي والأستقلالية في التعلم وتشجيع الطلاب على أخذ مبادرة في تعلم اللغة العربية (5) .

13 .إعداد:
مدرس مساعد : علي قيس محمد -2023

1. Course Number & Title (Credit Hours, Required or Elective):

MATH -102 - Calculus II, (6.0, Required), (Basic)

2. Course description:

A continuation of Calculus I. This is a study of multivariable calculus including vector-valued functions and the calculus of curves in space, differential calculus of multivariate functions, and integral calculus of multivariate functions, spherical and cylindrical coordinates, line and surface integrals.

3. Prerequisites:

- Calculus I

4. Text book(s) and /or required materials:

- Calculus; Ross . L . Finney ; George B . Thomas Jr. ; Addison – Wesley publishing company ,8th edition, 1990.
- Calculus and analytical geometry , George B. Thomas Jr. ; Addison – Wesley publishing company ,7th edition ,1988.
- Calculus; James Stewart ,10th edition, 2003.

5. Course Objectives:

1) Solve tangent and area problems using the concepts of limits, derivatives, and integrals.

2) Be able to determine the domain, codomain, range of functions of two or more variables, to do algebraic operations between them and sketch their graphs.
3) Be able to solve simple real problems related to derivatives of functions of two or three variables.
4) Be able to solve problems related to integral of functions of two or three variables.
5) Be able to understand that the modulus of a complex number is equal to the square root of the sum of the squares of the real and imaginary parts of the number.

6. Topics:

Students will learn:

- Vectors.
- Function of Two and more Variables and Their Derivatives
- Multiple Integral.
- Complex Number

7. Class/ laboratory Schedule:

- No lab

8. Design Project:

- None.

9. Computer/software Use:

- None

10. Evaluation Methods:

• Reports (5%), quizzes (5, 20%), online assignment (1, 5%), onsite assignment (5, 10%), Midterm exam (10%), final exam (50%)

11. Contribution to Professional Component:

-Help the engineer to solve engineering problems that requires complex mathematics.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

i. Solve tangent and area problems using the concepts of limits, derivatives, and integrals. (1)
ii. Be able to determine the domain, range of functions of two or more variables, to do algebraic operations between them and sketch their graphs. (1)
iii. Be able to solve simple real problems related to derivatives of functions of two or three variables. (1)
iv. Be able to solve problems related to integral of functions of two or three variables. (1)
v. Be able to understand that the modulus of a complex number is equal to the square root of the sum of the squares of the real and imaginary parts of the number. (1)

13. Prepared by:

Osama Hassan Ali , 2025

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG -102 - Strength of Materials, (6.0, Required), (Basic)

2. Course Description:

This course is designed to give engineering students a thorough understanding of the basic principles in Strength of materials . Classic mechanics will be introduced, including stresses ,strain , torsion beams effected by loading etc.. and you are expected to learn to solve elementary problems by applying Mathematics . Most students will find this a very demanding course that requires a significant amount of work and study time. For some, this will be the most challenging course you will encounter at the college level. For some disciplines, such as civil, chemical, mechanical, electrical and environmental engineering, physics is directly applicable and serves as the introductory course to the more advanced applied physics or engineering classes, the problem-solving and quantitative analysis skills you will learn from this course are a critical piece of your broader education

3. Prerequisite(s):

Engineering Mechanics.

4. Textbook(s) and/or other required materials:

Strength of Materials By Ferdinand L. Singer, Andrew Pytel 1982

5. Course Objectives:

1) To understand and be able to apply the principles of Strength of materials.
2) To effectively communicate classical mechanics concepts and solutions to problems, both in written English and through mathematics.
3) To be able to apply critical thinking and problem-solving skills in the application of classical mechanics.

6. Topics:

- Introduction to Strength of Materials
- Action and Reactions
- Simple Stress
- Simple strain
- Thin-walled cylinders
- Torsion in Beams
- Stresses in Beams
- Beams deflection

7. Class/laboratory Schedule:

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

Week	Material Covered
Week 1	Introduction to Strength of Materials (introduction, what is Strength of materials, Action, and reaction)
Week 2	Simple Stress
Week 3	Simple Stress
Week 4	Simple Strain

Week 5	Simple Strain
Week 6	Thin-Walled cylinders
Week 7	Midterm exam, Thin-Walled cylinders
Week 8	Thin-Walled cylinders
Week 9	Torsion in Beams
Week 10	Torsion in Beams
Week 11	Torsion in Beams, Stresses in beams
Week 12	Stresses in beams
Week 13	Stresses in beams,
Week 14	Beams deflection
Week 15	Beams deflection
Week 16	**Final Exam**

8. Design Project:

None

9. Computer/software Use:

None

10. Evaluation Methods:

- Quizzes: 3, 15%, Online assignment: 3, 15%, Onsite assignment: 5, 5%, Reports: 1, 5%, Midterm 10%, Final exam, 50%.

11. Contribution to Professional Component:

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

For the Strength of materials, students will learn:

3. Apply basic physical principles of strength of Materials (3,4,7).
4. actin and Reactions to solve problems in beam loading (4,5).

13. Prepared by:

Mohammed J.Abed , 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG-102 - Environmental Physics, (4.0, Required), (Core)

2. Course Description:

Environmental physics

Understand the aspects of physics that pervade environmental processes in our daily lives and in natural phenomena. In addition to understanding some of the basic mathematical skills necessary to apply basic thermodynamics to the human environment, understand the basic composition, structure and dynamics of the atmosphere, explain how the hydrological cycle works, discuss the mechanisms of water transport in the atmosphere and in the interior of the Earth, and discuss specific environmental problems such as noise pollution, ozone depletion and global warming in the context of a comprehensive understanding of atmospheric dynamics.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- Nigel Mason and Peter Hughes: **Introduction to Environmental Physics: Planet Earth, Life and Climate**, Taylor and Francis, 200*1*

5. Course Objectives:

For Environmental Physics students will learn:

- Understand how basic thermodynamics applies to the human environment,
- Understand the basic composition, structure and dynamics of the atmosphere,
- Explain how the hydrological cycle works and discuss the mechanisms of transporting water in the atmosphere and underground,
- Discuss specific environmental problems such as noise pollution, ozone depletion and global warming in the context of a comprehensive understanding of atmospheric dynamics,
- Discuss energy demand problems and explain the potential contributions of renewable energy sources to energy supply. Also, we understand many other different topics of our environment.

6. Topics:

Students will learn:

Basic physical concepts that affect the environment.

- The basic physical concepts that affect the environment.
- Knowledge of the components and composition of the atmosphere.
- Study of water and winds, the physics of its creation.
- Knowledge of Earth physics, soil cycle.

7. Class/laboratory Schedule:

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Introduction, Human Environment, Laws of Thermodynamics. Problems
Week 2	Energy transfer processes, radiation, survival in cold and hot climates, noise pollution, problems
Week 3	The atmosphere and radiation, structure and composition of the atmosphere, atmospheric pressure, escape velocity, problems
Week 4	Ozone, ozone hole, terrestrial radiation, Earth as a black body
Week 5	Global warming and its effects, problem solving
Week 6	Water and the hydrosphere, the hydrogen cycle
Week 7	Mid-Term Exam
Week 8	Physics of cloud formation and clouds, thunderstorms, problem solving
Week 9	Wind, physics of wind creation, major forces affecting air masses, problem solving
Week 10	Frictional force, problem solving
Week 11	Hurricanes and anticyclones, problem solving
Week 12	Earth physics, soil cycle and hydrology, water flow and evaporation
Week 13	Living energy, fossil fuels, nuclear energy
Week 14	Renewable resources, energy demand and conservation
Week 15	Heat transfer and thermal insulation, heat loss in buildings

Week 16 Final Exam

8. Design Project:

Non

9. Computer/software Use:

Students typically use words in writing their reports of problem-based learning in addition to google meetings and classroom.

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10. Evaluation Methods:

- Quizzes: 3, 18%, Online assignment: 1, 6%, Onsite assignment: 1, 6%, min project: 1, 10%, Midterm 10%, Final exam, 50%

11. Contribution to Professional Component:

For Environmental physics, students will learn the basic concepts of Environmental physics. Understand how basic thermodynamics applies to the human environment, Understand the basic composition, structure, and dynamics of the atmosphere, explain how the hydrological cycle works and discuss the mechanisms of transporting water in the atmosphere and underground.

12. Relationship with Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):
related Student Outcome 1

For Environment physic students will learn:

1- Discuss specific environmental problems such as noise pollution, ozone depletion, and global warming in the context of a comprehensive understanding of atmospheric dynamics and apply principles of engineering, science, and mathematics to solve these problems.
2- Basic thermodynamics applies to the human environment, Understand the basic composition, structure, and dynamics of the atmosphere, explain how the hydrological cycle works and discuss the mechanisms of transporting water in the atmosphere and underground.

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG-104 – Analytical Chemistry (6.0, Required), (Core)

2. Catalog Description:

Analytical chemistry is concerned with the study of chemical reactions with very high accuracy. The aim of this course is to know the most important classifications of analytical chemistry and the most important reactions in it, especially the stoichiometric reactions, in addition to knowing the balance of chemical equations, preparing solutions and the values of the pH of solutions.

3. Prerequisite(s): for Analytical Chemistry

None

4. Textbook(s) and/or other required materials:

- **Fundamentals of analytical chemistry** by Skoog, Douglas A., Donald M. West, F. James Holler, and Stanley R. Crouch, Cengage learning, 2021.
- **Modern analytical chemistry** by Harvey D. McGraw Hill, 2000.

5. Course Objectives:

This course enable the students to understand the basic concepts of Analytical Chemistry and its classifications and how to calculate and distinguish the normality and molarity of solutions. In addition to understand what is the titration and its purposes and uses, and also learn the principle of equilibrium in chemical reactions and be able to predict the pH of solutions at the end of reaction and learn the principle of the electrochemical cells and their calculations. Finally, the students will learn some application of Analytical Chemistry in the Environmental Engineering.

6. Topics:

- Introduction to Analytical Chemistry and its classifications (2hrs).
- Calculation of the concentration, Normality and Molarity of solutions (6 hrs).
- Titration and its calculations (6 hrs).
- Acid and base equilibria and pH of solutions (6 hrs).
- An introduction to electro analytical chemistry (4 hrs).

Applications of Analytical Chemistry in the Environmental Engineering (6 hrs).

7-Class/laboratory Schedule:

7.1: Class schedule:

	task	No of hours
1	Introduction of analytical chemistry, quantitative analysis, qualitative analysis	2
2	Gravimetric calculations of chemical analysis	2
3	Calculations involving concentrations of solutions, physical methods, Molar Methods, Equivalent Methods	2
4	Dilution of solutions	2
5	Analysis of samples by titration with standard solution	2
6	Calculation of Oxidation – Reduction titration	2
7	Acid – base equilibrium and PH of solutions, Equilibrium constant	2
8	Med term exam	2
9	Expression of equilibrium constant in acidic medium	2
10	Expression of equilibrium constant in basic medium	2
11	Calculation of pH of aqueous solution, Weak acid plus its salt	2
12	Titration curves, Strong acid- strong base, Weak acid – strong base	2
13	strong acid – weak base, weak acid – weak base	2
14	Acid — Base indicator	2

7.2: Laboratory Schedule:

Environmental chemistry (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

Material Covered

Week 1 Lab 1: Identifying laboratory chemicals, their conditions, risks, and the correct ways to

identify them.

Week 2	Lab 2: Identifying laboratory equipment, names, and terms.
Week 3	Lab 3: Preparation & Standardization From solid.
Week 4	Lab 4: Preparation & Standardization From solid, continue.
Week 5	Lab 5: Preparation & Standardization From liquid.
Week 6	Lab 6: Preparation & Standardization From liquid, continue
Week 7	Lab 7: Titration of Sodium Carbonate with Hydrochloric acid (Acid – Base Titration).
Week 8	Lab 8: Titration of Sodium Hydroxide with Hydrochloric acid (Acid – Base Titration).
Week 9	Lab 9: Titration of Mixture with Hydrochloric acid (Acid – Base Titration).
Week 10	Lab 10: Determine the concentration of a given base using a standard acid.
Week 11	Lab 11: Determine the concentration of a given acid using a standard base.
Week 12	Lab 12: Qualitative analysis.
Week 13	Lab 13: pH determinations of acid and base.
Week 14	Lab 14: pH determinations of salts.
Week 15	Lab 15: pH dilution.

8. Design Project:

None

9. Computer/software Use:

Students typically use words in writing their reports of problem-based learning in addition to google meeting and classroom.

10. Evaluation Methods:

(Two hours Mid-Exams exam 10%, three hours final exam 50%)

(Quizzes, Lab. reports, Online Assignments, and Onsite Assignments, projects 40%).

11. Contribution to Professional Component:

Analytical chemistry is concerned with the study of chemical reactions with very high accuracy. The aim of this course is to know the most important classifications of analytical chemistry and the most important reactions in it, especially the stoichiometric reactions, in addition to knowing the balance of chemical equations, preparing solutions and the values of the pH of solutions. Finally, electrochemical cells and their types will be studied, the most important equations for their reactions. All of this course will be used in a way that save the environment and serve the environmental sciences and knowing how and the importance of using each topic in the environmental engineering.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

For Analytical Chemistry, students will learn:

5. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (3).

13- Prepared by:

Ahmed Khaleel Ibrahim**, 2024**

1. Course Number & Title (Credit Hours, Required or Elective):

ENG-106 - Engineering Workshops, (6.0, Required), (Supplement)

2. Course Description:

The engineering workshop course focuses on identifying risks in the work environment and industrial safety guidelines. And training on how to measure and determine, and the use of filing tools and their work. Learn about the types of wood used in carpentry, the process of shaping it, and the use of carpentry tools and machines. Training in welding work, its types, and the process of joining metals by welding. Training on various casting works and training on mechanical operation, which includes turning, milling, and grinding. Training on pipe knowledge, how to connect, sanitary engineering works, and training on the basics of electrical workshops.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- Abd fares , Engineering workshops
- Technology of Machine Tools , Steve F. Krar & J. William Oswald ,McGraw-Hill

Publishing Company , fourth Edition , 1991

5. Course Objectives:

Theoretical and practical training in which the student is scientifically and technically established with the most necessary skills in the field of engineering technology

6. Topics:

Students will learn:

- Industrial safety workshop(2 hours)
- Measurement &Marking workshop(3 hours)
- Filing workshop (10 hours)
- Carpentry workshop (10 hours)
- Welding workshop (10 hours)
- Casting workshop (10 hours)
- Machining workshop (10 hours)
- plumbing workshop (10 hours)

- Electrical workshop (10 hours)

7. Class/laboratory Schedule:

Delivery Plan (Weekly Syllabus

Week	**Material Covered**
Week 1	Industrial safety workshop & Measurement and marking workshop
Week 2	Filing workshop
Week 3	Filing workshop
Week 4	Carpentry workshop
Week 5	Carpentry workshop
Week 6	Welding workshop
Week 7	Welding workshop , **Midterm Exam**
Week 8	plumbing workshop
Week 9	plumbing workshop
Week 10	Machining workshop
Week 11	Machining workshop
Week 12	Casting workshop
Week 13	Casting workshop
Week 14	Electrical workshop
Week 15	Electrical workshop
Week 16	**Final Exam**

8. Design Project:

One design project

9. Computer/software Use:

None

10. Evaluation Methods:

(Two hours Mid-Exams exam 10%, 4 quizzes 12 %, 2Onsite Assignments 8%, 2Online assignment 8%, 6reports 12%. three hours final exam 50%)

11. Contribution to Professional Component:

The workshops engineering are Theoretical and practical training in which the student is scientifically and technically established with the most necessary skills in the field of engineering technology

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 6):

- **An ability to recognize the ongoing need to acquire new knowledge, to choose appropriate learning strategies, and to apply this knowledge.**

13. Prepared by:

Qusay Oglah Salih, 2024

1. Course Number & Title (Credit Hours, Required or Elective):

UOT-001 – English Language I, (2.0, Required), (Supplement)

1. **Course number & Title (Credits Hours, Required or Elective)**

MATH-201, Engineering Analysis (6 Credits, Required) (Basic)

2. **Course description:**

Mathematical analysis with emphasis on solution techniques and engineering applications. Topics include ordinary differential equations (ODEs), Laplace transformations, initial and boundary value problems, Fourier series and partial differential equations.

3. **Prerequisites:**
   - Calculus II

4. **Text book(s) and /or required materials:**
   - Advanced Engineering Analysis C. Ray Wylie.
   - Advanced Engineering Mathematics, 5th ed., D.G. Zill and M.R. Cullen.

5. **Course Objectives:**
   1) Recognize and classify ordinary differential equations.
   2) Ability to implement and solve mathematical models for engineering problems.
   3) To enable the students to study the Laplace Transforms, properties of Laplace Transform, inverse Laplace Transform and some applications to solve the differential equations and integral equations
   4) To enable the students to study Fourier Transforms and some concepts of infinite Fourier Sine and Cosine transforms, finite Fourier Sine and Cosine

transforms and applications to solve some infinite and boundary value problems using finite and infinite transforms.

5) To familiarize the students with the fundamental concepts of PDE's and their solutions in the context of Laplace, Heat and Wave equations.

6. **Topics:**

Students will learn:

- Ordinary Differential Equations.
- Differential Equations Applications.
- Laplace Transform
- Fourier Transform
- Partial Differential Equations

7. **Class/ laboratory Schedule:**
   - No lab

8. **Design Project:**
   - None.

9. **Computer/software Use:**
   - None

10. **Evaluation Methods:**

• Reports (5%), quizzes (5, 20%), online assignment (1, 5%), onsite assignment (5, 10%), midterm exam (10%), final exam (50%)

11. **Contribution to Professional Component:**

-Help the engineer to solve engineering problems that requires complex mathematics.

