Ministry of Higher Education and Scientific Research
University of Anbar
College of Engineering
Dams And Water Resources Engineering Department

# Dams and Water Resources Engineering Department

# 2022-2023

# CATALOGE

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## About the DWE

The study of water resources is important for any country as it is one of the important pillar of the national prosperity. The presence of the Euphrates River that inters Iraq from Anbar, and the presence of Haditha Dam, AlThirthar Lake, AlHabbanyah Lake, 15 small dams in the West Desert of Iraq, and many barrages in addition to the problem of water shortage have increased the importance of the subject of water resources. Therefore, the department of Dams and Water Resources was established in 2002-2003 to provide efficient engineering staffs to satisfy the need of the country and the province. The first class included 13 students and the size of the classes currently reached 155 students while the size of the faculty reached 33 for the year of 2021-2022 and the number of the graduated classes is 15.

The study in the department includes water resources syllabus in addition to parts of the civil engineering syllabus and the department grants BSc in water resources engineering. The syllabus has been updated to be in consistence with the program accreditation criteria of ABET. The syllabus includes both theoretical and experimental studies which are achieved by many laboratories such as survey, remote sensing, soil, hydraulic, environment, geology, and computer labs.

The significant and obvious development of the department contributes to provide the industry with efficient staffs and keeping pace with the local and international developments through the participation of the faculty in the scientific conferences and workshops. The faculty also participated in research and consulting teams, under the supervision of the Engineering Consulting Bureau, that have supervised tens of different engineering projects. The department has an important role in building constructive relationships with other colleges and research centers in the university by conducting mutual research and supervisions and participating in training courses such as those with The Center of Developing High Euphrates Basin and Desert Studies Center. This collaboration has led to adopting a research line that focuses on building a series of small dams in the West Desert of Iraq and study their effects on the river basin in terms of hydraulics and electric generation in addition to completing many masters theses and research papers that have been published in international journals that have an Impact Factor.

## Department Vision:

To be a national leader in education and research in the field of dams and water resources engineering recognized for world-class graduates.

## Department Mission:

To provide quality education by integrating the principles of science and engineering with technical, innovative, and communication skill, and to conduct applied research that investigate pioneer solutions to the challenges of dams and water resources engineering.

# Programme Educational Objectives (PEO's)

### PEO-1: Professional Presence

As a result, within a few years, the graduate has established an Internet presence, either through professional organizations, social networking and/or other activities which demonstrate an appreciation and use of modern technological capabilities.

### PEO-2: Workforce Skilled in Integrating Engineering, Design, and modern Technology

As a result, graduates will identify opportunities to contribute to society from a variety of positions, ranging from water management engineering, design and construction of hydraulic structures and engage professionally in private and governmental sectors such as consulting firms, contracting companies, marketing and real-estate investments. The graduate may also pursue further education in the form of graduate and professional degrees.

### PEO-3: Leadership in Research, Innovation and Design

As a result, within a few years of graduation, the graduate will have made significant or meaningful contributions in his or her chosen field, either thorough research publications and/or presentations, the development of a new design or construction process, obtaining patents, or other evidence of contributing to the advancement of knowledge, particularly in the fields of hydraulic structures and water resources engineering.

### PEO-4: Ethical Reasoning, Behaviour and Professionalism

As a result, within a few years of graduation, the graduate will demonstrate adherence to the professional codes of conduct appropriate to his or her field of study and/or practice, as well as exhibit behaviour consistent with accepted standards of fiduciary responsibility, risk/benefit analysis and professional accountability.

### PEO-5: Communication

As a result, graduates will have outstanding communication skills as evidenced by their professional presentations, and in their productive interactions with co-workers. The graduates may also use their communication skills to foster collaborative effort among co-workers and/or may represent his or her company, institution and/or laboratory to other interested parties.

### PEO-6: Personal Engagement

As a result, within a few years, the graduate will be working independently and in multidisciplinary teams to effectively and efficiently achieve personal and organizational goals, engage in community or public service, create a product or construction that fills a social need, and/or participate in educating individuals about an issue of societal concern.

