56 Course Specification of Sanitary Engineering-2

I. Course Identification and General Information:							
1	**Course Title:**	***Sanitary Engineering-2***					
2	**Course Code & Number:**	CE402					
3	**Credit hours:**	C.H				**Credit Hours**	
		Th.	Tu.	Pr.	Tr.		
		2		2		3	
4	**Study level/ semester at which this course is offered:**	5th Level/ 1st semester					
5	**Prerequisite (if any):**	Sanitary Engineering-1, Irrigation Eng., Harbor Eng.					
6	**Co –requisite (if any):**						
8	**Program (s) in which the course is offered:**	Civil Engineering					
9	**Language of teaching the course:**	English+ Arabic					
10	**Location of teaching the course:**	Classroom+ lab					
11	**Prepared By:**	Prof. Dr. Fadhl Al-Nozaily					
12	**Date of Approval**						

II. Course Description:

This course deals with basic topics in sanitation Network and wastewater Engineering. It will mainly include some topics such as basic information about wastewater characteristics, design, operation and maintenance of sewerage networks, sewage pumping stations, Manholes and appurtenances, wastewater treatment plants, sludge treatment, plumbing system in houses.

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
	Dr. Abdulkareem Yahya Al khattabi	Ass. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Ass. Prof. Dr. Huda Al-Emad

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III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a.1	Describe the role of sanitary Engineer in the society in order to protect the environment from pollution.	**A4**
a.2	Discuss the traditional practice of sanitation that applied in the early days in Yemen.	**A2**
a.3	Define the knowledge of mathematics for estimating wastewater discharges and population forecasting.	**A1**
b.1	Discuss the characteristics of the wastewater in the reference books and compare with Yemen case.	**B1**
b.2	choose the knowledge of mathematics for estimating wastewater discharges and population forecasting.	**B2**
b.3	Choose appropriate methods of mathematics in calculating the hydraulic and organic loading and the design of different wastewater treatment units.	**B2**
b.4	Compare the wastewater quality to the international standards from industries as well as for the population equivalent from organic and quantity point of view.	**B3**
c.1	Design of sewerage networks, pumping stations, force main.	**C2**
c.2	Apply newly developed package software such as SewerCad, civil 3D to design sewerage networks.	**C3**
c.3	Design of wastewater treatment processes/ units	**C2**
c.4.	Use laboratory and field equipment to analyze wastewater quality, record, analyze	**C1**
d.1	Communicate effectively within multi-disciplinary teams and act professionally in design and supervision of wastewater projects in order to be able to lead and supervise a group of designers and site technicians.	**D1**

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1- Discuss the role of sanitary Engineer in the society in order to protect the environment from pollution.	Lecture Multimedia Presentations	Written assignment; quiz, Midterm Exam; Final exam; student's presentation
a2- Discuss the traditional practice of sanitation that applied in the early days in Yemen.		
a.3 Define the knowledge of mathematics for estimating wastewater discharges and population forecasting.		

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b.1.- Discuss the characteristics of the wastewater in the reference books and compare with Yemen case.	Lecture Multimedia Presentations Tutorial	Participation- Written assignment written exam
b.2 Choose the knowledge of mathematics for estimating wastewater discharges and population forecasting.	Lecture Lab Multimedia Presentations Tutorial	Assignment, quiz lab report lab exam
b.3- Choose appropriate methods of mathematics in calculating the hydraulic and organic loading and the design of different wastewater treatment units.	Lecture Case study- Multimedia Presentations	Assignment, Written exam
b.4- Compare the wastewater quality to the international standards from industries as well as for the population equivalent from organic and quantity point of view.	Lecture Small group working Presentations Tutorial Reading	Written exam – Project Assignment