12. **Relationship to Student Outcomes:**

Course Learning Objectives (related Student Outcomes 1-7):

1) Recognize and classify ordinary differential equations. (1)
2) Ability to implement and solve mathematical models for engineering problems. (1)
3) To enable the students to study the Laplace Transforms, properties of Laplace Transform, inverse Laplace Transform and some applications to solve the differential equations and integral equations. (1)
4) To enable the students to study Fourier Transforms and some concepts of infinite Fourier Sine and Cosine transforms, finite Fourier Sine and Cosine transforms and applications to solve some infinite and boundary value problems using finite and infinite transforms. (1)

To familiarize the students with the fundamental concepts of PDE's and their solutions in the context of Laplace, Heat and Wave equations. (1)

13. Prepared by:

Maaly N Tawfiq, 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG -101– Thermodynamics, (4.0, Required), (Supplement)

2. Caourse Description:

Thermodynamics course is designed to enhance students' ability to understand key thermodynamic concepts, including the nature of thermodynamic systems and the various forms of energy. Students will develop the skills needed to analyze and calculate the heat transfer within systems, focusing on heat gain and loss and its environmental impact. The course covers both theoretical and practical aspects, providing insight into real-world applications such as energy conversion, system efficiency, and environmental engineering solutions.

3. Prerequisite(s): for Thermodynamics

None

4. Textbook(s) and/or other required materials:

- **Thermodynamics An Engineering Approach,** Yunus A. Cengel and Michael A. , 5th Edition BolesMcGraw-Hill, 2006.
- **Applied thermodynamic for engineering Basic teaching and learning resources and tools technologist,** Estop, T. D. and McConkey, A., Kindersly Fifth edition ,2009.

5. Course Objectives:

This course aims to provide a comprehensive understanding of both theoretical and practical concepts in thermodynamic processes. It covers the principles of material properties and heat effects, delves into the role of thermodynamics in materials science, and examines various types and applications of thermodynamic systems. Additionally, it explores the connections between thermodynamics, environmental engineering, and sustainability, offering an integrated perspective on these interrelated fields.

6. Topics:

- Introduction and basic concepts (9 hrs)
- Energy, energy transfer, and general energy analysis (9 hrs)
- Properties of pure substances and Energy analysis of closed systems (18 hrs)
- Environmental engineering applications of thermodynamics (9hrs)

7. Class/laboratory Schedule:

2Hours Class and 1Hour Tutorial

7.1: Class Schedule:

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction and basic concepts
Week 2	Introduction and basic concepts, cont'd
Week 3	Energy, energy transfer, and general energy analysis
Week 4	Energy, energy transfer, and general energy analysis, cont'd

Week 5	Properties of pure substances
Week 6	Properties of pure substances, cont'd
Week 7	**Midterm exam**
Week 8	Energy analysis of closed systems
Week 9	Energy analysis of closed systems, cont'd
Week 10	Mass and energy analysis of control volumes
Week 11	Mass and energy analysis of control volumes, cont'd
Week 12	Engineering applications of thermodynamics
Week 13	Engineering applications of thermodynamics, cont'd
Week 14	Environmental engineering applications of thermodynamics
Week 15	Environmental engineering applications of thermodynamics, cont'd
Week 16	**Final exam**

8. Design Project:

None

9. Computer/software Use:

Students typically use WORD OFFICE in writing their reports of problem-based learning in addition to google meeting and classroom.

10. Evaluation Methods:

(Two hours Mid-Exams exam 10%, three hours final exam 50%)
(Quizzes 16%, Online Assignments 14%, project 5%, and seminar 5%).

11. Contribution to Professional Component:

The Thermodynamics course in the Department of Environmental Engineering plays a critical role in equipping students with the fundamental principles of energy transfer and system efficiency, which are essential for designing sustainable environmental systems. By applying these concepts to real-world scenarios, students learn to optimize processes like waste treatment, energy recovery, and pollution control, ensuring minimal environmental impact

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

For Thermodynamics, the course will achieve:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (1).

13. Prepared by:

Ahmed Y. Radeef, 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG-202– Fundamentals of Fluid Mechanics, (6.0, Required), (Core)

2. Course Description:

Fluid mechanics is the study of fluids at rest (static fluids) and the subsequent effects of the fluid upon the boundaries, which may be either solid surfaces or interfaces with

other fluids. Both gases and liquids are classified as fluids, and the number of fluids engineering applications is enormous: breathing, blood flow, swimming, pumps, fans, turbines, airplanes, ships, rivers, windmills, pipes, missiles, icebergs, engines, filters, jets, and sprinklers, to name a few. When you think about it, almost everything on this planet either is a fluid or moves within or near a fluid.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- **Elementary Fluid Mechanics** by John K. Vennard and Robert L. Street, John Wiley & Sons 1982.
- **Fluid Mechanics** by Frank M. White, McGraw – Hill, 8th Edition 2016.

5. Course Objectives:

- Definition of fluids, dimensions, units and measurement systems for units used in fluid mechanics.
- A detailed explanation of the properties of different fluids such as density, specific gravity, viscosity, surface tension and compressibility and the equations for calculating these properties.
- Fundamentals of static pressure in fluids including derivation of Pascal's law, pressure changes in horizontal and vertical planes, pressure gauges used, atmospheric pressure and absolute pressure.
- Forces acting on plane and curved surfaces submerged in liquids and how to calculate these forces acting on surfaces.
- Archimedes' principle and buoyancy force, in addition to studying the stability of floating and submerged bodies in liquids.

6. Topics:

- Definition of fluid mechanics and Units (10 hrs.)
- Properties of fluid mechanics (16 hrs.)
- Fundamentals of static fluids (40 hrs.)
- Forces acting on submerged surfaces (12 hrs.)
- Submerged and floating bodies (12 hrs.)

7. Class/laboratory Schedule:

7.1: Class Schedule:

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

Week	Material Covered
Week 1	General introduction.
Week 2	Review of fundamentals of fluid mechanics, units.
Week 3	Properties of fluids (Mass density, Weight density, Relative density, Specific volume, Viscosity, Compressibility and Surface tension).
Week 4	Properties of fluids (Mass density, Weight density, Relative density, Specific volume, Viscosity, Compressibility and Surface tension).
Week 5	Newton's equation of viscosity.

Week 6	Principle of static fluids and general equation related with variation of pressure.
Week 7	Pressure measurement in static fluids.
Week 8	Mid-Term Exam.
Week 9	General concept of forces affecting on submerged bodies.
Week 10	Forces affecting on submerged plane surfaces.
Week 11	Forces affecting on submerged curved surfaces.
Week 12	General concept of submerged and floating bodies.
Week 13	Stability of floating and submerged bodies.
Week 14	Stability of floating and submerged bodies.
Week 15	Review Week before Final Exam.
Week 16	Final Exam.

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Introduction in Fluid Mechanics Laboratory.
Week 2	Description of Laboratory Equipment.
Week 3	Description of Laboratory Equipment (Contd.).
Week 4	Calibration of Rotameter.
Week 5	Calibration of Rotameter (Contd.).
Week 6	Determination of Viscosity by Capillary Tube Viscometer.
Week 7	Determination of Viscosity by Capillary Tube Viscometer (Contd.).
Week 8	Determination of Hydrostatic Forces.
Week 9	Determination of Hydrostatic Forces (Contd.).
Week 10	Determination of Metacentric Height.
Week 11	Determination of Metacentric Height (Contd.).
Week 12	Review Week before Final Exam.
Week 13	Review Week before Final Exam (Contd.).
Week 14	Review Week before Final Exam (Contd.).
Week 15	Final Exam.

8. Design Project:

Students are assigned a project that includes one or more topics related to the basics of fluid mechanics, such as pressure in static fluids or properties of fluids, etc.

9. Computer/software Use:

- Microsoft Word.
- Microsoft Excel.

10. Evaluation Methods:

(Two hours Mid-Exams exam 10%, three hours final exam 50%)
(Quizzes, Lab. Reports, Assignments, and Projects 40%).

11. Contribution to Professional Component:

Fluid mechanics is the study of fluids at rest (static fluids) and the subsequent effects of the fluid upon the boundaries, which may be either solid surfaces or interfaces with other fluids. Both gases and liquids are classified as fluids, and the number of fluids engineering applications is enormous: breathing, blood flow, swimming, pumps, fans, turbines, airplanes, ships, rivers, windmills, pipes, missiles, icebergs, engines, filters, jets, and sprinklers, to name a few. When you think about it, almost everything on this planet either is a fluid or moves within or near a fluid.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-3):

For Fundamentals of Fluid Mechanics, students will learn:

1. Interpret and analyses data related to fluid mechanics.
2. Apply the fundamental of fluid mechanics on each component of the static fluids.
3. Formulate the elementary principles of fluid mechanics including properties of fluids, pressure measurement in static fluids, forces acting on the submerged surfaces and floating bodies.
4. Understand the basics of static fluids.

13. Prepared by:

Akram K. Mohammed, 2024

1. Course Number & Title (Credit Hours, Required or Elective):

UOT-031 – Computer II, (3.0, Required), (Supplement)

2. Course Description:

Urging the student to think about the importance of programming using the Matlab language in facilitating contemporary life. Urging the student to think about the importance of the influence of Matlab on the development of scientific research methods. Urging the student to think and follow the rapid development of Matlab language and learning how to execute 2D and 3D plotting.

3. Prerequisite(s):

UOT-003 Computer I

4. Textbook(s) and/or other required materials:

INTRODUCTION TO MATLAB FOR ENGINEERING STUDENTS, David Houcque Northwestern University, (version 1.2, August 2005)

5. Course Objectives:

This course introduces fundamental computing principles concepts such as:

- Use the high-level programming language, MATLAB to develop and implement programs to solve engineering problems.
- Basic programming concepts covered include algorithm design, data types.

- Plotting and numerical methods.
- Flow control, functions, sorting.

6. Topics:

Students will learn:

- An idea of programming in Matlab and how to write a program.
- Using Command Window and execute Basic Arithmetic on Vectors and Matrices and Solving equations.
- 2D plotting commands , plot, subplot , 3D plots , Graphics of functions of two variables..
- Flow Control and M-files.

7. Class/laboratory Schedule:

Class 1: Introduction to programming in MATLAB, Principles of MATLAB
Class 2: MATLAB environment and commands
Class 3: Linear Algebra and matrices
Class 4: Fundamental engineering computing
Class 5: Save, load, display and print commands
Class 6: 2D plotting
Class 7: 3D plotting
Class 8: **Midterm exam**
Class 9: Solutions to systems of linear equations
Class 10: Conditional statements
Class 11: Loops
Class 12: MATLAB scripts and functions
Class 13: MATLAB scripts and functions
Class 14: Using MATLAB for simple engineering problems
Class 15: Control flow and operators

Lab 1: Application on Principles of MATLAB
Lab 2: Application on MATLAB environment and commands
Lab 3: Application on Linear Algebra and matrices
Lab 4: Application on Fundamental engineering computing
Lab 5: Application on Save, load, display and print commands
Lab 6: Application on Save, load, display and print commands (Cont.)
Lab 7: Application on 2D plotting
Lab 8: Application on 2D plotting (Cont.)
Lab 9: Application on 3D plotting
Lab 10: Application on linear equations
Lab 11: Application on Conditional statements
Lab 12: Application on Loops
Lab 13: Application on MATLAB scripts and functions
Lab 14: Application on using MATLAB for simple engineering

problems
Lab 15: Application on Control flow and operators

8. Design Project:
None

9. Computer/software Use:
Matlab Programming Language

10. Evaluation Methods:
Exams (3 Quizzes 12% and midterm 10%, and Final exam 50%)
3 assignments (1 onsite, 2 online) 18% and 1 Labs 10%

11. Contribution to Professional Component:
For engineering, students will learn about professionalism and codes of solving problems, understanding programming, computer techniques of data representations.

12. Relationship to Student Outcomes:
Course Learning Objectives (related Student Outcomes 1-7):

1. Use the high-level programming language, MATLAB to develop and implement programs to solve engineering problems.(6)
2. Basic programming concepts covered include algorithm design, data types.(6)
3. Plotting and numerical methods.(6)

13. Prepared by:
Aalaa Ahmed Mohammed, October 2024

1. Course Number & Title (Credit Hours, Required or Elective):
ENVR-ENG -203– Engineering Surveying, (6.0, Required), (Supplement)

2. course Description:
This course introduces environmental engineering students to the fundamentals of land measurement and surveying techniques. Surveying involves measuring, mapping, and analyzing the Earth's surface and features, providing essential spatial data. Applications include infrastructure development, urban planning, environmental monitoring, and management. The course focuses on understanding surveying theory and applying field procedures to create accurate maps.

3. Prerequisite(s): for Engineering Surveying
None

4. Textbook(s) and/or other required materials:

- ✓ **N. N. Basak, Surveying and Leveling, ISBN: 9780074603994.**
- ✓ **B. C. Punmia, A. K. Jain, and A. K. Jain, Surveying, Vol. I & II*, ISBN: 978-8170088837, 978-8189401238.**

5.Course Objectives

Introduce students to fundamental principles, techniques, and equipment used in engineering surveying.

1. **Understand the fundamental principles, tools, and techniques used in engineering surveying.**
2. **Acquire practical skills in measuring distances, angles, and elevations accurately.**
3. **Learn to analyze and interpret survey data for creating maps, cross-sections, and earthworks designs.**
4. **Comprehend the concepts of geometry, coordinate systems, and map projections essential for accurate mapping.**
5. **Develop problem-solving, teamwork, and technical communication skills applicable to surveying and its applications in environmental engineering.**

6.Topics

1. **Introduction to Surveying Principles and Concepts (2 hrs)**
2. **Techniques and Tools for Distance Measurement (6 hrs)**
3. **Leveling: Methods and Applications (8 hrs)**
4. **Angle Measurement and Traversing (6 hrs)**
5. **Applications of Surveying in Earthworks and Underground Projects (6 hrs)**

7. Class/laboratory Schedule:

2Hours Class and 3Hours Practical

7.1: Class Schedule:

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Basic Concepts of Surveying Introduction to surveying Definitions, objectives, and importance. Overview of surveying techniques and equipment. Applications in engineering fields.
Week 2	Distance Measurement Principles of distance measurement. Overview of methods: Direct (Chain, Tape) and Indirect (EDM). Sources of errors and corrections (temperature, sag, slope).
Week 3	Chain and Tape Measurement: Procedures for chaining and taping in the field. Correct methods for accurate distance measurement using chains and tapes. Practical exercises.
Week 4	Checking and Calibration: Methods for calibrating chains and tapes. Corrections for standard length, temperature, sag, and slope. Importance of regular checking and calibration.
Week 5	Solving practical problems on correction of chain and tape measurements. Applying temperature, sag, slope, and standard length corrections.
Week 6	Principles of leveling. Types of leveling instruments (Dumpy level, Auto level, Digital level). Applications in civil engineering projects.
Week 7	Differential leveling: Procedure, equipment, and applications. Solving leveling problems using HI and Rase Fall methods. Field exercises in leveling techniques.
Week 8	Mid-Term Exam.

Week 9	Types of errors in leveling: Instrumental, personal, and natural errors. Techniques for error detection and correction. Correction for curvature and refraction.
Week 10	Introduction to contouring. Advanced leveling techniques: Differential leveling, profile leveling, and cross-sectioning. Practical applications in surveying.
Week 11	Principles of measuring angles. Types of angles: Horizontal and vertical angles. Applications in triangulation and traverse surveys.
Week 12	Using Theodolites for Angle Measurement Parts and functions of a theodolite. Methods of measuring horizontal and vertical angles
Week 13	Underground surveying: Optical methods – Line and level
Week 14	Circular curves: Principles and applications. Setting out curves: Methodology and equipment. Design and application.
Week 15	A comprehensive review of all topics. Group discussion and clarification of complex topics. Final exam preparation.

7.2: Practical Schedule:

Delivery Plan (Weekly Practical. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Identification Surveying Equipment + Distance Measurement by Tape + Horizontal Angle Measurement By Tape
Week 2	Setting and Stakeout columns by Rules 2,3,4
Week 3	Stakeout a map on the ground using a tape measure
Week 4	Identification Leveling and Using Equipment
Week 5	Two Page Test
Week 6	Reciprocal Leveling
Week 7	Leveling Profile
Week 8	Leveling Cross Section
Week 9	Identification of Theodolite and Using Equipment
Week 10	Horizontal Distance Measurement
Week 11	Vertical Distance Measurement
Week 12	Stakeout parallel and perpendicular straight lines by tape and theodolite equipment.
Week 13	Surveying a building with tape and theodolite
Week 14	Stakeout a building with tape and theodolite
Week 15	Final Exam.

8. Design Project:

None

9. Computer/software Use:

Students typically use various tools and software to write their problem-based learning reports, including word processing applications, Google Meet for virtual collaboration, Google Classroom for organization and submission, and AutoCAD for drafting and designing relevant project components.

10. Evaluation Methods:

(Two hours Mid-Exams exam 10%, three hours final exam 50%)

(Quizzes 20%, onsite 5%, Online Assignments 5%, Reports 10%).

11. Contribution to Professional Component:

For a surveying engineering program, this contribution can include:

Technical Skills:

- Proficiency in modern surveying tools (e.g. Leveling, Theodolite, total station).

Data Management and Analysis:

- Collection, processing, and interpretation of geospatial data.

Problem-Solving:

- Application of engineering principles to real-world challenges in land development, infrastructure, and environmental monitoring.

Communication and Teamwork:

- Effective communication through reports, maps, and presentations.
- Collaboration with multidisciplinary teams on projects.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 3):

For surveying engineering, students will learn:

1. Students will learn to apply mathematical and scientific principles (e.g., geometry, trigonometry) in conducting precise fields, level and total stations, and other surveying tools. They will also design and conduct surveys, analyze data, and produce accurate spatial outputs.
2. Students will develop the ability to design survey plans and solve real-world surveying challenges, such as boundary determination and volume calculations.
3. Students will gain an understanding of their role as surveyors, including maintaining accuracy in data collection and ensuring compliance with industry standards.

13. Prepared by:

MOHAMMED HASHIM AMEEN 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG-204– Engineering Ethics, (3.0, Required), (Supplement)

1. Course Number & Title (Credit Hours, Required or Elective):

UOT-005 – The Crimes of The Baath Regime in Iraq, (2.0, Required), (Supplement)

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG-205 – Environmental Geology, (4.0, Required), (Core)

2. Catalog Description:

Environmental geology is the study of how people interact with their natural surroundings, including rocks, water, air, soil, and life. Both the processes of Earth and human activity have an effect on the planet. The study of these environmental interactions will be based on physical geologic principles (rocks, minerals, and plate tectonics) in this introductory-level course. Natural hazards like earthquakes, volcanoes, and storms; natural resources like water, soil, and energy; climate change; and human population will all be covered in this course.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

ACCESS Environmental Geology: An Earth Systems Approach by Dorothy Merritts, Kirsten Menking, Andrew DeWet, 2018. 2nd Edition.
Environmental Geology by James S. Reichard , 2011, publishedby McGraw-Hill.