# Student Learning Outcomes (SLO's)

## National Graduate Outcomes (NGO's)

i) An ability to distinguish, identify, define, formulate, and solve engineering problems by applying principles of engineering, science and mathematics.

ii) An ability to produce engineering designs that meet desired needs within certain constraints by applying both analysis and synthesis in the design process.

iii) An ability to create and carry out proper measurement and tests with quality assurance, analyze and interpret results, and utilize engineering judgment to make inferences.

iv) An ability to skillfully communicate orally with a gathering of people and in writing with various managerial levels.

v) An ability to perceive ethical and professional responsibilities in engineering cases and make brilliant judgments taking into account the consequences in worldwide financial, ecological and societal considerations.

vi) An ability to perceive the continual necessity for professional knowledge growth and how to find, assess, assemble and apply it properly.

vii) An ability to work adequately on teams and to set up objectives, plan activities, meet due dates, and manage risk and uncertainty.

## ABET Student Outcomes (SO's)

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

2. an ability to 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

3. an ability to communicate effectively with a range of audiences

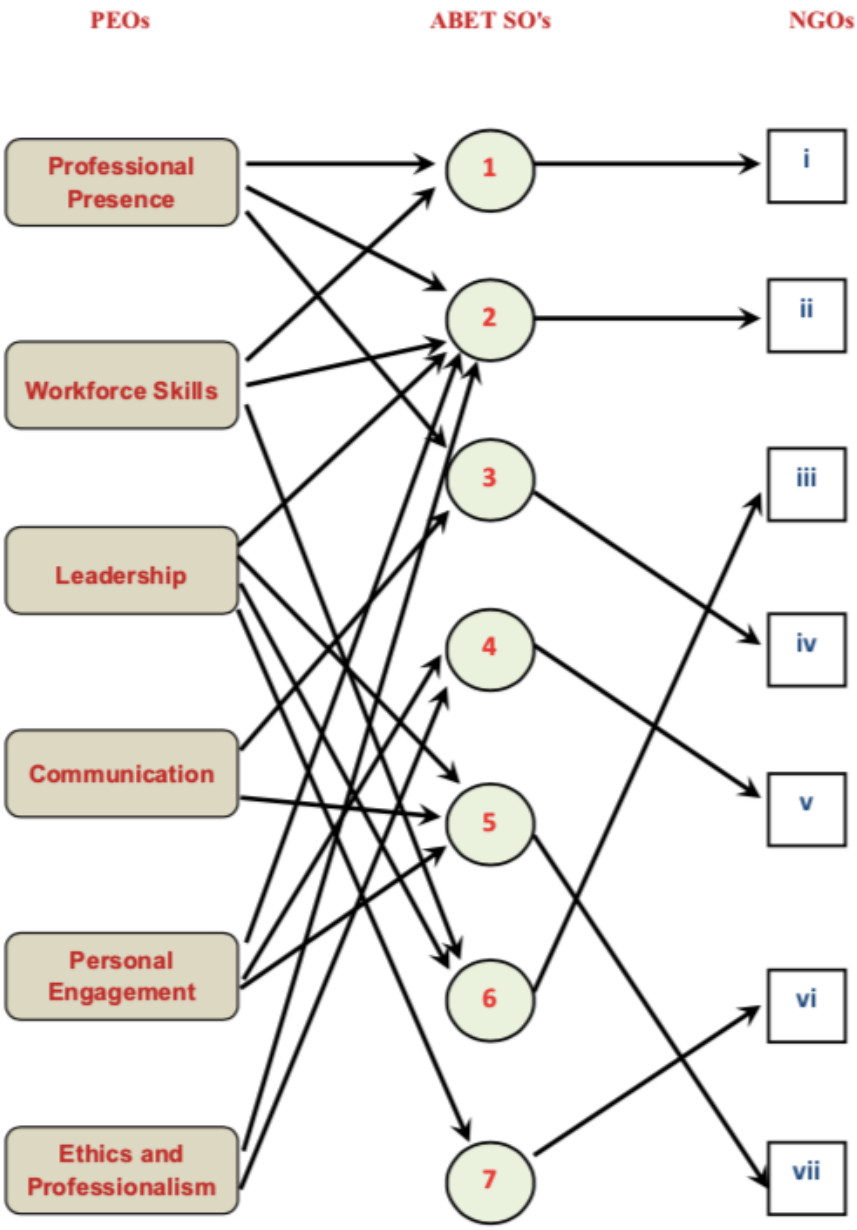
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