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c.1. Design of wastewater network, pumping stations, force mains.	Lecture, tutorial Multimedia Presentations Small group working Case study	Assignments Students' presentation; written exam; group work, Project.
c.2. Apply newly developed package software such as SewerCad, civil 3D to design sewerage networks.		
c.3- Design of wastewater treatment processes/ units.	Lecture, tutorial Case study- Individual/group projects Presentations	Students' presentation; written exam; Project
c.4. Use laboratory and field equipment to analyze wastewater quality, record, analyze	Lecture Lab	Lab report Lab exam

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Communicate effectively within multi-disciplinary teams and act professionally in design and supervision of wastewater projects in order to be able to lead and supervise a group of designers and site technicians.	Case study- lab Field visit: to sewerage networks/ wastewater treatment plant	Project Field visit reprt Student's presentation Assignments from internet

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IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	subtropics List	Number of Weeks	contact hours
1	Ch.1.Source and characteristics of wastewater	a.1. b.1,	History of Sanitation; wastewater classification compared to its characteristics in Yemen	1	2
2	Ch.2. Information and Studies required for design of sewerage and storm networks	a.2	measurements and date collection	1	2
3	Ch.3.Type and shapes and sanitary networks	a.3.	apply the shapes to the actual case at different cities of Yemen	1	8
4	Ch.3. Layout of Sanitary and Storm Networks	b.1. b.3	apply layout of sanitary and storm networks to the actual case at different cities	1	8
5	Ch. 4. Principles and design formula for partial and full pipes	b.2, c.1	Ch. 4. Principles and design formula for partial and full pipes	1	2
6	Ch. 5. Design of Sewerage networks	b.3.,c1	Ch. 5. Design of Sewerage networks	1	2
7	Ch. 5. Design of Storm networks	b.3.	Ch. 5. Design of Storm networks	1	2
8	Ch. 6. Networks manholes and appurtenances	c.1.	Ch. 6. Networks manholes and appurtenances	1	2
9	Ch. 7. implementation and operation of sewerage networks	c.2.	Ch. 7. implementation and operation of sewerage networks	1	2
10	Ch. 8. Introduction of wastewater treatment	c.3.a.1	Preliminary treatment; Primary treatment	1	2

Prepared by | Head of Department: Dr. Abdulkareem Yahya Al khattabi | Quality Assurance Unit: Ass. Prof. Dr. Mohammad Algorafi | Dean of the Faculty: Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance: Ass. Prof. Dr. Huda Al-Emad

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IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	subtropics List	Number of Weeks	contact hours
11	Ch. 8. Introduction to different wastewater treatment technologies	d.1.b.3	Secondary treatment	1	2
12	Ch. 8. Introduction to different wastewater treatment technologies	d.1.b.3	aerobic vs anaerobic treatment	1	2
13	Ch. 9. Introduction to sludge treatment	d.4 d.1.b.3	aerobic vs anaerobic sludge treatment	1	2
14	Ch. 10. Introduction to inside house sewage plumbing system	d.4 d.1.b.3	separation of greywater from black water	1	2
Number of Weeks /and Units Per Semester				**14**	**28**

B - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	Introduction to lab and subject topics; participation	2	4	c1, b3, c4
2	pH, EC, temperature, color, odour, tase, Turbidity.	2	4	c1, b3, c4
3	Total Suspended solids (TSS); Total Dissolved Solids (TDS), total Solids (TS), total fixed solids (TFS); Total Volatile Solids (TVS); Dissolved Oxygen (DO)	2	4	c1, b3, c4
4	NH_4, NO_3, PO_4,	2	4	c1, b3, c4
5	Chloride (Cl), Sulfate (SO4),	2	4	c1, b3, c4
6	BOD, COD	2	4	c1, b3, c4
7	Total Coliform (TC), Fecal Coliform (FC)	2	4	c1, b3, c4
Number of Weeks /and Units Per Semester		**14**	**28**	

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	Dr. Abdulkareem Yahya Al khattabi	Ass. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Ass. Prof. Dr. Huda Al-Emad

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V. Teaching strategies of the course:

Lectures
Multimedia Presentations
Tutorial
Lab
Filed visit
Individual/group projects

VI. Report:

No	Assignments	Aligned CILOs (symbols)	Week Due	Mark
1	Hydraulic and organic loading	a.1,c4	1,2	2.5
2	Field visits report and presentation	b.2	3,4	5
3	design examples of sewerage network partial vs full flow	c.1,c.4	5,6	2.5
4	Design example of storm networks partial vs full flow	c.1,c.4	7,8	2.5
5	Design project of sanitary sewerage	c.2,c.4	9,10	5
6	Design project of sanitary sewerage	c.2,c.4	11,12	2.5
7	Project on sanitation inside the houses	b.1,c1,c3	13,14	2.5

VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Report	1-14	22.5	15	a.1,b.2,c.1,c.1, c.2,c.2,b.1
2	Quizzes.	one time	7.5	5	b.2,b3,b4
3	Mid-term Exam.	7th	15	10	a1. ,a.2,a.3, b.1,b.2,b.3,b.4
4	Final Exam.	13	75	50	a1. ,a.2,a.3, b.1,b.2,b.3,b.4,c.1,,c.3
5	Project	7,8	15	10	c.1,c.2,d.1
6	Lab exam	14	15	10	c.4

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	Sum		**150**	**100%**	

VIII. Learning Resources:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

- 1 -IHE-Delft (recently named UNESCO- IHE) (1990-1991). Post graduate Diploma lecture notes on sanitary Engineering course by different authors, Delft, The Netherlands
- MetCalf & Eddy (2003) Wastewater Engineering, Treatment and Use (Fourth Edition, McGraw-Hill Series)
- MetCalf & Eddy (1981) Wastewater Engineering, Collection, Pumping of wastewater McGraw-Hill Series).

2- Essential References.

2- Al-Nozaily F., Al-Hamdi M., Haidera M., Aklan M. Eng. Mohamed Al-Mekhlafy (2019), Sanitation network and wastewater treatment (in Arabic), Al-Jeel Al-jadeed publishing, 3nd edition, Sana'a, Yemen.

3- Electronic Materials and Web Sites etc.

1- web site of the local Yemen institutions such as: SWSLC
2-web site of the international organizations such as: GIZ
3- Bentley SewreCAD V8i (SELECT series 5):
http://communnities.bentley.com/Wiki/view.aspx/Haestad_Methods_Product_Tech_Notes_And_FAQs

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IX. Course Policies:	
1	**Class Attendance: min 75%** - The students should have more than 75% of attendance according to rules and regulations of the faculty.
2	**Tardy:** - The students should respect the timing of attending the lectures. They should attend with 1 minute from starting of the lecture.
3	**Exam Attendance/Punctuality**: - The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final exam.
4	**Assignments & Projects:** - The assignment is given to the students after each chapter, the student has to submit all assignments for checking on time.
5	**Cheating:** -If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for enquiries.
6	**Plagiarism:** - The student will be terminated from the faculty if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
7	**Other policies:** - All the teaching materials should be kept out of the examination hall. - The mobile phone is not allowed. - There should be a respect between the student and his teacher.

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies** **Dr. Tarek A. Barakat** **Dr. Mohammad Algorafi**
	Deputy Rector for Academic Affairs Dr. Ibrahim AlMutaa **Dr. Ahmed mujahed** **Dr. Munaser Alsubri**

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
	Dr. Abdulkareem Yahya Al khattabi	Ass. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Ass. Prof. Dr. Huda Al-Emad

Rector of Sana'a University
Prof. Dr. Al-Qassim Mohammed Abbas

Course Plan (Syllabus) of Sanitary Engineering-2

I. Information about Faculty Member Responsible for the Course:							
Name of Faculty Member	Prof. Fadhl Ali Al-Nozaily	**Office Hours**					
Location& Telephone No.	Office : sanitary/hydraulics building; 777381627	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	drfadhl@yahoo.com	10-12					