5. Course Objectives:

Environmental geology imparts geological information to understand the interactions between Earth's living organisms, particularly humans, and its geological components (rocks, minerals, soils, rivers, energy resources, morphology, geological structures, processes, and phenomena). It explains how geological resources play a role in environmental planning, spatial organization, and regional development that alters our resources. The effects of geological processes on human existence are also discussed, including geological dangers and disasters

.6. Topics:

Students will learn:

Fundamental Concepts of Environmental Geology
Earth Structure and Plate Tectonics, Plate Tectonics and the Environment
Minerals , Rocks and the Environment
Soil resources and the environment
Natural hazards. Landslides and subsidence
Natural hazards. Earthquakes and volcanic activity
Natural hazards. Streams and flooding
Desertification. Deserts and draught
Mid-Term Exam
Water pollution
Water resources
Energy resources
Pollution and waste disposal , Waste management and geology
Mining and the environment
Relationship and impacts between environmental and oil geology

7. Class/laboratory Schedule:

15 weeks of 180 min, lectures, 1 time a week, No lab.

8. Design Project:

Non

9. Computer/software Use:

Students typically use words in writing their reports of problem-based learning in addition to google meeting and classroom. .

10. Evaluation Methods:

- Quizzes: 3, 18%, Online assignment: 1, 6%, Onsite assignment: 1, 6%, Reports: 1, 10%, Midterm 10%, Final exam, 50%

11. Contribution to Professional Component:

1- Environmental geologists are trained to analyze complex geological data, identify environmental hazards, and develop solutions for mitigation and remediation.

1- Environmental geologists often work in multidisciplinary teams, collaborating with engineers, policymakers, and the public.

2- Environmental geologists must understand and adhere to environmental regulations and ethical standards related to resource management, pollution control, and site remediation.

3- Environmental geologists play a key role in promoting sustainable practices and minimizing the environmental impact of human activities.

4- The ability to assess geologic hazards, like floods, earthquakes, and landslides, and to create mitigation plans is a core professional component.
By studying Environmental Geology, students generally develop a multidisciplinary approach to understanding complex environmental systems, preparing them to address global environmental challenges through scientific knowledge and innovative solutions.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

For Environment Geology students will learn:

1- Fundamentals of geological processes and their impact on the human environment: Understand the basic composition, structure, and dynamics of the Earth's crust, explain how the rock cycle and terrestrial hydrological cycle work, and discuss the mechanisms of transporting water in the subsurface and their environmental impact (1).

2- Discuss specific environmental problems such as geological pollution (soil and groundwater contamination), landslides, earthquakes, and volcanoes in the context of a comprehensive understanding of geological dynamics, and apply principles of engineering, science, and mathematics to solve these problems (1, 7) .

1. Course Number & Title (Credit Hours, Required or Elective):

- ENVR-ENG-206- Water Supply Engineering (ECTS: 6, Required)(core)

2. Course Description:

Water Supply Engineering is a topic that concern about the water resources and how to collect water and treat it in special units to supply then to consumers. Design the water treatment plant units is covered during the course.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- Water Supply and Sewerage. Sixth ed., by E.W. Steel and Terence J. Mc Ghee , 1991. Publisher McGraw- Hill, Inc.

- Water Supply and Sewerage. Fifth ed., by Terence J. Mc Ghee , 1979. Publisher McGraw- Hill, Inc.

5. Course Objectives:

On successful completion of this course students will be able to:

1- Understand the basic concepts of water consumption.
2- Learn how to forecast the population.
3- Learn the most common impurities in water that must be taken in consideration while design conventional water treatment plant units.
4- Know the important concepts of design that taken in consideration while designing the unit operations of WTP and know how to handle the operation problems in the water treatment plant units.
5- Determine the quality of water samples by comparing them with standard specifications due to conduct experiments.

6. Topics:

- Per capita water consumption
- Population Forecasting
- Common impurities in water
- Conventional water treatment plant design

7. Class Schedule:

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Per capita water consumption
Week 2	Fire demand
Week 3	Population forecasting
Week 4	Common impurities in water
Week 5	Water quality
Week 6	Water treatment philosophy
Week 7	Midterm exam
Week 8	Intakes and screens
Week 9	Intakes and screens, continued
Week 10	Plain sedimentation
Week 11	Plain sedimentation, continued
Week 12	Sedimentation with chemicals (Coagulation and Flocculation)
Week 13	Filtration
Week 14	Disinfection, Taste and Odor Control

Week 15 Disinfection, Taste and Odor Control, continued

Week 16 **Final Exam**

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Lab 1: Determination of temperature of water
Week 2	Lab 2: Determination of Total dissolved solids (TDS)
Week 3	Lab 3: Determination of Total suspended solids (TSS)
Week 4	Lab 4: Determination of Total solids (TS)
Week 5	Lab 5: Determination of Turbidity of water
Week 6	Lab 6: Determination of sulphate (SO_4) by turbidity method
Week 7	Lab 7: Determination of Chlorides
Week 8	Lab 8: Determination of Odor
Week 9	Lab 9: Determination of Color
Week 10	Lab 10: Determination of Dissolved Oxygen in water
Week 11	Lab 11: Determination of Chlorine Demand
Week 12	Lab 12: Determination of Optimum Dose of Coagulant
Week 13	Lab 13: Determination of Total Hardness
Week 14	Lab 14: Determination of Calcium Hardness
Week 15	Lab 15: Determination of Calcium and Magnesium concentration

8. Design Project:

- None

9. Computer/software Use:

None

10. Evaluation Methods:

Midterm exams (10%), final exam (50%), 2 Quizzes (16%), Lab Reports (10%), 2 Online Assignments (4%), and Project (10%).

11. Contribution to Professional Component:

The students will earn skill of design conventional water treatment plant units as well as water qualification tests and be able to analyze and interpretate data.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

2. An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and global, cultural, social, environmental, economic, and other factors as appropriate to the discipline.
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

13. Prepared by:

Nadia Nazhat Sabeeh, 2025

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG-207 – Fluid Flow, (6.0, Required), (Core)

2. Catalog Description:

The fluid flow course introduces students to the mathematical and conceptual framework necessary for understanding fluid mechanics. It covers fundamental equations and principles such as fluid types, classifications, ideal and real fluid flow, the equations governing different types of fluid flow, pipe flow systems, pumps and turbines and introduction to open channels flow. Students will engage with both theoretical concepts and practical problem-solving techniques related to fluid behavior.

3. Prerequisite(s):

(ENVR-ENG-202) Fundamentals of Fluid Mechanics

4. Textbook(s) and/or other required materials:

- **Elementary Fluid Mechanics** by John K. Vennard and Robert L. Street, John Wiley & Sons 1982.
- **Fluid Mechanics** by Frank M. White, McGraw – Hill, 8th Edition 2016.
- **Fluid Mechanics and Hydraulic Machines** by K. Subramanya, McGraw Hill 2011.

5. Course Objectives:

- This course is attempted to help satisfy the required need for bringing together the information related to the principle of fluid flow.

6. Topics:

- Definition of fluid flow through ducts (8 hrs.)
- Classification of flow depending on Time, distance, Forces affected and Direction (8 hrs.)
- Derivation of Mass Conservation Law, Momentum Conservation Law and Energy Conservation Law (28 hrs.)
- Real and Ideal Fluid Flow and Friction Losses (32 hrs.)
- Flow through Branched Pipes (14 hrs.)

7. Class/laboratory Schedule:

2 hrs. Class, 2 hrs. Tutorial and 2 hrs. lab.

7.1: Class Schedule:

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	General Introduction and Fluid Flow through Ducts.

Week 2 Classification of Flow Depending on Time, Distance, Forces affected and Direction.
Week 3 Basic Equations of Fluid Motion (Mass Conservation Law).
Week 4 Basic Equations of Fluid Motion (Momentum Conservation Law).
Week 5 Basic Equations of Fluid Motion (Energy Conservation Law).
Week 6 Applications of Bernoulli's Equation.
Week 7 Mid-Term Exam.

Week 8 Energy Equation in Real Fluid Flow.
Week 9 Flow and Friction Losses in Pipes.
Week 10 Types of Pipe-Flow Problems Including Head Loss, Discharge and Sizing Problems.
Week 11 Flow through Branched Pipes Including Series and Parallel Pipe System.
Week 12 General Concept of Connected Multiple Tanks.
Week 13 Pumps and Turbines
Week 14 Introduction to Open Channels Flow (Geometry of Channel and Manning's Equation).
Week 15 Review Week before Final Exam.
Week 16 Final Exam.

8. Design Project:

Students are assigned a project that includes one or more topics related to the basics of fluid flow, such as applications of Bernoulli's equation, pipes flow systems and pumps etc.

9. Computer/software Use:

None

10. Evaluation Methods:

(Two hours Mid-Exams exam 10%, three hours final exam 50%)
(Quizzes, Lab. Reports, Assignments, and Projects 40%).

11. Contribution to Professional Component:

The fluid flow course introduces students to the mathematical and conceptual framework necessary for understanding fluid mechanics. It covers fundamental equations and principles such as fluid types, classifications, ideal and real fluid flow, the equations governing different types of fluid flow, pipe flow systems, pumps and turbines and introduction to open channels flow. Students will engage with both theoretical concepts and practical problem-solving techniques related to fluid behavior.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-4):

For Fundamentals of Fluid Mechanics, students will learn:

1. Interpret and analyses data related to fluid flow.
2. Apply the fundamental of fluid flow on each component of the ideal and real fluids.
3. Formulate the elementary principles of fluid flow including mass conservation law, momentum conservation law, Energy conservation law, Bernoulli's equation in both ideal

and real fluid, friction losses in pipe flow, flow through branched pipes, Pumps and turbines.
4. Understand the basics of fluid flow.

13. Prepared by:

Akram K. Mohammed, 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG-208 –Environmental Microbiology,(6.0, Required), (Core)

2. Catalog Description:

The Environmental Microbiology course aims to introduce students to microorganisms in natural and industrial environments, with emphasis on their roles in different ecosystems, and their impact on the environment and public health. The course covers microbial diversity, biogeochemical processes, microbial interactions, and the use of microorganisms in environmental remediation. It also includes the study of modern techniques in environmental microbiology, such as metagenomics and molecular analysis.

3. Prerequisite(s):

Yes .

4. Textbook(s) and/or other required materials:

- Brock Biology of Microorganisms, M. T. Madigan, J. M. Martinko, and D. Clark. 2009. Prentice Hall, N.J., 12th Edition or above.
- Environmental Biology for Engineers and Scientists David A. Vaccari, Peter F. Strom, James E. Alleman, John Wiley & Sons, Inc, 2006

5. Course Objectives:

Fundamentals of microbiology, biochemistry, and aquatic biology as they apply to environmental engineering. General topics include cell structure and composition, microbial metabolism, bioenergetics, microbial ecology, bioremediation, and biodegradation.

6. Topics:

Students will learn:

Indicative content includes the following.

- Microorganisms and microbial groups (4hrs)
- Chemistry and biochemistry (4hrs)
- Cell structure and function (4hrs)
- Microbial metabolism (4hrs)
- Microbial growth (10hrs)
- Microbial catabolism (4hrs)
- Nutrient cycles and bioremediation (2hrs)
- Biological applications of microorganisms (2hrs)
- Industrial Microbiology (2hrs)
- Molecular microbiology (8hrs)
- Methods in Microbial ecology (2hrs)

7. Class/laboratory Schedule:

2 Hours Class and 3Hours laboratory

7.1 Delivery Plan (Weekly Syllabus)

Environmental chemistry (Weekly Lab. Syllabus)

	Material Covered
Week 1	**Microorganisms and Microbiology**
Week 2	**Microbial groups**
Week 3	**Chemistry and biochemistry**
Week 4	**Cell structure and function**
Week 5	**Microbial metabolism**
Week 6	**Microbial growth**
Week 7	**Microbial Evolution and systematics, Midterm Exam**
Week 8	**Bacteria: the proteobacteria, Gram-Positive and other bacteria**
Week 9	**Archaea/Eukaryotic cells**
Week 10	**Metabolic diversity**
Week 11	**Microbial catabolism**
Week 12	**Microbial ecosystems**
Week 13	**Nutrient cycles and bioremediation**
Week 14	**Molecular microbiology**
Week 15	**Methods in Microbial ecology**
Week 16	**Final Exam**

7.2: Laboratory Schedule:

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Laboratory safety, Preparation of the medium
Week 2	Preparation of solid and liquid medium
Week 3	Preparation of membranes (slides), Lecture on how to use light microscope
Week 4	Total count of germs
Week 5	Detection of bacteria of the colon
Week 6	Way to measure the total count of bacteria colonies and the more likely way to use in measurement
Week 7	Detection of fecal causative bacteria

8. Design Project:

In addition exams, there is a problems-based learning.

9. Computer/software Use:

On completion of this course students will be able to:

- Identify the main concepts of microbial ecology.
- Learn a sound background in microbiology and environmental biology.
- Improve understanding of selected ideas and mechanisms and achieve a broader perspective of the topic.
- Enhancing students' abilities to pull important information out of the literature and to work in a group to organize and review a topic in depth.

10. Evaluation Methods:

(Two hours Mid-Exams exam 10%, three hours final exam 50%)

(Quizzes, Lab. reports, Online Assignments, and Onsite Assignments, projects 40%).

Course Guidelines

- Classroom Procedure and Participation
- Be in class. Attendance to class is required. Regular attendance is an important element of success in this course. Please note that the student having unexcused absences for 5% will be subject to get an Initial Alert and for 10% will get a Final Alert for the course. However, I will warn you in person before taking such further action.
- Be on time. Coming in late is disruptive and disrespectful.
- Put your cell phone calls away! Be focused during the lecture.
- Read the pre-assigned material or view the online lecture material. Please come to class having read the assigned text material (see syllabus) and completed the previously assigned homework. The best learning occurs when you complete the reading assignment BEFORE class and then read more carefully after class having your lecture notes to guide you for clarification. Do not spend time memorizing material but read for concepts and principal understanding.
- Participate in class. Please ask questions and ask for clarifications. The best class experiences always occur when there is good interaction between Instructor and students. It helps me know where to elaborate on difficult concepts. Your fellow students will also benefit as often they may not understand well enough to exactly know how to ask the question.
- Bring your stuff. Bring the textbook, writing implement, calculator, and note paper to every lecture.
- Typical Lecture. My instructional philosophy is to present the new material for the day and when applicable, follow that up with working an example problem(s) on the board that will be typical of the types of homework problems that have been assigned from that lecture. In some cases, you will be responsible for reviewing a lecture online before class.

Reading Assignments, Homework, and Quizzes

Come to class having read the assigned text material per the syllabus. If we get off schedule in the class, I will adjust the syllabus and inform you ahead.
Work the Homework Problems! Working problems is ABSOLUTELY essential for Engineering. I will assign problems throughout the semester.
Weekly quizzes. To hold you accountable in working the problems, *I will hold quizzes almost every week that will consist of concepts and problems from previous lectures and assigned homework problems.* Note that quizzes cumulatively make up the biggest percentage of your grade (20%). A missed quiz will be counted as zero unless I have excused you from the quiz. STUDENTS WILL HAVE ONE WEEK FROM THE TIME OF RETURN OF THE QUIZ TO REQUEST A REVIEW OF THEIR GRADED QUIZ**.** Persons arriving late for quizzes will not be given extra time.

Examinations

There will be 2 exams

Exam 1 cover: Microorganisms and Microbiology, Microbial groups, Chemistry and biochemistry, Cell structure and function, Microbial metabolism, Microbial growth

Exam 2 cover: Bacteria: the proteobacteria , Gram-Positive and other bacteria , Archaea/Eukaryotic cells , Metabolic diversity , Microbial catabolism , Microbial ecosystems , Nutrient cycles and bioremediation , Molecular microbiology , Methods in Microbial ecology

Persons arriving late for an exam will not be given extra time to complete it. A missed exam will be counted as zero unless I excuse you from the exam.
For students missing an exam under justified circumstances (determined by me), a makeup exam will be given.

Grading Policy

The final grade for the semester will be assigned based on the following percentages
Quiz and HW Composite and Reports -- 20%
Exam 1 ----------10%
Exam 2 ----------10%
Final Exam ----------60%
Exams (two hours' mid exam 10 %, three hours final exam 60%)
Problem Based Learning project 10%

11. Contribution to Professional Component:

On completion of this course students will be able to:
Environmental Microbiology focuses on the study of microorganisms in natural and engineered environments, exploring their roles in ecological balance, biogeochemical cycles, and environmental sustainability. This course aims to provide an in-depth understanding of microbial diversity, interactions, and their impact on ecosystems. It

covers key topics such as microbial classification, microbial roles in carbon, nitrogen, sulfur, and phosphorus cycles, and their applications in bioremediation, wastewater treatment, and pollution control. Additionally, modern techniques like molecular biology and metagenomics will be introduced for analyzing microbial communities. The course also examines the relationship between microorganisms and climate change, emphasizing their role in greenhouse gas emissions and carbon sequestration. Through laboratory experiments and research projects, students will develop practical skills in microbiological analysis, data interpretation, and environmental problem-solving. The course highlights the importance of microbes in environmental sustainability and their applications in biotechnology, public health, and industrial processes, aligning with environmental sciences and engineering practices.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):
For Environmental Microbiology, students will learn:

5. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (1).
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (3).

13. Prepared by:

Abbas Ali Alkanoosh , 2025

1. Course Number & Title (Credit Hours, Required or Elective):

ENVR-ENG-209 – Air Quality Engineering, (4.0, Required), (Core)

2. Course Description:

This course provides an in-depth understanding of air pollution science, monitoring, and control technologies. It covers the sources, dispersion, and impacts of air pollution, alongside strategies for measurement, regulation, and mitigation. Students will explore dispersion modeling, air quality indices, policy frameworks, and sustainable urban solutions. Case studies will be used to illustrate real-world air quality challenges and interventions. The main course objectives:

1- Introduce students to the fundamentals of air pollution, including pollutant types, sources, and their environmental and health impacts.
2- Develop an understanding of meteorological influences on air pollution dispersion and the application of air quality monitoring techniques.