# Relationship of ABET Student Outcomes to PEO's and NGO's



## Course Descriptions:

Courses are coded as follows:

1. Course code and number
2. Course title
3. Parenthesized numerals, e.g., (4-3-1-3), indicate, in order, the credit hours, the classroom hours (1 hour = 1 credit hour), tutorial hours (credit hour = 0), and the laboratory hours (2 hour = 1 credit hour).

Prerequisites, if any, are indicated at the course description. These have been established to assure an adequate and uniform background for students in advanced classes. Occasionally, students may feel they already have the appropriate background for an advanced course because of previous training, transfer credits, or Credit by examination.

### Course Numbering System:

Course code = **DWE0000**, The number consists of 4 digits as following:-

1000- First year

2000- Second year

3000- Third year

4000- Fourth year level

100- University Requirements

200- College Requirements

300- Department requirements

Numbers from 01, 02, 03, …….etc. describes the sequence of the course in each **LEVEL**.

**Graduation Requirements**

| Requirements | Credit | Percentage (Credit/149) |
|---|---|---|
| University Requirements | **14** | **10 %** |
| College Requirements | **37** | **25 %** |
| Department Requirements | **94** | **63%** |
| Elective Courses | **4** | **3 %** |
| **Total** | **149** | |

| University Requirements: 14 Credit Hours | | | |
|---|---|---|---|
| **Course No.** | **Course Title** | **Cr. Hours** | **Weekly hours** |
| DWE 1102 | English Language- I | 2 | 2 |
| DWE 2103 | English Language- II | 2 | 2 |
| DWE 3102 | English Language- III | 2 | 2 |
| DWE 4102 | English Language -IV | 2 | 2 |
| DWE 1103 | Human Rights | 1 | 1 |
| DWE 1105 | Democracy | 1 | 1 |
| DWE 1101 | Arabic Language | 2 | 2 |
| DWE 4106 | Management and Leadership Skills | 2 | 2 |
| | **Total** | **14** | **14** |

| College Requirements:37 Credit Hours | | | | | |
|---|---|---|---|---|---|
| **Course No.** | **Course Title** | **Cr. Hours** | **Weekly hours** | | |
| | | | Lec. | Tut. | Lab |
| DWE 1201 | Calculus-1 | 3 | 3 | 1 | --- |
| DWE1202 | Calculus-2 | 3 | 3 | 1 | --- |
| DWE1203 | Physics | 4 | 3 | --- | 2 |
| DWE1213 | Engineering Mechanics- Static | 3 | 3 | 1 | -- |
| DWE1205 | Chemistry | 4 | 3 | --- | 2 |
| DWE1209 | Computer Science | 3 | 2 | --- | 2 |
| DWE1210 | Engineering Drawing | 4 | 3 | 1 | 2 |
| DWE2211 | Calculus-III | 3 | 3 | 1 | --- |
| DWE2212 | Calculus-IV | 3 | 3 | 1 | --- |
| DWE3213 | Engineering Statistics | 2 | 2 | --- | 1 |
| DWE3214 | Engineering Numerical Methods | 3 | 2 | 1 | 2 |
| DWE1212 | Fundamentals of Electrical Engineering | 2 | 1 | --- | 2 |
| | **Total** | **37** | **31** | **7** | **13** |