II. Course Identification and General Information:						
1	**Course Title:**	***Sanitary Engineering (II)***				
2-	**Course Number & Code:**	CE402				
3-	**Credit hours:**	**C.H**				**Credit Hours**
		Th.	Tu.	Pr.	Tr.	
		2		2		3
4-	**Study level/year at which this course is offered:**	5th grade/ 1st semester				
5-	**Pre –requisite (if any):**	Sanitary Engineering- 1, Irrigation Eng., Harbor Eng.				
6-	**Co –requisite (if any):**					
7-	**Program (s) in which the course is offered**	Civil engineering				
8-	**Language of teaching the course:**	English+ Arabic				
9-	**System of Study:**	Semester/ credit hrs				
10-	**Mode of delivery:**	Lecturing				
11-	**Location of teaching the course:**	Education building b3				

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
	Dr. Abdulkareem Yahya Al khattabi	Ass. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Ass. Prof. Dr. Huda Al-Emad

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Prof. Dr. Al-Qassim Mohammed Abbas

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III. Course Description:

This course deals with basic topics in sanitation Network and wastewater Engineering. It will mainly include basic information about wastewater characteristics, design, operation and maintenance of sewerage networks, sewage pumping stations, Manholes and appurtenances, wastewater treatment plants, sludge treatment, plumbing system in houses.

IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop:

a.1 Describe the role of sanitary Engineer in the society in order to protect the environment from pollution. A4 (A)
a.2 Discuss the traditional practice of sanitation that applied in the early days in Yemen. A2 (A)
a.3 Define the knowledge of mathematics for estimating wastewater discharges and population forecasting. A1 (A)
b.1 Discuss the characteristics of the wastewater in the reference books and compare with Yemen case. B1 (A)
b.2 Choose the knowledge of mathematics for estimating wastewater discharges and population forecasting. B2 (A)
b.3 Choose appropriate methods of mathematics in calculating the hydraulic and organic loading and the design of different wastewater treatment units. B2 (A)
b.4 Compare the wastewater quality to the international standards from industries as well as for the population equivalent from organic and quantity point of view. B3 (A)
c.1 Design sewerage networks, pumping stations, force main. C2 (A)
c.2 Apply newly developed package software such as SewerCad, civil 3D to design sewerage networks. C3(A),
c.3 Design wastewater treatment processes/ units C2 (E)
c.4. Use laboratory and field equipment to analyze wastewater quality, record, analyze C1 (E)
d.1 Communicate effectively within multi-disciplinary teams and act professionally in design and supervision of wastewater projects in order to be able to lead and supervise a group of designers and site technicians. D1 (I)

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
	Dr. Abdulkareem Yahya Al khattabi	Ass. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Ass. Prof. Dr. Huda Al-Emad

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Prof. Dr. Al-Qassim Mohammed Abbas

V. Course Content:

- Distribution of Semester Weekly Plan Of course Topics/Items and Activities.

A – Theoretical Aspect:

Order	Topics List	subtropics List	Week Due	Contact Hours
1	Source and characteristics of wastewater	History of Sanitation; wastewater classification compared to its characteristics in Yemen	1	2
2	Information and Studies required for design of sewerage and storm networks	measurements and date collection	2	2
3	Type and shapes and sanitary networks	apply the shapes to the actual case at different cities of Yemen	3	8
4	Layout of Sanitary and Storm Networks	apply layout of sanitary and storm networks to the actual case at different cities	4	8
5	Principles and design formula for partial and full pipes	Ch. 4. Principles and design formula for partial and full pipes	5	2
6	Design of Sewerage networks	Ch. 5. Design of Sewerage networks	6	2
7	Design of Storm networks	Ch. 5. Design of Storm networks	7	2
8	Midterm Exam		8	2
9	Networks manholes and appurtenances	Ch. 6. Networks manholes and appurtenances	9	2
10	implementation and operation of sewerage networks	Ch. 7. implementation and operation of sewerage networks	10	2
11	Introduction of wastewater treatment	Preliminary treatment; Primary treatment	11	2

V. Course Content:

- Distribution of Semester Weekly Plan Of course Topics/Items and Activities.