3- Equip students with the ability to evaluate air pollution control technologies and regulatory standards.
4- Encourage the exploration of sustainable urban air quality solutions, including green infrastructure, smart city initiatives, and clean transportation.
5- Work effectively in teams and develop problem-solving skills.

3. Prerequisites:
None

4. Textbook(s) and/or other required materials:
Air Pollution by M.N. Rao and H.V.N. Rao. 1989 Publisher Tata McGraw-Hill ISBN: 9780074518717.

5. Course Learning Outcomes
On successful completion of this course, students will be able to:

a) Understand and classify air pollutants, their sources, and their effects on human health and the environment;
b) Analyze meteorological factors and apply dispersion models to predict air pollution transport.
c) Analyze air quality monitoring techniques, interpret data using international air quality indices and standards, and evaluate suitable air pollution control technologies and mitigation strategies for various pollution sources.
d) Assess and develop sustainable urban air quality solutions, integrating green infrastructure, smart city initiatives, and clean transportation.

6. Topics:
Students will learn:

- Air Pollution Sources & Effects
- Meteorological Factors & Dispersion Models
- Air Quality Monitoring, Standards & Control
- Sustainable Urban Air Quality Solutions

7. Class Schedule:

Delivery Plan (Weekly Syllabus)
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	Material Covered
Week 1	**Introduction to Air Pollution** - Definitions, and types of pollutants (primary/secondary, particulate/gaseous). - Health and environmental impacts.
Week 2	**Sources and Effects of Air Pollution** - Natural vs. anthropogenic sources (industrial, automotive, agricultural). - Global and local effects on ecosystems, materials, and climate.
Week 3	**Earth's Atmosphere & Climate Change** - Atmospheric composition and layers (troposphere, stratosphere). - Greenhouse effect, global warming causes/impacts, mitigation strategies.

- Ozone Depletion & Acid Rain

Week 4	**Meteorological Factors Influencing Air Pollutant Dispersion** Atmospheric stability, Types of lapse rates, plume behavior.
Week 5	**Air Dispersion Model** - Introduction to Dispersion Models - Gaussian plume model: equations, dispersion coefficients.
Week 6	**Effective Stack Height** Buoyant plumes, non-buoyant plumes, and Plume rise for larger volume source
Week 7	**Midterm Exam**
Week 8	**Introduction to Air Quality Index (AQI)** - What is AQI and why it's important? - How AQI is calculated (based on pollutants like PM2.5, PM10, NO_2, SO_2, O_3, CO)
Week 9	**AQI Monitoring, Measurement, and Standards.** - Air Quality Monitoring Techniques - Air Quality Measurement Methods
Week 10	**AQI Monitoring, Measurement, and Standards.** - AQI Standards Across Different Countries - Using AQI Data for Public Health Warnings and Policies
Week 11	**Control Measures** - Control Measures for Air Pollution - Air pollution control technologies
Week 12	**Case Studies** Case studies of air pollution incidents and their management
Week 13	**Air Quality and Sustainable Urban Development** Impact of urbanization on air pollution Role of green infrastructure (urban forests, vertical gardens)
Week 14	**Air Quality and Sustainable Urban Development** Sustainable transport solutions (electric vehicles, bike-friendly cities, public transit) Smart city initiatives for air quality management
Week 15	**Review Session** Recap of key concepts, problem-solving workshops, Q&A.
Week 16	**Final Exam**

8. Design Project:

None

9. Computer/software Use:

Students typically use Microsoft Word in writing their assignments.

10. Evaluation Methods:

Quizzes 16%, Online Assignments 14%, project 5%, seminar 5%, midterm exams 10% and final exam 50%

11. Contribution to Professional Component:

This course contributes to the professional component by equipping students with fundamental knowledge of air pollution science, monitoring, and control technologies, essential for careers in environmental engineering, public health, and sustainable urban planning. It provides technical knowledge in air quality measurement, dispersion modeling, and mitigation strategies, along with regulatory awareness of international air quality standards (WHO, EPA, EU). Additionally, it fosters problem-solving abilities through case studies and the integration of sustainable urban air quality solutions, preparing students to address real-world air pollution challenges in engineering, policy, and environmental management.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

13. **Prepared by:**

1. Course Number & Title (Credit Hours, Required or Elective):

UOT-011 – Arabic Language II, (2.0, Required), (Supplement)

1. Course Number & Title (Credit Hours, Required or Elective):

UOT-021 – English Language II, (2.0, Required), (Supplement)

1. Course description :

This module equips students with essential professional and academic communication skills necessary for career and academic advancement. It covers job application processes, including writing CVs, cover letters, and preparing for interviews. Additionally, students will learn how to craft letters of intent (statements of purpose) and letters of recommendation for academic applications. The module also develops presentation techniques and enhances writing proficiency, focusing on paragraph structure, coherence, and essay composition. By the end of the course, students will be able to effectively communicate their qualifications, ideas, and arguments in both written and spoken formats.

2. Prerequisites

None

3. Textbook and/or other required materials

David F. Beer, David A. McMurrey - A Guide to Writing as an Engineer-Wiley (2013)

Oresund Bridge: www.engineeringdaily.net/spotlight-project-the-oresund-bridgeSound for quiet cars: www.ivanhoe.com/science/story/2010/11/786si.html.

4. Course Learning outcomes

The module is designed to enhance students' written and oral communication abilities for both professional and academic settings, ensuring they can effectively present themselves in job applications, academic submissions, and professional interactions.

5. Topics

- Job Applications & Recruitment Procedures and how to apply for jobs and understand recruitment processes, along with interview preparation.
- Academic Applications & Writing.
- Presentation Skills.
- Paragraph & Essay Writing Fundamentals

6. Class Schedule

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	learn how to make job applications and which recruitment procedures must be gone through in the process
Week 2	acquire the special terminology used in job applications and recruitment procedures
Week 3	learn how to design a letter of application and CV
Week 4	have a clear idea about how to prepare for an interview and how to behave during an interview
Week 5	become familiar with the methods of writing a "letter of intent" ("statement of purpose") when applying for academic studies
Week 6	have an idea about the "letter of recommendation" that will be needed when applying for an academic program after completing university education
Week 7	**Midterm exam**
Week 8	gain an understanding of presentation techniques
Week 9	gain an understanding of presentation techniques
Week 10	become familiar with the basic principles of "Paragraph Writing"
Week 11	become familiar with the basic principles of "Paragraph Writing"
Week 12	learn and practice the key concepts of paragraph writing such as Topic Sentence, Supporting Sentences, Concluding Sentence, Unity and Coherence
Week 13	learn and practice the key concepts of paragraph writing such as Topic Sentence, Supporting Sentences, Concluding Sentence, Unity and Coherence
Week 14	gain insight into the essential principles of "Essay Writing"
Week 15	gain insight into the essential principles of "Essay Writing"
Week 16	**Final Exam**

7. Design Project

None

8. Computer/software

Students are mainly using Microsoft word to write their assignments.

9. Evaluation Methods

Two quizzes 10%, Midterm 10%, Two HomeWorks 8%, discussion and activities 10%, Project 12%, Final Exam 50%.

10. Contribution to Professional component

This will greatly contribute to student's professional component in the future by equipping them with essential skills for the workplace. Proficient communication both verbal and written, will allow them to express ideas clearly and persuasively, fostering effective collaboration with colleagues and clients. Enhanced writing skills will enable them to

produce high quality reports, proposals and presentations, crucial for making a lasting impression in any profession.

11. Relationship to student outcomes:

Course learning objectives (related student outcome 1-7):

4. An ability to communicate effectively with a range of audience.

13. Prepared by:

Hind Munaem

1. Course Number & Title (Credit Hours, Required or Elective):

E301 - Engineering Analysis

14. **Catalog description:**

Mathematical analysis with emphasis on solution techniques and engineering applications. Topics include ordinary differential equations (ODEs), Laplace transformations, initial and boundary value problems, Fourier series and partial differential equations.

15. **Prerequisites:**

- Calculus II

16. **Text book(s) and /or required materials:**

- Advanced Engineering Analysis C. Ray Wylie.
- Advanced Engineering Mathematics, 5th ed., D.G. Zill and M.R. Cullen.

17. **Course Objectives:**

6) Recognize and classify ordinary differential equations.
7) Ability to implement and solve mathematical models for engineering problems.
8) To enable the students to study the Laplace Transforms, properties of Laplace Transform, inverse Laplace Transform and some applications to solve the differential equations and integral equations
9) To enable the students to study Fourier Transforms and some concepts of infinite Fourier Sine and Cosine transforms, finite Fourier Sine and Cosine transforms and applications to solve some infinite and boundary value problems using finite and infinite transforms.
10) To familiarize the students with the fundamental concepts of PDE's and their solutions in the context of Laplace, Heat and Wave equations.

18. **Topics:**

Students will learn:

- Ordinary Differential Equations.
- Differential Equations Applications.

- Laplace Transform
- Fourier Transform
- Partial Differential Equations

19. **Class/ laboratory Schedule:**
    - No lab

20. **Design Project:**
    - None.

21. **Computer/software Use:**
    - None

22. **Evaluation Methods:**

• Reports (5%), quizzes (5, 20%), online assignment (1, 5%), onsite assignment (5, 10%), midterm exam (10%), final exam (50%)

23. **Contribution to Professional Component:**

-Help the engineer to solve engineering problems that requires complex mathematics.

24. **Relationship to Student Outcomes:**

Course Learning Objectives (related Student Outcomes 1-7):

5) Recognize and classify ordinary differential equations. (1)
6) Ability to implement and solve mathematical models for engineering problems. (1)
7) To enable the students to study the Laplace Transforms, properties of Laplace Transform, inverse Laplace Transform and some applications to solve the differential equations and integral equations. (1)
8) To enable the students to study Fourier Transforms and some concepts of infinite Fourier Sine and Cosine transforms, finite Fourier Sine and Cosine transforms and applications to solve some infinite and boundary value problems using finite and infinite transforms. (1)

To familiarize the students with the fundamental concepts of PDE's and their solutions in the context of Laplace, Heat and Wave equations. (1)

14. Prepared by:

Hassan Ali Ahmed , 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENV305 - Remote Sensing,

1. **Course Description:**
   This course introduces the fundamentals and advanced concepts of remote sensing, including image acquisition, preprocessing, classification, interpretation, and visualization. It focuses on the electromagnetic spectrum, energy interactions, satellite platforms, and environmental applications. Students will develop skills in analyzing and interpreting remotely sensed data for environmental and geographic applications.
2. **Prerequisites:**
   None

3. **Textbook(s) and/or other required materials:**
    - M. Anji Reddy, *Textbook of Remote Sensing and Geographical Information Systems*, 3rd Edition, 2008.
    - Dr. S. Kumar, *Basics of Remote Sensing and GIS*.
4. **Course Learning Outcomes:**
   Upon successful completion of this course, students will be able to:
    - Understand the basic principles of electromagnetic energy and its role in remote sensing.
    - Distinguish between passive and active remote sensing systems.
    - Identify appropriate sensors and satellite platforms for various environmental applications.
    - Analyze spectral reflectance characteristics of natural features.
    - Apply remote sensing techniques to monitor environmental phenomena such as watershed, irrigation, and rainfall-runoff.
    - Evaluate remote sensing data and interpret imagery for practical engineering uses.
5. **Topics:**

Week	Theoretical Topics
1–3	Basic Concepts: Introduction, EM energy, passive/active systems, platforms, advantages and limitations
4–5	Electromagnetic Radiation Spectrum: energy sources, principles, radiation use in remote sensing
6–7	Energy Interactions in the Atmosphere: scattering, absorption, sensor selection
8	Energy Interactions with Earth's Surface Features: reflection types, interaction mechanisms
9–10	Spectral Reflectance Curves: vegetation, soil, water, and natural features
10–11	Satellites and Orbits: geosynchronous, polar, sun-synchronous, applications
12	Applications in Environmental Monitoring
13	Applications in Watershed Management
14	Applications in Irrigation Management
15	Applications in Rainfall-Runoff Modeling

7. **Class/laboratory Schedule:**
   2 hours theoretical per week
8. **Design Project:**
   None
9. **Computer/software Use:**

   None specified, though image processing software may be recommended for project-based learning.
10. **Evaluation Methods:**

- Midterm Exam: 20%
- Quizzes & Assignments: 10%

- PBL Project: 10%
- Final Exam: 60%

11. **Contribution to Professional Component:** This course supports the environmental engineering curriculum by equipping students with knowledge and tools to utilize satellite-based data in environmental monitoring, management, and planning. It enhances their understanding of spatial analysis and data interpretation in relation to natural systems and anthropogenic impacts.
12. **Relationship to Student Outcomes:**

- Outcome 1: Ability to identify and solve engineering problems using scientific and technical knowledge
- Outcome 3: Ability to analyze and interpret data
- Outcome 6: Ability to recognize the need for and acquire new knowledge
- Outcome 7: Ability to work effectively on interdisciplinary teams

13. **Prepared by:** Mohammed Hashim Ameen, M.Tech in Civil Engineering (Surveying)

1. Course Number & Title (Credit Hours, Required or Elective):
ENV301 - Wastewater Treatment Systems I,

2. Course Description:
This course introduces students to the principles and design of wastewater treatment systems. It covers the types of wastewater, treatment objectives, and various unit processes. Students will learn the fundamentals of flow design, hydraulic calculations, reaction kinetics, and reactor types. The course emphasizes the design of preliminary treatment units and basic components of wastewater infrastructure, preparing students to handle real-world engineering challenges in environmental treatment systems

3. Prerequisites:
Fluid Mechanics, Environmental Engineering Principles

4. Textbook(s) and/or other required materials:

- *Wastewater Engineering: Treatment and Resource Recovery*, 5th Edition by Metcalf & Eddy, McGraw-Hill Education.
- Supplementary lecture materials and engineering design guidelines

5. Course Learning Outcomes:
Upon successful completion of this course, students will be able to:

- Identify different types and sources of wastewater.
- Describe various treatment methods and system classifications.
- Perform basic design calculations for flow and unit processes.
- Understand the fundamentals of reaction engineering in environmental systems.
- Design key preliminary treatment units including pumping wells, screening channels, and equalization basins.

6. Topics:

Week	Topic
1	Wastewater and Treatment Concepts – Types and characteristics of wastewater
2–3	Treatment Methods and Classification of Systems
4–5	Basic Design Considerations – Flow rates, loading rates, and design criteria
6–7	Design Procedure – General calculation methods and hydraulic flow diagrams
8–9	Reaction Engineering – Reaction kinetics in wastewater treatment
10–11	Types of Reactors – Batch, CSTR, plug flow, and reactor applications in treatment
12–13	Design of Preliminary Treatment Units – Pumping stations, sumps
14–15	Approach Channels, Equalization Basins, and Screens

7. Class/laboratory Schedule:
Lecture: 3 hours/week
No laboratory

8. Design Project:
None

9. Computer/software Use:
None required

10. Evaluation Methods:

- Midterm Exam: 20%
- Assignments/Quizzes: 10%
- Final Exam: 70%

11. Contribution to Professional Component:
This course provides foundational knowledge in wastewater engineering, equipping students with the essential skills to analyze, design, and evaluate preliminary treatment processes. It prepares students for advanced study in treatment technologies and supports their role in developing sustainable sanitation systems.

12. Relationship to Student Outcomes:
This course supports the following ABET student outcomes:

- **SO1**: Identify and solve engineering problems related to wastewater flow and treatment.
- **SO2**: Apply engineering design to wastewater infrastructure.
- **SO6**: Acquire new knowledge necessary for effective environmental engineering practice.

13. Prepared by:
Masood Muhsin Hazzaa, 2024

1. Course Number & Title (Credit Hours, Required or Elective):
ENV302 - Solid Waste Management I,

2. Course Description:
This course provides students with fundamental knowledge and practical skills in managing solid waste from various sources, including municipal, industrial, and agricultural sectors. Topics include waste generation, composition, collection systems, processing technologies, and sustainable waste management strategies. Emphasis is placed on integrated solid waste management (ISWM) and the evaluation of environmental and health impacts associated with improper waste handling.

3. Prerequisites:
Introduction to Environmental Engineering

4. Textbook(s) and/or other required materials:

- Tchobanoglous, G., Theisen, H., & Vigil, S.A. *Integrated Solid Waste Management*. McGraw-Hill.
- UN-Habitat (2020). *Solid Waste Management in the World's Cities*
- Instructor handouts and case studies

5. Course Learning Outcomes:
Upon successful completion of this course, students will be able to:

- Identify the sources, types, and composition of solid waste.
- Quantify and characterize solid waste using standard sampling and analysis methods.
- Analyze environmental and public health impacts of waste mismanagement.
- Evaluate waste collection systems, transportation logistics, and storage strategies.
- Compare treatment and disposal technologies (biological, thermal, mechanical).
- Design an integrated solid waste management plan with sustainability considerations.

6. Topics:

Week	Topic
1	Waste Generation and Functional Elements
2	Sources and Types of Solid Wastes (municipal, industrial, agricultural, hazardous); Global Waste Trends
3	Composition of Municipal Solid Waste and Composting
4	Physical/Chemical Characteristics, Waste Sampling & Analysis, Collection System Design
5	Collection Routes, Temporary Storage, Transfer Operations

Week	Topic
6	Purposes of Waste Processing
7	**Midterm Exam**
8	Waste Treatment Technologies: Composting, Anaerobic Digestion, Incineration, Pyrolysis
9	Mechanical Volume Reduction and Compaction Equipment
10	Component Separation, Hand Sorting
11	Screening, Other Separation Techniques, Drying, Dewatering, Recovery Systems
12	Waste Collection System Design: Static vs. Mobile Containers, Placement Strategies
13	Operational Scheduling for Waste Crews, Truck Routing, Crew Rotation
14	Integrated Solid Waste Management (ISWM) and Sustainability Principles
15	Scheduling Challenges: Population Activity, Emergency Response Planning
16	**Final Exam**

7. Class/laboratory Schedule:
Lecture: 3 hours/week

8. Design Project:
None

9. Computer/software Use:
None required; optional use of spreadsheet software for collection system design and analysis

10. Evaluation Methods:

- Midterm Exam: 20%
- Assignments/Quizzes: 10%
- Final Exam: 70%

11. Contribution to Professional Component:
This course prepares students to work in waste management planning, environmental consulting, and public health sectors. Students gain skills in system design, operations planning, and sustainability integration in solid waste management, aligning with professional environmental engineering practice.