| Department Requirements: 94 Credit Hours | | | | | |
|---|---|---|---|---|---|
| Course No. | Course Title | Cr. Hours | Weekly hours | | |
| | | | Lec. | Tut. | Lab |
| **FIRST YEAR** | | | | | |
| DWE1303 | Engineering Geology | 3 | 2 | --- | 2 |
| DWE1304 | Applied Physics | 4 | 3 | --- | 2 |
| **SECOND YEAR** | | | | | |
| DWE2304 | Engineering Mechanics (Dynamics) | 3 | 3 | 1 | --- |
| DWE2305 | Fluid Mechanics | 3 | 2 | 1 | 3 |
| DWE2306 | Engineering surveying-I | 3 | 2 | 1 | 2 |
| DWE2307 | Building Materials Technology | 3 | 2 | --- | 2 |
| DWE2310 | Computer Programming | 3 | 2 | --- | 2 |
| DWE2315 | Open Channels | 2 | 2 | 1 | --- |
| DWE2309 | Concrete Technology | 2 | 2 | 1 | 2 |
| DWE2311 | Engineering surveying-II | 3 | 2 | 2 | 2 |
| DWE2317 | Soil Physics | 3 | 2 | 2 | 2 |
| DWE2314 | Strength of Materials | 3 | 2 | 1 | 2 |
| DWE2308 | Construction of Water Resources Projects | 2 | 2 | --- | --- |
| **THIRD YEAR** | | | | | |
| DWE3318 | Engineering Hydrology | 2 | 2 | 1 | --- |
| DWE3319 | Soil Mechanics | 3 | 2 | 2 | 2 |
| DWE3320 | Environmental Engineering | 2 | 2 | 1 | 1 |
| DWE3213 | Engineering Statistics | 2 | 2 | --- | 1 |
| DWE3322 | Theory of Structures | 3 | 3 | --- | --- |
| DEW3315 | Engineering Management | 2 | 2 | 2 | --- |
| DWE3316 | Hydraulic Machines | 2 | 2 | 1 | --- |
| DWE3338 | Ground Water Hydrology | 2 | 2 | 1 | - |
| DWE3328 | Foundations Engineering | 2 | 2 | 1 | - |
| DWE3321 | Hydraulic Structures | 2 | 2 | 1 | 1 |
| DWE3313 | Water Quality Control | 3 | 2 | 1 | 2 |
| DWE3323 | Sanitary Engineering | 2 | 2 | 1 | - |
| DWE3324 | Reinforced Concrete Design | 2 | 2 | 1 | - |
| **FOURTH YEAR** | | | | | |
| DWE4325 | Engineering Optimization | 3 | 3 | 1 | --- |
| DWE4326 | Irrigation Engineering | 3 | 3 | 1 | --- |
| DWE4327 | Design of Dams | 3 | 3 | 1 | --- |
| DWE4333 | Design and Evaluation of On-farm Irrigation systems | 2 | 2 | 1 | --- |
| DWE4329 | Senior Design I | 3 | 2 | 1 | 2 |
| DWE4330 | Methods of Construction and Estimation | 3 | 3 | 1 | --- |
| DWE4332 | Drainage Engineering | 2 | 2 | 1 | --- |
| DWE4334 | Safety and Operation of Dams | 3 | 3 | 1 | --- |
| DWE4331 | Water Resources Planning and Management | 3 | 3 | 1 | --- |
| DWE4335 | Senior Design II | 3 | 3 | --- | 3 |
| | **Total** | **94** | **82** | **32** | **33** |

| DWE Elective Classes: 6 Credit Hours | | | | | |
|---|---|---|---|---|---|
| Course No. | Course Title | Cr. Hours | Weekly hours | | |
| | | | Lec. | Tut. | Lab |
| DWE4336 | Remote Sensing& GIS Applications in Hydrology | 2 | 2 | 1 | --- |
| DWE4313 | Steel Structures | 2 | 2 | 1 | --- |
| DWE4314 | River Mechanics | 2 | 2 | 1 | --- |
| DWE4315 | Computer Applications in Water Engineering | 2 | 2 | 1 | --- |
| DWE4316 | Engineering Economy | 2 | 2 | 1 | --- |
| DWE4341 | Design of Reinforced Concrete Hydraulic Structures | 2 | 2 | 1 | --- |
| DWE4318 | Irrigation and Drainage Networks | 2 | 2 | 1 | --- |
| | **Total** | **12** | **12** | **7** | --- |