A – Theoretical Aspect:

Order	Topics List	subtropics List	Week Due	Contact Hours
12	Introduction to different wastewater treatment technologies	Secondary treatment	12	2
13	Introduction to different wastewater treatment technologies	aerobic vs anaerobic treatment	13	2
14	Introduction to sludge treatment	aerobic vs anaerobic sludge treatment	14	2
15	Introduction to inside house sewage plumbing system	separation of greywater from black water	15	2
16	Final Exam		16	2
Number of Weeks /and Units Per Semester			**16**	**32**

B - Practical Aspect:

Order	Topics List	Week Due	Contact Hours
1	Introduction to lab and subject topics; participation	1,2	4
2	pH, EC, temperature, color, odour, tase, Turbidity.	3,4	4
3	Total Suspended solids (TSS); Total Dissolved Solids (TDS), total Solids (TS), total fixed solids (TFS); Total Volatile Solids (TVS); Dissolved Oxygen (DO)	5,6	4
4	NH_4, NO_3, PO_4,	7,8	4
5	Chloride (Cl^-), Sulfate (SO_4),	9,10	4
6	BOD, COD, imhoff cone	11,12	4
7	Total Coliform (TC), Fecal Coliform (FC)	13,14	4
Number of Weeks /and Units Per Semester		**14**	**28**

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VI. Teaching strategies of the course:

Lecture
Multimedia Presentations
Presentations
Tutorial
Reading
Small group working
Independent study

VII. Report:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	hydraulic and organic loading	a.1,c4	1,2	2.5
2	Field visits report and presentation	b.2	3,4	5
3	design examples of sewerage network partial vs full flow	c.1,c.4	5,6	2.5
4	design example of storm networks partial vs full flow	c.1,c.4	7,8	2.5
5	Design project of sanitary sewerage	c.2,c.4	9,10	5
6	Design project of sanitary sewerage	c.2,c.4	11,12	2.5
7	project on sanitation inside the houses	b.1,c1,c3	13,14	2.5

VIII. Schedule of Assessment Tasks for Students During the Semester:

Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Report	1-14	22.5	15
2	Quizzes.	one time	7.5	5
3	Mid-term exam.	7^{th}	15	10
4	Final exam.	13	75	50
5	Project	7,8	15	10
6	Lab exam	14	15	10

Prepared by
Head of Department
Dr. Abdulkareem Yahya Al khattabi

Quality Assurance Unit
Ass. Prof. Dr. Mohammad Algorafi

Dean of the Faculty
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Academic Development Center & Quality Assurance
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Rector of Sana'a University
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2- MetCalf & Eddy (2003) Wastewater Engineering, Treatment and Use (Fourth Edition, McGraw-Hill Series)

3- MetCalf & Eddy (1981) Wastewater Engineering, Collection, Pumping of wastewater McGraw-Hill Series).

2- Essential References.

2- Prof. Dr. Al-Nozaily F., Dr. Al-Hamdi M., Dr. Haidera M., Eng. Aklan M. and Eng. Al-Mekhlafi M. (2019), Sanitation network and wastewater treatment (in Arabic), Al-Jeel Al-jadeed publishing, 3rd edition, Sana'a, Yemen.

3- Electronic Materials and Web Sites *etc*.

1 -web site of the local Yemen institutions such as: SWSLC: *www.**swslc**-yemen.com.ye*
2-web site of the international organizations such as: GIZ: *https://www.**giz**.de*
3- Bentley SewreCAD V8i (SELECT series 5):
http://communnities.bentley.com/Wiki/view.aspx/Haestad_Methods_Product_Tech_Notes_And_FAQs

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
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X. Course Policies:	
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