12. Relationship to Student Outcomes:
This course supports the following ABET student outcomes:

- **SO1**: Ability to identify and solve solid waste management problems.
- **SO2**: Apply design principles to develop waste systems that meet public and environmental needs.

- **SO5**: Recognize professional responsibilities regarding environmental and public health impacts.

13. Prepared by:

Rand Rafea Ahmed
Department of Environmental Engineering
2025

1. Course Number & Title (Credit Hours, Required or Elective):

ENV307 - Treatment Plant Hydraulic,

2. Course Description:

This course attempted to help satisfy the required need for bringing together the information and fundamental knowledge of the hydraulic design of treatment plants. This information would be related to the hydraulic design and analysis of water and wastewater treatment facilities

3. Prerequisites

Fluid Flow (FLUD-202).

4. Textbook(s) and/or other required materials:

Treatment Plant Hydraulics for Environmental, 4th Edition by Larry D. Benefield. 2015 Publisher: Prentice-Hall ISBN: 9780139302480.

5. Course Learning Outcomes

On successful completion of this course students will be able to:

a) Have an appreciation for the importance of the hydraulic design of water and wastewater treatment facilities.
b) Understand elementary principles flow in pipe systems including conservations laws, head losses in pipes, pipe series, sludge flow… etc.
c) Understand advanced open-channel flow processes including uniform and varied flow.
d) Understand the basics of flow measurement and hydraulics control points such as, weirs (Rectangular and Triangular) and flow meters (Venturi meter, Parshall flume)
e) Understand the basics of designing process for treatment plants.

6. Topics:

Students will learn:

Week	Topic
1	General introduction, dimensional analysis, units
2	Flow in pipes (pipes in series, parallel, and equivalent pipe)
3	Introduction to pumps and pump curves
4	Pumps in series and parallel
5	Open channels flow and channel geometry properties
6	Exam 1
7	Critical flow and specific energy
8	Critical flow and specific energy

9	Flow measurement and hydraulics control points (weir)
10	Flow measurement and hydraulics control points (Venturi meter, Parshall flume)
11	Hydraulics Analysis of multiport diffuser
12	Hydraulics Design of multiport diffuser
13	Exam 2
14	Comprehensive Design Example for WWTP
15	Comprehensive Design Example for WWTP

7. Class/laboratory Schedule:

No lab

8. Design Project:

None

9. Computer/software Use:

None

10. Evaluation Methods:

Exams (mid exams 20%, Quizzes 10%, PBL project 10%, and final exam 60%)

11. Contribution to Professional Component:

Hydraulics of Treatment Plants will provide students with an opportunity to establish fundamental knowledge of hydraulic design and engineering of treatment plants systems. Students are introduced to standard hydraulic for the design of water multiport diffuser systems for treatment plants. Also, they will be able to know the details of the pumps and pump curves and their accessories, and everything related to the flow measurement and hydraulics control points.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcome 1-7):

2. An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and global, cultural, social, environmental, economic, and other factors as appropriate to the discipline.

13. Prepared by:

Wesam S. Mohammed Ali, 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENV303 - Water Quality Management,

1. Course Number & Title (Credit Hours, Required or Elective):

ENV304 - Air Pollution Control,

1. Course Number & Title (Credit Hours, Required or Elective):

ENV306 – Concrete Technology, Ektifaa Salih Khudhur

1. Course Number & Title (Credit Hours, Required or Elective):

U302 - Research Methodology (1, Required)

2. Catalog Description:

Scientific research methodology is essential for preparing academic scientific research. It is the method that contributes to identifying scientific facts that have always needed explanation, especially in the field of engineering sciences with its various specializations.

Therefore, it is important to realize that scientific methodology generally requires following regular steps and activities with specific characteristics aimed at teaching students scientific research, developing a scientific spirit within them, and facilitating their research mission. Accordingly, the subject of research methodology aims to provide students with a methodology for preparing a research project and diagnosing the procedures followed in addressing phenomena by covering various scientific techniques and methods in particular.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- Research Methodology: Tools and Techniques.
- Lectures drawn from numerous books and articles on research methodology.

5. Course Objectives:

- Introducing the student to the characteristics and importance of scientific research, the motives, and methods for arriving at the truth about objects and phenomena.
- Developing the student's ability to recognize the relationships between the various phenomena under investigation.
- Introducing the student to the types of scientific research and the general structure of research, graduation projects, and master's and doctoral theses.
- Introducing the student to the qualities that a researcher and their scientific supervisor should possess.
- Increasing knowledge of the stages of scientific research and the importance of each stage.
- Teaching the student the scientific method for writing scientific research.

6. Topics:

- Introduction to scientific research, definition of scientific research, and its characteristics.
- The importance of scientific research and motivations for writing research.
- Types of scientific research. • Structure of scientific research.
- Characteristics of a scientific researcher and a scientific supervisor.
- Stages of preparing scientific research.
- Methods of writing scientific research and evaluation criteria.

7. Class/laboratory Schedule:

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to scientific research, concept and definition of scientific research, characteristics of scientific research.
Week 2	Importance of scientific research and motivations for writing scientific research.
Week 3	Types of scientific research - scientific research in terms of use.

Week 4	Scientific research in terms of method and objective.
Week 5	Structure of scientific research.
Week 6	Scientific researcher and scientific supervision (Characteristics of a scientific researcher and characteristics of a scientific supervisor).
Week 7	First monthly exam.
Week 8	Stages of preparing scientific research - selecting a research topic and defining its problem.
Week 9	Stage of collecting documents and information – Stage of reading and reflecting.
Week 10	Stage of dividing the research Topic.
Week 11	Stage of collecting and storing information.
Week 12	Stage of writing the research.
Week 13	Punctuation marks and their use.
Week 14	Discussing the research topic and evaluation criteria.
Week 15	Second monthly exam

8. Design Project:

None

9. Computer/software Use:

None

10. Evaluation Methods:

Exams (2 hours monthly exams 40%, 3 hours final exam 60%)

11. Contribution to Professional Component:

Through this course, students will be able to identify the characteristics and importance of scientific research, the motives and methods for arriving at the truth about things and phenomena, while developing their ability to recognize the flow of relationships that link the various phenomena under investigation. Students will learn about the types of scientific research, the general structure of research, graduation projects, master's and doctoral theses, and the qualities that researchers and their scientific supervisors should possess. This course will also increase their knowledge of the stages of scientific research, the importance of each stage, and teach students the scientific method for writing scientific research.

12. Relationship to Student Outcomes:

After completing the curriculum, the student will be able to:

- The importance of scientific research, the motives, and methods for arriving at the truth about things and phenomena.
- Identify the relationships between the various phenomena under investigation.
- Understand the types of scientific research and the general structure of research, graduation projects, master's and doctoral theses.
- Understand the qualities that a researcher and their scientific supervisor should possess.
- The scientific method for writing scientific research.

13. Prepared by:

Prof. Dr. Raad H. Irzooki, 2025

1. Course Number & Title (Credit Hours, Required or Elective):

ENV312 - Soil and Groundwater Remediation, (3, Required)

2. Course Description:

This course focuses on understanding the sources and types of pollutants that affect soil and groundwater, as well as the mechanisms of transport and dispersion of these pollutants.

The course includes studying soil and groundwater's physical and chemical properties and the effects of organic and inorganic contaminants, such as heavy metals, petroleum, pesticides, and industrial chemicals.

It also covers pollution monitoring and assessment techniques, numerical modelling of pollutant transport, and treatment and rehabilitation strategies, such as pumping and treatment, aeration, and biological treatment.

The course aims to provide students with the theoretical and applied knowledge necessary to understand the challenges of soil and groundwater pollution, assess environmental impact, and develop sustainable solutions for natural resource management.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- Principles of Soil Science: Abdullah Najm Al-Ani (1980)
- Soil Mechanics: Muhammad Omar Al-Ashou (1980)
- Soil Pollution Assessment - Pesticide Disposal Series No. 8 (Food and Agriculture Organization of the United Nations) / Rome (2002)
- Groundwater Pollution: Dr. Ahmed Al-Khatib (1993)

5. Course Objectives:

1. Expected learning outcomes:
2. Identify the primary sources of soil and groundwater pollution.
3. Understand the mechanisms of contaminant transport in soil and groundwater.
4. Assess the environmental risks associated with pollution.
5. Select and apply appropriate technologies to remediate contaminated sites.

6. Topics:

Indicative content includes the following.

1. General Introduction

2. Soil and Groundwater Properties:

- Physical, chemical, and biological properties of soil.
- Groundwater properties and movement in porous media.
- The relationship between soil structure and pollutant transport.

3. Types of pollutants:
    - Organic pollutants (hydrocarbons, pesticides).
    - Inorganic pollutants (heavy metals, salts).
    - Industrial, domestic, and agricultural waste.
4. Pollution Sources:
    - Waste.
    - Leakage from fuel and chemical tanks.
    - Use of fertilizers and pesticides.
    - Industrial and mining activities.
5. Pollutant Transport Mechanisms:
    - Diffusion, adsorption, dissolution, and decomposition.
    - Convective transport in soil and groundwater.
6. Soil and groundwater remediation techniques:
    - Pump and treat.
    - Bioremediation.
    - Thermal and physical treatment.
    - In-situ vs. ex-situ treatment.

7. Class schedual:

Engineering Mechanics

	Topics Covered
Week 1	Definition of soil, its components, soil formation factors, physical properties of soil, soil air, soil water, soil color
Week 2	Soil weight and volume relationships
Week 3	Atterberg limits, Soil classification
Week 4	Water flows through the soil
Week 5	Exam 1
Week 6	Soil chemical properties, major soil groups, Ion exchange capacity, soil acidity, its importance, and methods of measuring it, Mineral colloids, and organic colloids
Week 7	Salinity and alkalinity in soil, classification of salt-affected soils, determination of soil salinity
Week 8	Osmotic stress, reclamation of salt-affected soils, Biological properties of soil, major groups of soil biota
Week 9	Carbon and nitrogen cycle in nature, carbon to nitrogen ratio
Week 10	Pollution from agricultural chemical sources, pesticides and their types
Week 11	Pesticide uses and their environmental effects on soil and groundwater
Week 12	Exam 2
Week 13	Qualitative characteristics of pesticides
Week 14	Wind erosion, desertification, causes of desertification, and treatment methods
Week 15	Heavy and light metals in soil, their uses, and their availability for transfer to the soil system

8. Design Project:

One project per course.

9. Computer/software Use:

Students typically use words in writing their reports of problem-based learning and Excel to draw the figures.

10. Evaluation Methods:

- Quizzes: 1, 15%, Online assignment: 2, 5%, Onsite assignment: 1, 5%, Reports: 1, 5%, Midterm 20%, Final exam, 50%.

12. Contribution to Professional Component:

1. Qualify students to assess field environmental problems.
2. Enhance analytical and technical skills.
3. Ability to propose technical solutions and treatments.
4. Support sustainable environmental decision-making.
5. Prepare to work with multidisciplinary teams.
6. Enable students to pursue careers in fields.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

- An ability to identify, formulate, and solve engineering problems by applying engineering, science, and mathematics principles.

13. Prepared by:

Naser Abed Hassan, 2025

1. Course Number & Title (Credit Hours, Required or Elective):

E302 - Experimental Design, (1, Required)

2. Catalog description:

This course covers fundamental statistical techniques used in data analysis, including correlation, regression, hypothesis testing, and analysis of variance (ANOVA). Students will learn how to examine relationships between variables, develop predictive models, and test hypotheses using statistical methods. The course emphasizes both theoretical understanding and practical application through case studies, problem-solving exercises, and statistical software tools. By the end of the course, students will be able to apply statistical techniques effectively in research and decision-making.

3. Prerequisites:

None

4. Text book(s) and /or required materials:

*المدخل إلى الإحصاء" د. خاشع محمود الراوي-جامعة الموصل/كلية الزراعة والغابات -1984 .

*مبادئ الإحصاء الهندسي"، د. باسم نزهت السامرائي، د. مثنى جبر، الجامعة التكنولوجية، دار الحكمة للطباعة والنشر، بغداد، 1990

*الأساليب الإحصائية في العلوم الإدارية، تطبيقات باستخدام"(spss) ، د. صلاح الدين حسن إلهيتي، جامعة مؤتة، دار الوائل للطباعة والنشر، عمان 2004.

*Christian, H., & Michael Schomaker, S. (2016). Introduction to Statistics and Data Analysis with Exercises, Solutions and Applications in R.

5. Course Objectives:

1) Introduce the concept of correlation and give a definition.
2) Explain the types of correlation and graphical representation of data (scatter plot).
3) Methods of calculating different correlation coefficients.
4) Introduce the concept of regression and give a definition
5) Explain the types of regression.
6) Applying regression to time series.
7) Statistical Hypothesis Testing. (The Null Hypothesis & The Alternative Hypothesis)
8) Explain the One-Way ANOVA & Two-Way ANOVA

6. Topics:

Students will learn:

- engineering problems
- regression and correlation analysis
- Propose an engineering solution
- Quantify the improvement

7. Class Schedule:

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Explaining the concept of correlation
Week 2	Types of Correlation (Simple Linear Correlation and Multiple Linear Correlation)
Week 3	Determine the correlation (positive direct correlation and negative inverse correlation)
Week 4	Methods of calculating different correlation coefficients
Week 5	Pearson's correlation coefficient
Week 6	Spearman's correlation coefficient
Week 7	PHI- correlation coefficient & Point-Biserial Correlation Coefficient
Week 8	Midterm exam
Week 9	Introduce the concept of regression
Week 10	Explain the types of regression.
Week 11	Applying regression to time series
Week 12	Hypotheses and Fitness tests
Week 13	Hypotheses and Fitness tests
Week 14	Test of variation, one-way test. ANOVA
Week 15	Test of variation, two-way test. ANOVA
Week 16	Final Exam

8. Design Project:

- None

9. Computer/software Use:

Spss, V.25

10. Evaluation Methods:

- Quizzes (15%), Assignments (Home Works) (15%), Discussions (10%), Midterm exam (10%), Final exam (50%)

11. Contribution to Professional Component:

- Help the engineer to solve engineering problems that requires complex statistical analyses.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

1) Understand the concept of correlation and its types (simple and multiple correlation)
2) Calculate and interpret Pearson and Spearman correlation coefficients in terms of strength and direction.
3) Analyze the relationship between two variables and make data-driven decisions.
4) Understand and use the general ideas probability.
5) Apply t-tests to compare means in independent or paired samples.
6) Use F-tests to compare variances or assess the significance of regression models.
7) Interpret p-values and make decisions based on statistical significance levels.
8) Understand when and why to use One &Two-Way Analysis of Variance (ANOVA).

1. Course Number & Title (Credit Hours, Required or Elective):

ENV309 - Wastewater Treatment Systems II, (3, Required)

2. Catalog Description:

This course covers fundamental aspects of types of wastewater & wastewater treatment systems include treatment methods, in addition of measurement of their concentrations & the manners in which they affect the environmental & ecological systems.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- Wastewater Treatment Systems, Concept and Design – By G. L. Karia, R. A. Christian and Namrata D. G. Jariwala,2014

5. Course Objectives:

On successful completion of this course students will be able to:

- Understand the design of grit chamber.
- Understand the design of primary settling tank.
- Understand the design of aerobic tank.
- Understand the design of secondary settling tank.

6. Topics:

- Design of grit chamber.
- Design of primary settling tank.
- Design of aerobic tank.
- Design of secondary settling tank.

7. Class Schedule:

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Grit chambers and
Week 2	Aerated grit chambers.
Week 3	Design of primary treatment units:
Week 4	Design Primary settling tank,
Week 5	Flotation,
Week 6	Classification of treatment process,
Week 7	Bio-kinetic, Design consideration,
Week 8	Exam1,
Week 9	Biological treatment of wastewater,
Week 10	Aerobic process, Removal mechanism,
Week 11	Design of Secondary treatment unit,
Week 12	suspended growth treatment units,
Week 13	Activated sludge process,
Week 14	Secondary settling tank,
Week 15	Exam2
Week 16	Final Exam

8. Design Project:

- None

9. Computer/software Use:

None

10. Evaluation Methods:

Midterm exams (10%), final exam (50%), 2 Quizzes (16%), Lab Reports (10%), 2 Online Assignments (4%), and Project (10%).

11. Contribution to Professional Component:

The students will earn skill of design conventional wastewater treatment plant units as well as wastewater tests and be able to analyze and interpretate data.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

2-An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and global, cultural, social, environmental, economic, and other factors as appropriate to the discipline.

13. Prepared by:

Masood Muhsin Hazzaa, 2024

1. Course Number & Title (Credit Hours, Required or Elective):

ENV310 - Solid Waste Management II, (2, Required)

2. Catalog Description:

This course covers fundamental aspects of solid & hazardous waste includes handling & treatment methods, in addition of measurement of their concentrations & the manners in which they affect the environmental & ecological systems.

3. Prerequisite(s):

None

4. Textbook(s) and/or other required materials:

- Integrated Solid Waste Management's. By Tchobanoglous Mc-Grow Hill 1993

5. Course Objectives:

- To define the types of solid waste to manage them in engineering patterns.
- To provide experience in the analysis of pollution problems
- To sustain the environmental resources using proper operations to manage the waste, e.g., 4Rs.
- To define the important methods of collection, storage, processing & disposal.
- To provide design of collection routes, sanitary landfilling, and incinerators.