## FIRST YEAR- 1st Semester

| FALL | | | | |
|---|---|---|---|---|
| Course Title | Credit Hours | Weekly hours | | |
| | | Lec. | Tut. | Lab. |
| Calculus-I | 3 | 3 | 1 | --- |
| Physics | 4 | 3 | --- | 2 |
| Computer Science | 3 | 2 | --- | 2 |
| Chemistry | 4 | 3 | --- | 2 |
| Fundamentals of Electrical Eng. | 2 | 1 | -- | 2 |
| English Language-I | 2 | 2 | --- | --- |
| Human rights | 1 | 1 | --- | --- |
| **Total** | **19** | **14** | **1** | **8** |
| | | **25** | | |

## FIRST YEAR- 2nd Semester

| SPRING | | | | |
|---|---|---|---|---|
| Course Title | Credit Hours | Weekly hours | | |
| | | Lec. | Tut. | Lab. |
| Calculus-II | 3 | 3 | 1 | --- |
| Applied Physics | 4 | 3 | --- | 2 |
| Engineering Geology | 3 | 2 | --- | 2 |
| Engineering Drawing | 4 | 3 | 1 | 2 |
| Engineering Mechanics (Static) | 3 | 3 | 1 | --- |
| Arabic Language | 2 | 2 | --- | --- |
| Democracy | 1 | 1 | --- | --- |
| **Total** | **20** | **16** | **5** | **9** |
| | | **30** | | |

## SECOND YEAR- 1st Semester

| FALL | | | | |
|---|---|---|---|---|
| Course Title | Credit Hours | Weekly hours | | |
| | | Lec. | Tut. | Lab. |
| Calculus-III | 3 | 3 | 1 | --- |
| Engineering Mechanics (Dynamics) | 3 | 3 | 1 | --- |
| Fluid Mechanics | 3 | 2 | 1 | 3 |
| Engineering surveying-I | 3 | 2 | 1 | 2 |
| Building Materials Technology | 3 | 2 | --- | 2 |
| English Language-II | 2 | 2 | --- | --- |
| Computer Programming | 3 | 2 | --- | 2 |
| **Total** | **20** | **15** | **4** | **8** |
| | | **27** | | |

## SECOND YEAR- 2nd Semester

| SPRING | | | | |
|---|---|---|---|---|
| Course Title | Credit Hours | Weekly hours | | |
| | | Lec. | Tut. | Lab. |
| Calculus-IV | 3 | 3 | 1 | --- |
| Open Channels | 2 | 2 | 1 | --- |
| Concrete Technology | 2 | 2 | 1 | 2 |
| Engineering surveying-II | 3 | 2 | 2 | 2 |
| Soil Physics | 3 | 2 | 2 | 2 |
| Strength of Materials | 3 | 2 | 1 | 2 |
| Construction of Water Resources Projects | 2 | 2 | --- | --- |
| **Total** | **18** | **15** | **8** | **8** |
| | | **31** | | |

## THIRD YEAR- 1st Semester

| FALL | | | | |
|---|---|---|---|---|
| Course Title | Credit Hours | Weekly hours | | |
| | | Lec. | Tut. | Lab. |
| Engineering Hydrology | 2 | 2 | 1 | --- |
| Soil Mechanics | 3 | 2 | 2 | 2 |
| Environmental Engineering | 2 | 2 | 1 | 1 |
| Engineering Statistics | 2 | 2 | --- | 1 |
| Theory of Structures | 3 | 3 | --- | --- |
| Engineering Management | 2 | 2 | 2 | --- |
| Hydraulic Machines | 2 | 2 | 1 | --- |
| English Language-III | 2 | 2 | --- | --- |
| **Total** | **18** | **17** | **6** | **4** |
| | | **27** | | |

## THIRD YEAR- 2nd Semester

| SPRING | | | | |
|---|---|---|---|---|
| Course Title | Credit Hours | Weekly hours | | |
| | | Lec. | Tut. | Lab. |
| Ground Water Hydrology | 2 | 2 | 1 | - |
| Foundations Engineering | 2 | 2 | 1 | - |
| Hydraulic Structures | 2 | 2 | 1 | 1 |
| Engineering Numerical Methods | 3 | 2 | 1 | 2 |
| Water Quality Control | 3 | 2 | 1 | 2 |
| Sanitary Engineering | 2 | 2 | 1 | - |
| Reinforced Concrete Design | 2 | 2 | 1 | - |
| Total | 18 | 14 | 5 | 7 |
| | | 26 | | |

## FOURTH YEAR- 1st Semester

| FALL | | | | |
|---|---|---|---|---|
| Course Title | Credit Hours | Weekly hours | | |
| | | Lec. | Tut. | Lab. |
| Engineering Optimization | 3 | 3 | 1 | --- |
| Irrigation Engineering | 3 | 3 | 1 | --- |
| Design of Dams | 3 | 3 | 1 | --- |
| Management and Leadership Skills | 2 | 2 | --- | --- |
| Design and Evaluation of On-farm Irrigation systems | 2 | 2 | 1 | --- |
| Remote Sensing& GIS Applications in Hydrology DWE Elective Class | 2 | 2 | 1 | - |
| Senior Design I | 3 | 2 | 1 | 2 |
| **Total** | **18** | **17** | **6** | **2** |
| | | **27** | | |

## FOURTH YEAR- 2nd Semester

| SPRING | | | | |
|---|---|---|---|---|
| Course Title | Credit Hours | Weekly hours | | |
| | | Lec. | Tut. | Lab. |
| Methods of Construction and Estimation | 3 | 3 | 1 | --- |
| Drainage Engineering | 2 | 2 | 1 | --- |
| Safety and Operation of Dams | 3 | 3 | 1 | --- |
| Water Resources Planning and Management | 3 | 3 | 1 | --- |
| Design of Reinforced Concrete Hydraulic Structures DWE Elective Class | 2 | 2 | 1 | --- |
| Senior Design II | 3 | 3 | --- | 3 |
| English Language-IV | 2 | 2 | --- | --- |
| **Total** | **18** | **17** | **5** | **3** |
| | | **30** | | |

## Program Outcome Curriculum Map according to NGO's

| NGO's | i | ii | iii | iv | v | vi | vii |
|---|---|---|---|---|---|---|---|
| ABET SO's | 1 | 2 | 6 | 3 | 4 | 7 | 5 |
| **FIRST YEAR** | | | | | | | |
| Calculus-I | × | | | | | | |
| Physics | × | | × | | | | × |
| Arabic Language | | | | × | | | |
| Chemistry | × | | × | | | | × |
| Fundamentals of Electrical Eng. | × | | × | | | | × |
| English Language-I | | | | × | | | |
| Human rights | | | | × | × | | |
| Calculus-II | | | | | | | |
| Applied Physics | × | | × | | | | |
| Engineering Geology | × | | × | | | | × |
| Engineering Drawing | × | | | × | | | |
| Engineering Mechanics (Static) | × | | | | | | |
| Computer Science | × | | × | | | | × |
| Democracy | | | | × | × | | |
| **SECOND YEAR** | | | | | | | |
| Calculus-III | × | | | | | | |
| Engineering Mechanics (Dynamics) | × | | | | | | |
| Fluid Mechanics | × | × | | | | | |
| Engineering surveying-I | × | | × | | | | × |
| Building Materials Technology | × | | × | | | | × |
| English Language-II | | | | × | | | |
| Computer Programming | × | | × | | | | × |
| Calculus-IV | × | | | | | | |
| Open Channels | × | × | | | | | |
| Concrete Technology | × | | × | | | | × |
| Engineering surveying-II | × | | × | | | × | × |
| Soil Physics | × | | × | | | | × |
| Strength of Materials | × | | | | | | |
| Construction of Water Resources Projects | × | | | | | | |