6. Topics:

- Waste generation. (4 hr)
- Source and Types of Solid Waste. (4 hr)
- Composition of Municipal Solid Wastes and Compositing. (4 hr)
- Generation Rates. (4 hr)
- Collection services. (4 hr)
- Collection System, Equipment, and Labor Requirements. (4 hr)
- Transfer operation. (4 hr)
- Selection of Compaction Equipment. (4 hr)
- Materials Processing and Recovery Systems. (4 hr)
- Recovery of Chemical Conversion Products. (4 hr)
- Recovery of Biological Conversion Products. (4 hr)
- Disposal of Solid Wastes and Residual Matter. (4 hr)

- Site selection, Land filling Methods, and Operations. (4 hr)
- Design of Landfills, Land Requirements, and Landfill Operation Plan. (4 hr)
- Solid Waste filling Plan, Types of Wastes, Ocean Disposal of Solid Wastes. (4 hr)

7. Class/laboratory Schedule:

2 Hours Class and 2 Hours Tutorial.

7.1: Class Schedule:

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Purposes of Processing, Mechanical Volume Reduction, Selection of Compaction, and Equipment
Week 2	Chemical Volume Reduction, Mechanical Size Reduction, Size Reduction Equipment, and Selection of Size – Reduction Equipment
Week 3	Component Separation, Hand sorting, Air Separation, Magnetic Separation
Week 4	Screening, Other Separation Techniques, Drying and Dewatering
Week 5	Materials Processing and Recovery Systems
Week 6	Exam 1
Week 7	Recovery of Chemical Conversion Products
Week 8	Recovery of Biological Conversion Products
Week 9	Recovery of Energy from Conversion Products
Week 10	Disposal of Solid Wastes and Residual Matter
Week 11	Exam 2
Week 12	Site selection, Landfilling Methods and Operations
Week 13	Reactions Occurring in Completed Landfills, Gas and Leachate, Movement and Control
Week 14	Design of Landfills, Land Requirements, and Landfill Operation Plan
Week 15	Solid Waste Filling Plan, Types of Wastes, Ocean Disposal of Solid Wastes
Week 16	Final Exam

1. Course Number & Title (Credit Hours, Required or Elective):

ENV313 - Building Materials, (2, Required)

2. Course Description:

This course introduces students to the properties, characteristics, and testing of common construction materials. It covers natural and manufactured materials such as brick, concrete, plaster, stone, wood, tiles, glass, insulating materials, and asphalt. The laboratory component provides hands-on experience in evaluating material properties through standard tests

3. Prerequisites:

Introduction to Civil or Construction Engineering

4. Textbook(s) and/or other required materials:

- Mamlouk, M. S. & Zaniewski, J. P. *Materials for Civil and Construction Engineers*, 4th Edition.
- Instructor's lecture notes and standard ASTM testing procedures

5. Course Learning Outcomes:
Upon successful completion of this course, students will be able to:

- Identify and describe the physical and mechanical properties of building materials.
- Evaluate suitability of various construction materials based on structural and environmental requirements.
- Perform standard laboratory tests for materials such as brick, plaster, cement, and tiles.
- Understand differences between clay and non-clay bricks, and between natural and manufactured materials.
- Analyze test results and apply material selection in engineering projects.

6. Topics:

Week	Topic (Lecture)	Lab (if applicable)
1	Properties of Materials	Brick Test: Shape & Dimensions
2	Bricks	Absorption Test
3	Engineering Properties of Clay Brick	Compressive Strength Test
4	Types of Non-Clay Brick	Gypsum Tests: Fineness Test
5	Plaster	Optimum Water/Gypsum Ratio
6	Lime Mortar	Initial Setting Time
7	Wood	Compressive Strength Test
8	Tiles	Tile Test: Overall Shape
9	Stone	Absorption Test
10	Steel Concrete	Modulus of Rupture Test
11	Insulating Materials	—
12	Glass	—
13	Cement	—
14	Concrete Block	—
15	Asphalt Cement Concrete	—

7. Class/laboratory Schedule:

- Lecture: 2 hours/week
- Laboratory: 1 hour/week

8. Design Project:
None

9. Computer/software Use:
Not required

10. Evaluation Methods:

- Lab Reports and Attendance: 20%
- Midterm Exam: 20%
- Quizzes and Assignments: 10%
- Final Exam: 50%

11. Contribution to Professional Component:
This course contributes to the professional education of civil engineers by familiarizing them with the materials used in construction and how their properties affect design, safety, and performance. It builds foundational skills in materials selection and quality control.

12. Relationship to Student Outcomes:
This course supports the following ABET student outcomes:

- **SO1**: Identify and solve engineering problems related to material behavior.
- **SO3**: Conduct experiments and analyze data to evaluate material properties.
- **SO6**: Apply acquired knowledge to select appropriate building materials.

13. Prepared by:
Ektifaa Salih Khudhur, 2024

1. Course Number & Title (Credit Hours, Required or Elective):
ENV308 - Engineering Hydrology, (2, Required)

2. Catalog Description:
This course provides an introduction to the principles and applications of hydrology in engineering. Topics include the hydrologic cycle, precipitation, evapotranspiration, infiltration, surface runoff, streamflow, groundwater flow, and hydrologic analysis methods. Students will learn techniques for flood estimation, storm water management, watershed modeling, and the design of hydraulic structures. The course also covers statistical hydrology, hydrograph analysis, and the use of hydrologic software tools. Applications in water resources engineering, flood control, and environmental hydrology will be emphasized.

3. Prerequisite(s): for Engineering Hydrology
None

4. Textbook(s) and/or other required materials:

- **Engineering Hydrology,** 2nd Edition Mc Graw hill, New Delhi, K. Subramanya, 1997**.**
- **Hand book of applied hydrology,** Chow, V.T, Mc Graw hill, New York.
- **Hydrology for Engineering,** Linsley.

5. Course Objectives:

This course aims to establish fundamental knowledge of Engineering Hydrology is a field of study that focuses on the application of hydrological principles and methods to engineering design and water resources management. This course provides students with a comprehensive understanding of the principles and practices of hydrology, emphasizing their practical applications in engineering projects. students should have a strong foundation in engineering hydrology, enabling them to assess and manage water resources, design engineering projects with hydrological considerations, and make informed decisions regarding water-related issues in various contexts.

6. Topics:

The indicative contents of Engineering Hydrology typically cover the following topics:

- Introduction to Hydrology, water Cycle, and water balance (8 hrs.)
- Rainfall, Evapotranspiration, Infiltration Analysis (16 hrs.)
- Hydrological risk analysis. (8 hrs.)
- Runoff and Hydrographs (12 hrs.)
- Flood Hydrology (10 hrs.)
- Groundwater Hydrology (4 hrs.)

7. Class Schedule:

2 Hours Class and 1Hours Applications

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Engineering Hydrology, Hydrologic Cycle, Weather and Climate.
Week 2	Probability in Hydrology and Plotting Position Method
Week 3	Precipitation - Types of Precipitation - Measurement of Precipitation
Week 4	Flood Risk analysis
Week 5	Estimating Missing Precipitation Data, Double Mass Curve Analysis, Methods of Determination of Average Precipitation over area.
Week 6	Frequency of Rainfall, Hyetograph, and accumulated rainfall.
Week 7	Evaporation - Factors Controlling the Evaporation - Determination of Evaporation -Evaporation and Transpiration -ET Equations
Week 8	**Mid-Term Exam**
Week 9	Infiltration

	-Measurement of Infiltration - Infiltration capacity. - Infiltration Indices Φ-Index and W-Index
Week 10	Runoff Runoff -Rainfall Relationship .
Week 11	Hydrograph Analysis ,Components of Hydrograph , Hydrograph Separation , Synthetic Hydrograph
Week 12	Unit Hydrograph, Conversion of Unit Hydrograph, S-curve
Week 13	Flood Routing - River Routing -Reservoir Routing - Gumbel Distribution
Week 14	Introduction to Groundwater hydrology
Week 15	**Review Week before Final Exam**
Week 16	**Final Exam**

8. Design Project:

None

9. Computer/software Use:

Students typically use words in writing their reports of problem-based learning in addition to google meeting and classroom.

10. Evaluation Methods:

Module Evaluation

تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	20% (20)	2, 4, 7, 10,12,14	LO #1, 2, 3, and 4
	Assignments	10	20% (20)	3, 6, 9, 12	LO # 1, 2, 3, 4, and 5
Summative assessment	**Midterm Exam**	2	10% (10)	8	LO # 1-3
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

11. Contribution to Professional Component:

Engineering hydrology plays a crucial role in the professional development of civil and environmental engineers. It provides essential knowledge and skills that contribute to various aspects of engineering practice, including:

- Water Resources Management – Engineers apply hydrological principles to design and manage water supply systems, reservoirs, and irrigation networks, ensuring sustainable water use.
- Flood Control and Mitigation – Hydrological studies help in predicting and managing floods through the design of drainage systems, levees, and flood forecasting models.
- Infrastructure Design – Roads, bridges, and dams require hydrological assessments to ensure safety, stability, and efficiency in handling water flow.
- Environmental Protection – Hydrology aids in pollution control, watershed management, and maintaining ecological balance by assessing the impact of human activities on water bodies.
- Climate Change Adaptation – Engineers use hydrological data to develop strategies for coping with changing precipitation patterns, droughts, and rising sea levels.
- Professional Development and Ethical Responsibility – Hydrologists contribute to policy-making, regulatory compliance, and disaster risk reduction, reinforcing ethical and professional responsibilities in engineering practice.

Through these contributions, engineering hydrology strengthens the professional competency of engineers, ensuring they can address real-world water-related challenges effectively.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

For Engineering Hydrology, students will learn:

- identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (1).

13. Prepared by:

Ahmed S. Mahmood, 2025

1. Course Number & Title (Credit Hours, Required or Elective):

E303 - Numerical Analysis, (1, Required)

2. Catalog Description:

To make students familiar with the use of numerical methods to solve mathematical equations, including iterative methods and how to find completion in different ways, as well as numerical integration and numerical derivatives and the use of derivatives to solve a system of equations in different ways, and also the use of numerical solutions to solve first- and second-degree equations.

3. Prerequisite(s):

Numerical Analysis

4. Textbook(s) and/or other required materials:

C. Ray Wylie, "Advanced engineering mathematics" McGRAW-Hill ,INC, Ltd,, fourth edition, 1975

5. Course Objectives:

This course provides an introduction and details of the numerical methods used, their comparison with mathematical solutions and their use in solving engineering problems.

6. Topics:

- Numerical solution of ordinary Differential Equation .
- Matrices and its Applecations .
- Finite Differences .
- Fourier series and integral.

7. Class/laboratory Schedule:

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Numerical Methods in General, Introduction
Week 2	Numerical solution of ordinary Differential Equation .
Week 3	Matrices and its Applecations (Cramer rule) .
Week 4	Matrices and its Applecations (Gauss elimination method, Inverse matrix method) .
Week 5	Interpolation.
Week 6	Curve Fitting
Week 7	Midterm exam
Week 8	Numerical integration
Week 9	Gauss-Quadrature formula
Week 10	Application of the solution of differential equation
Week 11	Application of the solution of differential equation
Week 12	Fourier series and integral.
Week 13	Fourier series and integral.
Week 14	Fourier series and integral.
Week 15	Second exam

8. Design Project:

None

9. Computer/software Use:

None

10. Evaluation Methods:

- Quizzes: %, Online assignment: 3, 15%,: 5, 5%, 1, 5%, Midterm Final exam,.

11. Contribution to Professional Component:

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

For Strength of materials, students will learn:

7. Apply basic physical principles of strength of Materials (3,4,7).
8. actin and Reactions to solve problems in beams loading (4,5,6).

13. Prepared by:

Hassan A.Ahmed , 2025

1. Course Number & Title (Credit Hours, Required or Elective):

ENV311 - Noise Pollution ((2, Required)

2. Course Description:

With increasing noise pollution nationally and globally, it is necessary to be familiar with basic information regarding noise pollution to allow proper assessment of impacts arising from the various projects or activities and devising appropriate mitigation or control measures. In this respect, the Noise Pollution course is subdivided into two sections: the general introductory, and noise pollution sections. The general introductory section covers information on national standards and regulations governing noise levels; definitions of noise pollution. The noise pollution section covers sources, characteristics and effects of industrial, transportation and urban noise; measurement, assessment and evaluation of noise; control of noise and protection of recipients.

1. **Analyze the influence of environmental and spatial variables**, such as source type, distance, and the nature of the surrounding medium, on noise levels, and evaluate noise control approaches in line with environmental and health standards.
2. **Interpret scientific data and information related to noise pollution** and utilize them to understand general patterns of acoustic emissions, with the ability to draw logical conclusions that support sound environmental decision-making.
3. **Recognize the role of the environmental engineer** in assessing noise-related risks and developing strategies to mitigate their effects, along with understanding the legal and regulatory frameworks associated with noise control.

4. **Develop teamwork and environmental communication skills** through the discussion of real-world case studies and the proposal of scientifically-based solutions for reducing noise pollution in various environments.

3. Prerequisite(s)
None

4. Textbook(s) and/or other required materials:
Environmental Noise Pollution: Noise Mapping, Public Health, and Policy by Enda Murphy and Eoin A. King.
Publisher: Academic Press, 2014, ISBN: 978-0124115958

5. Course Learning Outcomes
On successful completion of this course students will be able to:

a) **Identify and evaluate the main sources of environmental noise** and understand how factors such as source characteristics, distance, and surrounding environment affect noise propagation and intensity.
b) b) **Interpret and analyze noise pollution data** using scientific and analytical methods, and apply this understanding to real-world environmental situations.
c) c) **Assess various noise control strategies and mitigation measures**, considering their effectiveness, feasibility, and alignment with environmental regulations and health standards.
d) d) **Make informed judgments on noise pollution issues** based on ethical, professional, environmental, and social considerations, while recognizing the broader implications of noise on public health and quality of life.

6. Topics:

Students will learn to:

- ✓ **sources and classifications of environmental noise**.
- ✓ **health and environmental impacts of prolonged exposure to noise pollution.**
- ✓ **methods of noise measurement**.
- ✓ **noise control techniques**.

7. Class/laboratory Schedule:
No lab

Week	Topic (Lecture)
1	Introduction to Noise Pollution: definitions, importance, overview
2	Basics of Sound and Acoustics: sound wave properties, dB scale
3	Sources and Types of Environmental Noise
4	Effects of Noise on Human Health and Environment
5	Noise Measurement Principles: time weighting, frequency weighting
6	Noise Propagation and Attenuation
7	Industrial Noise and Workplace Standards
8	Traffic and Transportation Noise
9	Aircraft and Construction Noise

10	National and International Regulations
11	Noise Control Methods: barriers, insulation, zoning
12-13	Public Awareness and Noise Management Strategies
14	Ethical and Professional Responsibilities
15	Review and Project Presentations

8. Design Project:

None

9. Evaluation Methods:

Midterm exams (20%), Quizzes (10%), PBL project presentation (6%), Assignments (4%), and final exam (60%).

11. Contribution to Professional Component:

For the Noise Pollution course, it provides students with an opportunity to develop key graduate attributes such as in-depth environmental knowledge, awareness of public health implications, and readiness to engage in environmental protection and community service. It also equips them with professional and ethical skills to assess noise-related issues, propose practical mitigation strategies, and contribute to creating healthier and more sustainable urban and industrial environments, while promoting safety, responsibility, and environmental justice.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcome 1):

- Develop the ability to assess environmental noise problems and propose appropriate mitigation strategies that align with public health and safety considerations, taking into account global, cultural, social, environmental, and economic contexts relevant to environmental engineering.

- Cultivate an understanding of ethical and professional responsibilities in addressing noise pollution issues, enabling students to make informed and responsible judgments regarding the impact of environmental noise on human well-being, ecosystems, and society as a whole.

1. Course Number & Title (Credit Hours, Required or Elective):

U302 - English Language III, (2, Required)

1. Course Number & Title (Credit Hours, Required or Elective):

ENV403 - Specification & Estimating,

2. Course Description:

This course provides comprehensive knowledge of estimation techniques and the preparation of technical specifications for building and civil engineering projects. It covers preliminary and detailed cost estimation, quantity take-off, methods of measurement, and the development and use of specifications in construction

documentation. The course emphasizes applied examples, construction work classifications, and their integration with drawings and project documents.

3. Prerequisites:

Construction Materials and Methods

4. Textbook(s) and/or other required materials:

- *Estimating in Building Construction*, 9th Edition by Steven J. Peterson & Frank R. Dagostino. Pearson, 2020. ISBN: 9780134995144
- Instructor handouts and sample specification documents

5. Course Learning Outcomes:

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

- Understand the objectives and methods of construction estimation.
- Prepare quantity take-offs and cost estimates for different types of construction works.
- Identify and apply units of measurement in civil and building work.
- Classify and quantify construction works using appropriate methods.
- Understand the development, function, and writing of technical specifications.
- Integrate specifications with engineering drawings and construction documents.

6. Topics:

Week	Topic
1	Introduction to estimation: purpose and benefits
2	Preliminary and detailed estimation – Estimating construction cost
3	Quantities of building and civil engineering works
4	Applied examples for residential building estimation – Quantity tables and methods – Units of measurement
5	Classification of works and measurement methods
6	Estimation of interior and exterior finishing works
7	Estimation of construction works above the DPC level
8	Earthworks in civil engineering projects
9	Sewage network works and their quantities
10	Technical specifications for building works
11	Reference specifications
12	Systems used in writing specifications
13	Relation between specifications and drawings
14	Functions of technical specifications

Week	Topic
15	Purpose of preparing technical specifications
16	Final Exam

7. Class/laboratory Schedule:

No lab

8. Design Project:

None

9. Computer/software Use:

None required; optional use of spreadsheet software for estimation tables

10. Evaluation Methods:

- Midterm Exams: 20%
- Quizzes: 10%
- PBL/Applied Estimation Assignment: 10%
- Final Exam: 60%

11. Contribution to Professional Component:

This course contributes to the professional component by equipping students with essential skills in estimating and specification writing, which are critical for planning, budgeting, and communicating technical details in construction projects. It prepares students for real-world challenges in cost planning and contract documentation.

12. Relationship to Student Outcomes:

This course contributes to the following student outcomes:

- **SO2**: An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health, safety, and various contextual factors.
- **SO4**: An ability to communicate effectively with a range of audiences through specifications and estimation reports.
- **SO5**: An ability to recognize professional responsibilities and make informed judgments, considering economic and societal factors in construction estimation.