| NGO's | i | ii | iii | iv | v | vi | vii |
|---|---|---|---|---|---|---|---|
| **THIRD YEAR** | | | | | | | |
| Engineering Hydrology | × | | | | | | × |
| Soil Mechanics | × | | × | | | | × |
| Environmental Engineering | × | | × | | | | × |
| Engineering Statistics | × | | | | | | |
| Theory of Structures | × | | | | | | |
| Engineering Management | × | | | | | × | × |
| Hydraulic Machines | × | × | | | | | × |
| Ground Water Hydrology | × | × | | | | | |
| Foundations Engineering | × | × | | × | | | × |
| Hydraulic Structures | × | × | | | | | |
| Engineering Numerical Methods | × | | | | | | |
| Water Quality Control | × | | × | | | | × |
| Sanitary Engineering | × | | × | | | | × |
| Reinforced Concrete Design | × | × | | | | | × |
| English Language-III | | | | × | | | |
| **FOURTH YEAR** | | | | | | | |
| Engineering Optimization | × | × | | | × | × | |
| Irrigation Engineering | × | × | | | | | × |
| Design of Dams | × | × | | | × | × | × |
| Administration and Leadership Skills | | | | × | × | | × |
| Design and Evaluation of On-farm Irrigation systems | × | × | | | | | × |
| Senior Design I | × | × | | | × | × | × |
| Methods of Construction and Estimation | × | | | | | × | × |
| Drainage Engineering | × | × | | | | | |
| Safety and Operation of Dams | × | × | | | × | | × |
| Water Resources Planning and Management | × | × | | | × | | |
| Senior Design II | × | × | | | × | × | × |
| English Language-IV | | | | × | | | |
| **ELECTIVE COURSES** | | | | | | | |
| Remote Sensing & GIS Applications in Hydrology | × | × | | | | | |
| Steel Structure | × | × | | | | | |
| | | | | | | | |

| NGO's | i | ii | iii | iv | v | vi | vii |
|---|---|---|---|---|---|---|---|
| River Mechanics | × | × | | | | | |
| Computer Applications in Water Engineering | × | × | | | | | × |
| Engineering Economy | × | | | | | | |
| Design of Reinforced Concrete Hydraulic Structures | × | × | | | | | |
| Irrigation and Drainage Networks | × | × | | | | | |

# Course Syllabus

# University Requirements

## DWE 1102: English-I (2-2-0-0)

**Designation (required/elective):** Required

### Course Description :

This course is designed to enable academic writing course which provides an opportunity for the students to learn and practice the skills needed for handling topics related to the field of study. The course emphasizes the development of academic writing skills as well as the ability to read and think critically. Students will learn to use the library and appropriate online resources to find and evaluate sources to inform, develop and support their ideas in term paper writing. They will also learn skills for reading analysis, such as comprehension and inference.

### Recommended Textbook(s) :

John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

### Prerequisites :

None

### Course Topics :

1. 
   - Am/ are/ is, my/ your
   - How are you?
   - What's this in English?
   - Plurals
   - This is …….
   - Good morning!
   - Numbers 1-10
2. 
   - Countries
   - Where's he from?
   - Numbers 11-30
   - He/ she/ they, his/ her
   - Fantastic/ awful/ beautiful
3. 
   - Jobs
   - Negatives and questions
   - Social expressions-1
   - Am/are/is
   - Personal information
4. 
   - Our/ their
   - The family
   - The alphabet
   - Possessive's
   - Has/ have
5. 
   - Sports/ food/ drinks
   - a/ an
   - Numbers and prices
   - Present simple- I/ you/ we/ they
   - languages and nationalities
6. 
   - The time
   - Always/ sometimes/ never
   - Days of the week
   - Question words
   - Present simple- he/ she
   - Words that go together
   - Me/ him/ us/ them

| | | |
|---|---|---|
| 7. | • This/ that<br>• Can I ….? | • adjectives |
| 8. | • Rooms and furniture<br>• Prepositions | • There is/ are<br>• Directions |
| 9. | • Saying years<br>• Past simple- irregular verbs<br>• When's your birthday? | • As/ were born<br>• Have/ do/ go |
| 10. | • Past simple- regular and irregular<br>• Sport and leisure | • Questions and negatives<br>• Going sightseeing |
| 11. | • Can/ can't<br>• Adjective+ noun | • Adverbs<br>• Everyday problems |
| 12. | • I'd like- some/ any<br>• Signs all around | • In a restaurant |

### Program and Course Outcomes :

By the end of successful completion of this course, the student will be able to:

1. Develop academic writing proficiency and critical thinking skills
2. Students are able to conduct effective searches of printed and electronic resources
3. Students can use external sources to support ideas in an academic writing in electrical
4. engineering
5. Students can identify and explain the academic integrity (how to avoid plagiarism)
6. Students are familiar with the citation methods like the APA style
7. Students can participate in a classroom community that involves constructive exchange of ideas

## DWE 2103: English II (2-2-0-0)

**Designation (required/elective):** Required

### Course Description :

This course is designed to enable the students to achieve academic oral and written communication to the standard required at university level. The course integrates all the language skills with emphasis on writing, and it stimulates students' imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse scientific topics. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as further readings in civil engineering.