14. Prepared by:

Saif Saad Mohammed,2024

1. Course Number & Title (Credit Hours, Required or Elective):
E401 - Graduation Project I, all faculty
1. Course Number & Title (Credit Hours, Required or Elective):
ENV402 - Engineering Management,

2. Course Description:
This course introduces engineering students to the fundamental concepts, tools, and practices in engineering management, particularly within the context of construction and project execution. Topics include the roles and responsibilities of project managers, planning and scheduling methods (CPM, PERT, LOB), time-cost trade-offs, resource leveling, and financial forecasting. Emphasis is placed on using analytical tools to optimize performance in engineering projects.

3. Prerequisites:
None

4. Textbook(s) and/or other required materials:

- Kerzner, H. *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, 12th Edition.
- Instructor's lecture notes and practice problems

5. Course Learning Outcomes:
Upon successful completion of this course, students will be able to:

- Understand the principles of engineering and construction management.
- Identify project phases and the duties of a project manager.
- Create and analyze project schedules using bar charts and network techniques.
- Apply CPM and PERT methods to determine project timelines and critical paths.
- Conduct resource leveling and assess time-cost trade-offs in engineering projects.
- Use forecasting methods to manage cash flow and monitor project costs.

6. Topics:

Week	Topic
1	Introduction, Principles of Management, Keywords, and References
2	Characteristics of Construction, Project Phases, and Project Manager Duties
3	Time Control Techniques and Bar-Chart Scheduling
4	Planning and Control Techniques, Network Diagrams
5	Critical Path Method (CPM) – Basics
6	Critical Path Method (CPM) – Continued

Week	Topic
7	Time-Cost Relationship in Project Management
8	Resource Leveling Techniques
9	Program Evaluation and Review Technique (PERT)
10	Precedence Diagramming Method (PDM)
11	Line of Balance (LOB) Method
12	Cash Flow Forecasting and Cost Control in Networks

7. Class/laboratory Schedule:
Lecture: 3 hours/week
No laboratory

8. Design Project:
Optional class mini-project on scheduling and resource planning using CPM/PERT

9. Computer/software Use:
Optional use of Microsoft Project or Primavera P6 for schedule modeling

10. Evaluation Methods:

- Quizzes and Assignments: 10%
- Midterm Exam: 30%
- Final Exam: 60%

11. Contribution to Professional Component:
This course strengthens project management and organizational skills among engineering students. It provides essential tools for planning, controlling, and executing engineering projects effectively and economically—skills required in both public infrastructure and private sector engineering roles.

12. Relationship to Student Outcomes:
This course supports the following ABET student outcomes:

- **SO2**: Apply the engineering design process to develop feasible schedules and resource allocations.
- **SO4**: Communicate management plans and performance through technical documentation.
- **SO5**: Recognize professional roles and ethical responsibilities in engineering leadership and decision-making.
-

13. Prepared by:
Aws S. Noaman
Department of Environmental Engineering

Academic Year: 2024–2025

1. Course Number & Title (Credit Hours, Required or Elective):

ENV401 - Simplified Wastewater Treatment Systems, (3, Required)

2. Course Description:

This course provides an in-depth overview of simplified wastewater treatment systems, focusing on the design and operation of biological treatment processes. Students will learn the principles behind both aerobic and anaerobic systems, including suspended and attached growth processes. Emphasis is placed on practical applications such as extended aeration, oxidation ditches, lagoons, trickling filters, and modern anaerobic reactors. The course prepares students to evaluate and design cost-effective, low-energy treatment systems suitable for developing regions or small communities.

3. Prerequisites:

Environmental Engineering or Wastewater Engineering

4. Textbook(s) and/or other required materials:

- *Wastewater Engineering: Treatment and Resource Recovery*, 5th Edition by Metcalf & Eddy, Inc., McGraw-Hill Education.
- Instructor handouts and technical guidelines (WHO, UN-Habitat, etc.)

5. Course Learning Outcomes:

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

- Understand and design various types of simplified biological treatment systems.
- Differentiate between suspended and attached growth systems.
- Analyze system performance and suitability for small communities and decentralized systems.
- Apply engineering principles in the design of both aerobic and anaerobic units.
- Evaluate energy and resource recovery potentials from wastewater.

6. Topics:

Week	Topic
1	Design of Secondary Biological Treatment Units – Suspended Growth Process: Extended Aeration System
2	Oxidation Ditch
3	Aerated Lagoon
4	Waste Stabilization Pond
5	Design of Aerobic Biological Treatment Units: Attached Growth Processes
6	Trickling Filters
7	Midterm Exam
8	Bio Towers

Week	Topic
9	Rotating Biological Contactors (RBC Units)
10	Design of Anaerobic Biological Treatment Units – Attached Growth Processes: Packed Bed Up-flow & Down-flow Reactors
11	Extended Bed Reactors & Fluidized Bed Reactors
12	Up-flow Anaerobic Sludge Blanket (UASB) Reactor
13	Anaerobic Suspended Growth Processes
14	Secondary Clarification
15	Methane Gas Production from Wastewater
16	Final Exam

7. Class/laboratory Schedule:
Lecture only, 3 hours per week

8. Design Project:
None

9. Computer/software Use:
None required

10. Evaluation Methods:

- Midterm Exam: 20%
- Assignments/Quizzes: 10%
- Design Application Problem (PBL): 10%
- Final Exam: 60%

11. Contribution to Professional Component:
This course contributes to students' understanding of sustainable wastewater treatment approaches, emphasizing cost-effective and energy-efficient systems suitable for developing and decentralized areas. It equips students with practical knowledge relevant to field applications in environmental and civil engineering.

12. Relationship to Student Outcomes:
This course supports the following ABET student outcomes:

- **SO2**: Apply the engineering design process to develop systems for community sanitation with environmental considerations.
- **SO3**: Communicate technical information related to treatment processes clearly and effectively.
- **SO5**: Demonstrate awareness of the environmental, societal, and economic impacts of wastewater management systems.

13. Prepared by:
Salwa Hadi Ahmed, 2024

1. Course Number & Title (Credit Hours, Required or Elective):
ENV404 - Sludge Treatment,(2, Required)

2. Course Description:
This course introduces students to the principles, processes, and technologies used in sludge treatment and disposal as part of wastewater management systems. It covers the characterization, estimation, stabilization, dewatering, and disposal of sludge using physical, chemical, and biological methods. Emphasis is placed on sustainable solutions, resource recovery, and compliance with environmental standards.

3. Prerequisites:
Wastewater Treatment Engineering or equivalent

4. Textbook(s) and/or other required materials:

- *Sludge Processing, Treatment, and Disposal*, by Izrail S. Turovskiy and P.K. Mathai. Wiley-Interscience.
- Supplementary materials, standards, and technical manuals from WHO, US EPA, and Iraqi MOE

5. Course Learning Outcomes:
Upon successful completion of this course, students will be able to:

- Define and characterize sludge in municipal wastewater treatment plants (WWTPs).
- Estimate sludge production using mass and volumetric balances.
- Evaluate and design sludge treatment methods such as thickening, stabilization, and dewatering.
- Identify and assess final disposal and reuse options for treated sludge.
- Address environmental and health risks associated with sludge handling.
- Apply national and international regulations in sludge management.
- Propose sustainable sludge treatment strategies aligned with the circular economy and life cycle principles.

6. Topics:

Week	Topic
1	Introduction to Sludge Treatment – Definition, types, and sources of sludge
2	Sludge Characteristics – Moisture content, organic/inorganic makeup, microbial load
3	Sludge Production Estimation – Mass and volumetric estimation for primary/secondary treatment

Week	Topic
4	Thickening Methods – Gravity, flotation, centrifugation
5	Sludge Stabilization – Aerobic digestion: principles, kinetics, design
6	Sludge Stabilization – Anaerobic digestion: principles, kinetics, design
7	Chemical Conditioning – Coagulants, polymers, and pH adjustments
8	Midterm Exam / Review
9	Dewatering Techniques – Drying beds, belt presses, centrifuges, screw presses
10	Sludge Drying – Thermal drying and energy considerations
11	Sludge Disposal – Land application, landfilling, incineration
12	Resource Recovery – Biogas, nutrient (N, P) recovery, composting
13	Environmental and Health Risks – Pathogens, heavy metals, odors, leachate
14	Regulations and Standards – Iraqi and international standards
15	Sustainable Sludge Management – LCA, energy use, circular economy

7. Class/laboratory Schedule:
Lecture: 2 hours/week
Tutorial: 1 hour/week

8. Design Project:
None

9. Computer/software Use:
None required

10. Evaluation Methods:

- Midterm Exam: 20%
- Assignments/Quizzes: 10%
- Final Exam: 70%

11. Contribution to Professional Component:
This course supports professional development in the area of wastewater engineering by equipping students with critical knowledge of sludge treatment operations. It emphasizes environmental protection, energy efficiency, resource recovery, and regulatory compliance, preparing students to work in municipal utilities, consulting, and environmental agencies.

12. Relationship to Student Outcomes:
This course contributes to the following ABET student outcomes:

- **SO1**: Identify and solve sludge management problems using engineering principles.

- **SO2**: Apply engineering design to create sustainable and environmentally sound treatment solutions.
- **SO5**: Recognize ethical and professional responsibilities in environmental decision-making.

13. Prepared by:
Asst. Prof. Dr. Haneen Ahmed Khudhair Karaghool
Department of Environmental Engineering
2025

1. Course Number & Title (Credit Hours, Required or Elective):
ENV405 - Wastewater Reuse, (2, Required)

2. Course Description:
This course introduces the principles, technologies, and applications of water reuse in environmental and industrial contexts. It covers types of reclaimed water, constituents in reused water, reuse categories, risk assessment, storage, and regulatory standards. Emphasis is placed on sustainable practices, industrial reuse, groundwater recharge, and advanced treatment processes such as membrane filtration and reverse osmosis.

3. Prerequisites:
Introduction to Environmental Engineering or Water and Wastewater Engineering

4. Textbook(s) and/or other required materials:

- Metcalf & Eddy. *Wastewater Engineering: Treatment and Resource Recovery*, McGraw-Hill.
- WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater
- Lecture notes and handouts provided by the instructor

5. Course Learning Outcomes:
Upon successful completion of this course, students will be able to:

- Define key concepts and terminology related to water reuse.
- Identify categories and applications of reclaimed wastewater.
- Understand health and environmental risks related to reused water and conduct basic risk assessment.
- Evaluate physical, chemical, and biological constituents in reclaimed water.
- Analyze water reuse regulations and implement storage and treatment practices.
- Apply membrane filtration and reverse osmosis in water reclamation systems.
- Design basic water reuse scenarios including industrial reuse and groundwater recharge.

6. Topics:

Week	Topic
1	Definitions and key terms in water reuse
2	Applications and categories of wastewater reuse; issues and constraints
3	Constituents in reclaimed water
4	Introduction to risk assessment (theory + practical)
5	Guidelines and regulations governing water reuse
6	Storage systems for reclaimed water (theory + practical)
7	Industrial water reuse (theory + practical)
8	Stability indexes of water (theory + practical)
9	Groundwater recharge using reclaimed water
10	Overview of water reclamation technologies
11	Membrane filtration systems (theory + practical)
12	Reverse osmosis systems (theory + practical)

Total Contact Hours:

- Theory: 30 hours
- Practical: 15 hours

7. Class/laboratory Schedule:
Lecture: 2 hours/week
Practical/Lab: 1 hour/week

8. Design Project:
None

9. Computer/software Use:
Basic spreadsheet tools for calculations and data analysis

10. Evaluation Methods:

- Midterm Exam: 20%
- Practical Performance: 20%
- Assignments/Quizzes: 10%
- Final Exam: 50%

11. Contribution to Professional Component:
The course enhances students' capabilities in sustainable water resource management by applying engineering principles to water reuse systems. Students learn to integrate risk analysis, regulatory compliance, and advanced treatment techniques into viable reuse projects suitable for municipal and industrial applications.

12. Relationship to Student Outcomes:
This course contributes to the following ABET student outcomes:

- **SO2**: Apply engineering design to develop water reuse systems meeting environmental and safety needs.
- **SO4**: Communicate effectively on regulatory and technical aspects of water reuse.
- **SO5**: Understand professional and ethical responsibilities in the context of water sustainability and public health.

13. Prepared by:
Mr. Mohammed Taha Hmood
Department of Environmental Engineering
Tikrit University
2025

1. Course Number & Title (Credit Hours, Required or Elective):
ENV406 - Heat Transfer, (2, Required)

1. Course Number & Title (Credit Hours, Required or Elective):
ENV407 - Environmental Impact Assessment, (2, Required)

2. Course Description:
This course introduces the principles, processes, and tools of Environmental Impact Assessment (EIA). It covers the legal and procedural aspects of EIA, methods for identifying and evaluating potential environmental impacts, and preparation of environmental reports for proposed industrial and development projects. Emphasis is placed on sustainability, stakeholder engagement, and decision-making support.

3. Prerequisites:
Introduction to Environmental Engineering

4. Textbook(s) and/or other required materials:

- Canter, L. W. *Environmental Impact Assessment*, 2nd Edition, McGraw-Hill.
- Iraqi and international environmental assessment guidelines
- Case studies and example reports provided by the instructor

5. Course Learning Outcomes:
Upon successful completion of this course, students will be able to:

- Understand the concept, evolution, and objectives of EIA.
- Identify the procedural and legal requirements of the EIA process.
- Evaluate environmental impacts using standard methods (checklists, matrices, direct techniques).
- Prepare components of an EIA report including scoping, impact prediction, and mitigation.

- Analyze case studies and apply EIA tools to proposed projects.
- Design an Environmental Management Plan (EMP) as part of the EIA process.

6. Topics:

Week	Topic
1	Introduction to Environmental Impact Assessment – Definitions
2	Evolution of the EIA Concept – Application to Proposed Industrial Projects
3	Objectives of EIA, EIA Requirements, and Timelines
4	Types of Environmental Impacts – Evaluation Checklists and Criteria – Stakeholder Roles
5	EIA Costs, Methodology, Process Stages, Environmental Management Plan
6–7	Tools and Techniques for EIA: Direct Method, Checklists, Matrix Methods
8	Case Studies and Sample EIA Reports

Total Contact Hours: 24

7. Class/laboratory Schedule:
Lecture: 2 hours/week

8. Design Project:
None

9. Computer/software Use:
None required; optional use of Excel or GIS tools for impact mapping

10. Evaluation Methods:

- Midterm Exam: 30%
- Assignments and Participation: 10%
- Final Exam: 60%

11. Contribution to Professional Component:
This course equips environmental engineering students with the technical and procedural tools to assess environmental consequences of projects and recommend sustainable practices. It supports compliance with regulatory standards and enhances interdisciplinary coordination in environmental planning.

12. Relationship to Student Outcomes:
This course supports the following ABET student outcomes:

- **SO2**: Ability to design and evaluate engineering solutions with environmental considerations

- **SO4**: Effective communication through EIA documentation and stakeholder engagement
- **SO5**: Awareness of professional and ethical responsibilities in environmental decision-making

13. Prepared by:
Dr. Mohammed M. Numaan
Department of Environmental Engineering
Date: 13 Sep. 2024

1. Course Number & Title (Credit Hours, Required or Elective):
ENV408 - Engineering Economic, (2, Required)

2. Course Description:

Building on foundational knowledge from Engineering Management—including principles of engineering management, project scheduling techniques (bar charts, critical path method, and line of balance)—this course develops the economic evaluation skills essential for engineering decision-making. Topics covered include the time value of money, simple and compound interest, nominal and effective interest rates, and the effects of inflation on project costs. Students also explore methods of depreciation and the application of value management to optimize project performance. Practical problem-solving and comparative economic analysis of engineering alternatives are emphasized throughout.

3. Prerequisites:
None

4. Textbook(s) and/or other required materials:
Engineering economy, Leland blank, Anthony Tarquin, seventh edition 2012

5. Course Learning Outcomes

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

1. **Apply** the concepts of time value of money to evaluate engineering alternatives using present worth, future worth, annual worth, and rate of return methods.
2. **Differentiate** between simple and compound interest, and between nominal and effective interest rates, and apply them to real-world financial problems.
3. **Incorporate** the effects of inflation in economic analysis and adjust cash flows accordingly in long-term engineering projects.
4. **Analyze** various methods of depreciation and determine asset values over time for cost estimation and accounting purposes.
5. **Integrate** value management principles to enhance project value and support informed economic decision-making in engineering contexts.
6. **Conduct** basic feasibility studies, including break-even and payback period analysis, to assess the viability and risk of engineering projects.

6. Class Schedule:

Engineering Economy

Week	Topic
1	Introduction to Engineering Economy and Review of Engineering Management
2	Time Value of Money: Basic Concepts and Equivalence
3	Simple Interest and Compound Interest Calculations
4	Cash Flow Diagrams and Economic Evaluation Criteria (PW, FW, AW)
5	Nominal and Effective Interest Rates
6	Uniform and Gradient Cash Flow Series
7	**Midterm Exam**
8	Depreciation Methods: SL, DB, and MACRS
9	Inflation and Price Change Considerations
10	Rate of Return (IRR) and Benefit-Cost Ratio
11	Payback Period and Break-even Analysis
12	Feasibility Studies: Structure and Evaluation
13	Value Engineering and Value Management Concepts
14	Course Review and Integrated Case Study
15	**Final Exam**

7. Computer/software Use:
Students typically use Microsoft Word in writing their assignments.

8. Evaluation Methods:
- Quizzes and home works 10%,
- Assessment 5%
- Seminar 5%
- Midterm exams 20%
- Final exam 60%

1. Course Number & Title (Credit Hours, Required or Elective):
ENV409 - Industrial Waste Management, (3, Required)

2.Course Description:
Industrial waste and waste management is the study of quality requirements of boiler and cooling waters, quality requirements of process water for textiles, food processing and brewery Industries, boiler and cooling water treatment methods. Basic theories of industrial waste water management, volume reduction and strength reduction. Neutralization, equalization and proportioning. Joint treatment of industrial wastes, consequent problems. Industrial wastewater discharges into streams, Lakes, oceans, and problems. Recirculation of industrial wastes. Use of Municipal Waste Water in Industries.

3. Prerequisite(s):
None

4.Textbook(s) and/or other required materials:
a-M.N. Rao and Dutta (2009), Waste Water Treatment, Oxford & IBH, New Delhi**.**
b-Met Calf and Eddy (1979), waste water engineering, Mc Graw hill publications, New Delhi, India **.**
c-Mark J. Hammer and Mark J. Hammer (Jr) (2008), Water and Waste Water technology, Prentice Hall, New York.

5.Course Objectives: Upon completion of this course the students will be to:
1- Be able to understand the basic Concepts of Industrial waste water discharges into streams. Lakes and oceans and problems. Recirculation of Industrial Wastes.
2-Use of Municipal Waste Water in Industries. Able to understand the Properties of industrial waste water
3- Learn how to find the difference between of industrial waste water and understand the basic of Static Fluids and buoyancy phenomena
4- Be able to be familiar with Phenomena surrounding of industrial waste water and that affect them
5- Learn the principle of Dimensional Analysis and how it is applied in the field of liquids

6.Topics:
Indicative content includes the following.

- Sources of pollution WW , General classification of industrial pollution , sampling of industrial WW
- Neutralization , Coagulation , Air flotation
- Treatment process
- industry WW (Source and parameter)

7. Class/laboratory Schedule:
7.1.Class Schedule:

Delivery Plan (Weekly Syllabus)
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Week	Material Covered
Week 1	Types and sources of pollution WW , General classification of industrial pollution , sampling of industrial WW
Week 2	Theories of minimizing the effect of industrial WW , Classification of treatment methods
Week 3	Oil separator to remove free oil globules (API)
Week 4	Neutralization , Coagulation , Air flotation
Week 5	Dialysis
Week 6	Elect dialysis (ED) , type of membrane and system design
Week 7	Reverse osmosis
Week 8	Fouling , Oxidation and reduction
Week 9	Solvent extraction

Week 10	Carbon adsorption
Week 11	Ion exchange design and parameter
Week 12	Food industry WW (Source and parameter)
Week 13	Dairy WW, Sugar WW
Week 14	Chemical industry WW , oil refinery
Week 15	Energy industry , Hydro electrical plant
Week 16	**Final Exam**

8. Design Project:

- None

9. Computer/software Use:

None

10. Evaluation Methods:

Midterm exams (10%), final exam (50%), 4 Quizzes (8%), 10 Lab Reports (20%), 4 Online Assignments (8%), and 2 Onsite Assignments (4%).

11. Contribution to Professional Component:

The students will earn skill of industrial waste water qualification tests and will be able to analyze and interpret ate data.

12. Relationship to Student Outcomes:

On completion of this course students will be able to:
1-Ability to apply knowledge of mathematics, science, and engineering.
2-Ability to design and conduct experiments, as well as to analyze and interpret data.
3-Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4-Ability to function on multi-disciplinary teams
5-Ability to identify, formulates, and solves engineering problems.
Understanding of professional and ethical responsibility.
6-Ability to communicate effectively.
7-The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
8-Recognition of the need for, and an ability to engage in life-long learning.
9-Knowledge of contemporary issues.
10-Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

13. Prepared by:

Aws S. Noaman
Department of Environmental Engineering
Academic Year: 2024–2025

1. Course Number & Title (Credit Hours, Required or Elective):

ENV413 - Water and Sanitary Networks, (2, Required)

2. Course Description:

This course attempted to help satisfy the required need for bringing together the information and fundamental knowledge of the hydraulic design of pipeline systems. This information would be related to the hydraulic design and analysis of water networks, sanitary networks, and plumbing systems in buildings.

3. Prerequisites

Fluid Flow (FLUD-202), Engineering Hydrology (ENHY-302).

4. Textbook(s) and/or other required materials:

Water Supply Engineering Design, M. Anis Al-Layla, S. Ahmad, E. J. Middlebrooks, Ann A. Publishers, Inc,1997

5. Course Learning Outcomes

On successful completion of this course students will be able to:

f) Interpret and analyses data related to flow demand and people growth.
g) Apply the fundamental flow theories to analyze water supply pipeline.
h) Formulate the elementary principles of distributing plumbing system in buildings.
i) Understand the strategies for designing sewer system.
j) Understand the strategies for designing water storm system.

6. Topics:

Students will learn:

Week	Topic
1	General introduction to water resources and study of the water demand
2	Demand prediction and percentage of growth rate
3	Water distribution system, the type of pipes used water supply system
4	Analysis of the water distribution system (Equivalents pipes)
5	Analysis of the water distribution system (Hardy-cross)
6	Plumbing systems, fixtures, and hot and cold water in multistory buildings
7	Plumbing systems, fixtures, and hot and cold water in multistory buildings
8	Mid-Term Exam + The source of sewage
9	The type of sewer systems
10	Appurtenances of the sewer system
11	Design of the sewer system
12	The source of stormwater and rainfall
13	Design of the stormwater pipes system
14	Design of gutters and inlets in stormwater system
15	Review Week Before Final Exam

7. Class/laboratory Schedule:

No lab

8. Design Project:

None

9. Computer/software Use:

None

10. Evaluation Methods:

Exams (mid exams 20%, Quizzes 10%, PBL project 10%, and final exam 60%)

11. Contribution to Professional Component:

Water and Sanitary Networks will provide students with an opportunity to establish fundamental knowledge of hydraulic design and engineering of pipeline systems. Students are introduced to standard hydraulic for the design of water network distribution systems for towns and buildings. Also, they will be able to know the details of the water and sewerage network and their accessories, and everything related to the work of pipelines.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcome 1-7):

2. An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and global, cultural, social, environmental, economic, and other factors as appropriate to the discipline.

13. Prepared by:

Wesam Sameer M. Ali

1. Course Number & Title (Credit Hours, Required or Elective):

ENV411 - Hazard & Radioactive Waste,(2, Required)

2. Course Description:

This course addresses the management of hazardous and radioactive wastes, focusing on identification, transportation, treatment, disposal methods, and the regulatory framework. Emphasis is placed on environmental fate, pollution prevention, recycling strategies, and health and safety of workers dealing with hazardous waste. The course equips students with the technical knowledge necessary for minimizing the risks associated with hazardous waste.

3. Prerequisites:

Environmental Engineering or equivalent introductory environmental science course.

4. Textbook(s) and/or other required materials:

- *Hazardous Waste Management*, 2nd Edition by Michael D. LaGrega, Phillip L. Buckingham, Jeffrey C. Evans. McGraw-Hill Education. ISBN: 9780071181835
- Supplementary lecture materials and case studies provided by the instructor.

5. Course Learning Outcomes:

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

- Define hazardous waste and identify major sources and types.
- Describe pathways and fate of hazardous waste in the environment.
- Understand the transportation, treatment, and disposal processes of hazardous waste.
- Explain pollution prevention and waste minimization strategies.

- Assess methods for recycling and reuse of hazardous materials.
- Discuss radioactive waste management practices and radiation safety measures.
- Understand the occupational health and safety principles for workers in hazardous waste environments.

6. Topics:

Week	Topic
1	Introduction to Hazardous Waste
2	Pathways and Fate of Hazardous Waste Releases
3	Disposition of Hazardous Waste Releases
4	Hazardous Waste Sources and Generators
5	Transportation of Hazardous Wastes
6	Disposal Methods of Hazardous Waste
7	Midterm Exam
8	Treatment Methods of Hazardous Waste
9	Processes of Hazardous Waste
10	Pollution Prevention and Waste Minimization
11	Reuse and Recycling of Hazardous Materials
12	Radioactive Waste Management
13	Radiation Protection
14	High- and Low-Level Radioactive Waste Management
15	Hazardous Waste Worker Health and Safety
16	Final Exam

7. Class/laboratory Schedule:
No laboratory component

8. Design Project:
None

9. Computer/software Use:
None required

10. Evaluation Methods:

- Midterm Exam: 20%
- Quizzes & Assignments: 10%
- Project or Case Study on Waste Management: 10%
- Final Exam: 60%

11. Contribution to Professional Component:
This course contributes to the environmental and safety awareness of engineering students by teaching them how to manage hazardous waste responsibly and efficiently. It integrates health, environmental sustainability, and legal compliance into the practice of engineering design and operation in industrial and municipal sectors.

12. Relationship to Student Outcomes:
This course supports the following ABET student outcomes:

- **SO2**: Apply the engineering design process to develop solutions considering safety and environmental constraints.
- **SO4**: Communicate effectively about risks and mitigation strategies related to hazardous materials.
- **SO5**: Recognize ethical and professional responsibilities, especially concerning health, safety, and environmental regulations.

13.Prepared by:
Mohammed Mothanna Numaan

1. Course Number & Title (Credit Hours, Required or Elective):
E402 - Graduation Project II, all faculty

1. Course Number & Title (Credit Hours, Required or Elective):
ENV410 - Geographical information System, (2, Required)

2. Catalog Description:
GIS is a hardware/software system for managing and displaying spatial data. GIS identifies and studies many environments in many directions, especially physical, biological, chemical, and climate. It tracks the changes occurring in a given area and estimates the different impacts on neighboring regions by comparing a set of images and maps on different dates.

3. Prerequisite(s): for GIS.
None

4. Textbook(s) and/or other required materials:

- Textbook of Remote Sensing and Geographical Information Systems 3rd Edition . M.Anjreddy, 2008
- Introduction To Geographic Information Systems Nine Edition By Kang-Tsung Chang 2018
- Decker, Drew. GIS data sources. John Wiley & Sons, 2001.
- Van Sickle, Jan. Basic GIS coordinates. CRC press, 2010.

5. Course Objectives:
This course aims to familiarize you with essential topics in GIS applications. Specific topics include, but are not limited to, building geodatabase, adding and displaying data,

querying, editing, analyzing, working with tables, and finally presenting data. At the end of this course, the student will apply projects on environmental topics. The course includes a lecture and lab component, both of which are student-centered and thus highly interactive.

6. Topics:

- Introduction to Geographic Information Systems GIS.
- ArcCatalog & ArcMap.
- Using GIS with Global Positioning System GPS and Coordinate systems.
- Editing & Tables in GIS and Working with tables..
- Symbology , Labelling and Toolbox

7. Class/laboratory Schedule:

2Hours Class and 3Hours laboratory.

7.1: Class Schedule:

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to Geographic Information Systems GIS.
Week 2	Identifying the essential elements (people, computers, data, and analysis software) in GIS.
Week 3	Identifying the main components of the computer and input/output units.
Week 4	Accessing the analysis and drawing program **ArcMap.**
Week 5	Explanation of ArcMap software (theoretically and practically). and how to open a SHP file.
Week 6	Opening an existing map document, Adding data, Moving around the map, Displaying a layer, Identifying a feature, Adding graphics, and Laying out a map
Week 7	**Midterm exam**
Week 8	Introduction to GPS and Coordinate systems.
Week 9	Using GIS with Global Positioning System GPS.
Week 10	Editing & Tables in GIS : Editor tool and Working with tables.
Week 11	Symbolizing Points, Symbolizing Polygons.
Week 12	Symbolizing Categories, Graduated Color, and Labeling Features.
Week 13	Analysis tools, Conversion tools. Statistics and Modeling.
Week 14	Statistics and Modeling.
Week 15	Map layout, and Project
Week 16	**Final Exam**

8. Design Project:

None

9. Computer/software Use:

ArcGIS (ArcMAP) is typically used. Students also use Microsoft words in writing their reports of problem-based learning in addition to google meeting and classroom.

10. Evaluation Methods:

(Two hours Mid-Exams, exam 10%, three hours final exam 60%)

(Quizzes, Lab. reports, Online Assignments, and Onsite Assignments, projects 30%).

11. Contribution to Professional Component:

The aim of this Geographic Information Systems (GIS) course is to provide students with a thorough understanding of GIS concepts, data collection, and spatial data analysis. The course focuses on creating digital maps and utilizing GIS tools for advanced spatial analysis. Students will learn to interact with various types of data and apply GIS techniques using modern software. By the end, students will be equipped to use GIS in fields such as urban planning, natural resource management, and environmental projects.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

For GIS, students will learn:

1. The ability to apply engineering knowledge and modern techniques, design and solve engineering problems within economic, environmental, and social constraints, and work effectively in multidisciplinary teams.
2. A deep understanding of professional and ethical responsibility, effective communication skills, and awareness of contemporary issues, along with a commitment to lifelong learning.

13- Prepared by:

Saif Saad

1. Course Number & Title (Credit Hours, Required or Elective):

ENV412 - Mass Transfer, (2, Required)

2. Catalog Description:

Mass Transfer course offers a comprehensive introduction to mass transfer operations, ranging from basic to intermediate concepts. It focuses on the principles of diffusion and interphase mass transfer, applying these concepts to various processes such as distillation and absorption. Emphasizing both theoretical fundamentals and practical applications, the course equips students with analytical methods for addressing steady-state and unsteady-state mass transfer challenges. Through a combination of theory and industrial problem-solving, students will develop a solid understanding of mass transfer processes and their real-world applications.

3. Prerequisite(s): for Thermodynamics

None

4. Textbook(s) and/or other required materials:

- **Mass Transfer: Theory and Practice,** Anantharaman, N., and KM Meera Sheriffa Begum, PHI Learning Pvt. Ltd., 2017.
- **Fundamentals of Momentum, Heat, and Mass Transfer,** Welty, Wicks, Wilson, Rorrer, 6th ed., John Wiley & Sons, Inc., 2014.

5. Course Objectives:

This course provides students with the fundamentals of mass transfer and the principles behind processes such as absorption, distillation, leaching, and liquid extraction. Students will apply theoretical knowledge to the design and evaluation of these processes. The course focuses on developing analytical and conceptual skills needed to address real-world mass transfer challenges. By the end, students will have a solid foundation to understand, apply, and solve complex mass transfer problems.

6. Topics:

- Introduction to Diffusion and Diffusivity (9 hrs)
- Mass Transfer Theory and Coefficients (9 hrs)
- Environmental engineering applications of Mass Transfer (12 hrs)

7. Class/laboratory Schedule:

2 Hours Class

7.1: Class Schedule:

Delivery Plan (Weekly Syllabus)

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Week	Material Covered
Week 1	Introduction & Overview of Mass Transfer Operation
Week 2	Molecular and Eddy Diffusion, Diffusion velocities, and Fluxes
Week 3	Fick's First and Second Law
Week 4	Steady-state molecular diffusion in fluids under stagnant and laminar flow conditions
Week 5	Diffusion through the variable cross-sectional area
Week 6	Gas phase diffusion coefficient measurement, Gas phase diffusion coefficient Prediction
Week 7	**Mid-Term Exam**
Week 8	liquid phase diffusion coefficient measurement and prediction
Week 9	Mass transfer coefficient concept and classifications
Week 10	Mass transfer coefficient in laminar flow
Week 11	Mass transfer theories, Interphase mass transfer
Week 12	Introduction to absorption, Equilibrium in gas-liquid system
Week 13	Design of packed column absorber based on the Individual Mass Transfer Coefficient
Week 14	Introduction to distillation
Week 15	Distillation in packed towers
Week 16	**Final Exam**

8. Design Project:

None

9. Computer/software Use:

Students typically use WORD OFFICE in writing their reports of problem-based learning in addition to google meeting and classroom.

10. Evaluation Methods:

(One hour Monthly-Exams 20%, three hours final exam 60%)
(Quizzes 5%, Online Assignments 5%, project 5%, and seminar 5%).

11. Contribution to Professional Component:

This course provides essential knowledge for environmental engineering by teaching mass transfer principles. Students will understand modes of mass transfer, molecular diffusion, and Fick's Law, which are key for analyzing pollutant movement. They will apply mass transfer principles to predict transfer coefficients, critical for designing environmental systems. Students will also identify mass transfer operations and evaluate the stages needed for effective environmental processes like air and water treatment.

12. Relationship to Student Outcomes:

Course Learning Objectives (related Student Outcomes 1-7):

For Mass transfer, the course will achieve:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (1).

13. Prepared by:

Ahmed Y. Radeef, 2025

1. Course Number & Title (Credit Hours, Required or Elective):

– English Language IV, (2.0, Required)

2. Catalog Description:

This course is designed to provide engineering students with the necessary oral and written skills required for effective communication in academic and workplace contexts, both with experts in their field and lay persons. It begins by introducing them to the principles of good academic practice, which are also presented as a model for ethical workplace practice, and thus help them to avoid issues such as plagiarism. The main part then leads on to developing research and summarizing skills that form the basis for the later activities. Students next learn to apply these skills to conducting technical presentations, as well as in group discussions that culminate in project planning activities.

3. Prerequisite(s):

English III

4. Textbook(s) and/or other required materials:

- Beer, D. & McMurrey, D. 2004, A Guide to Writing as an Engineer (2nd ed), New York: Wiley

- Borowick, Jerome N., 2002, Technical Communication and its Applications (2nd ed), New Jersey: Prentice-Hall, Inc.

5. Course Objectives:

5. Identify various reading skills and apply them in reading, referencing and summarizing literature on engineering
6. Identify various skills of technical presentation and apply them in conducting short technical presentations based on information extracted from readings
7. Identify technical discussion skills and apply these in planning and conducting simulated technical discussions characteristic of those that go on in engineering contexts.
8. Identify and compare the structures and language characteristics of various types of written study and workplace reports characteristic of those produced by engineering students and practicing engineers (e.g., incident reports and progress reports) mainly, and applying this knowledge in writing one of the latter
9. Develop communication skills through active participation in class and group activities.

6. Topics:

Students will learn:

- Technical presentations
- Conducting technical discussions about engineering projects
- Writing technical documents
- Writing business correspondence

7. Class/laboratory Schedule:

No lab

8. Design Project:

In addition, exams, there is a problems-based learning.

9. Computer/software Use:

Students typically use words in writing their reports of problem based learning.

10. Evaluation Methods:

Exams (two hours mid exam 10%, three hours final exam 60%)
Problem Based Learning project 10%, Quizzes 10%, seminars 10%

11. Contribution to Professional Component:

1. Cognitive goals

2. Developing the learning competence of getting a new language.

3.Setting the requirements and grammatical resemblance among languages.

4.The skills goals special to the program.

5. Writing and reading skills.

6.Speaking and listening skills.

12. Relationship to Student Outcomes:
Course Learning Objectives (related Student Outcomes 3-5-7):

Course objectives no.	The relation to student outcomes
1	4
2	4
3	4
4	4
5	4