### Recommended Textbook(s) :

John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

### Prerequisites:

- DWE1101 English I

**Course Topics :**

| | | |
|---|---|---|
| 1 | - Tenses | - Question forms |
| | - Vocabulary (Jobs) | - Writing (informal letter) |
| 2 | - Present simple | - Have/have to |
| | - Present continuous | - Writing (Linking words +Describing a person) |
| 3 | - Past simple | - Have + noun |
| | - Past continuous | - Writing (a story 1) |
| 4 | - Count and uncount nouns | - Articles |
| | - Expression of quantity | - Vocabulary (clothes) |
| | | - Writing (filling in forms) |
| 5 | - Verb patterns | - Will and going to |
| | - Would like and like | - Writing (postcard) |
| 6 | - What … like? | - Vocabulary (adjective formation) |
| | - Comparative and superlatives | - Writing (relative closes) |
| 8 | - Present perfect | - Vocabulary (men and women) |
| | - Tense revision | - Writing (a biography) |
| 9 | - have to & got to | - Vocabulary (job description) |
| | - have to & should & must | - Writing (formal letter) |
| 10 | - Present simple or will | - Time clauses |
| | - Conditional clauses | - Writing (discussing ideas) |
| 11 | - Verb patterns | - Infinitives |
| | - Used to | - Writing (formal letters) |
| 12 | - The passive form | - Vocabulary (words with more than one meaning) |
| | - Active and passive | - Writing (email) |
| 13 | - Second conditional | - Vocabulary (phrasal verbs) |
| | - Might | - Writing (a story 2) |

**Program and Course Outcomes :**

- Develop academic essay writing proficiency
- Promote reading skills
- Expand academic vocabulary through reading
- Promote speaking ability through group discussions and debates
- Promote critical thinking skills

## DWE3102: English III (2-2-0-0)

**Designation (required/elective):** Required

**Course Description :**

This course is designed to enable the students to achieve academic oral and written communication to the standard required at university level. The course integrates all the language skills with emphasis on writing, and it stimulates students' imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse scientific topics. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as further readings in civil engineering.

## Recommended Textbook(s) :

John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

## Prerequisites:

- DWE1101 English II

## Course Topics :

1. 
   - Auxiliary verbs
   - Grammar revision
   - Vocabulary
   - Pronunciation
   - Prepositions
   - **Writing** (Correcting mistakes 1)
   - **Reading** (Wonders of the modern world)
   - **Listening and speaking** (My wonders)
2. 
   - Present simple
   - Pronunciation revision
   - Present states and actions
   - Vocabulary
   - Phrasal verbs
   - **Reading and speaking** (I'm a clown doctor!)
   - **Writing** (Letters and emails)
3. 
   - Past simple and past continuous
   - Grammar revision
   - Past perfect
   - Past passive
   - Vocabulary
   - Prepositions revision
   - **Listening and writing** (Books and films)
   - **Writing** (Narrative 1)
   - **Everyday English** (Giving opinions)
4. 
   - Have to /don't have to
   - Can and be allowed to
   - Should
   - Must and have to
   - Vocabulary
   - Pronunciation
   - **Listening and speaking** (Come round to my place!)
   - **Writing** (For and against)
5. 
   - Future form 1
   - Future form 2
   - Grammar revision
   - Vocabulary
   - Pronunciation
   - Prepositions revision
   - **Reading and speaking** (Hotels with a difference)
   - **Writing** (Making a reservation)
6. 
   - Like
   - Grammar review

- Verb patterns
- Vocabulary
- Pronunciation
- Phrasal verbs
- **Listening and speaking** (New York and London)
- **Everyday English** (Signs and sounds)
- **Writing** (A description 1)

7.
- Present perfect
- Tense review
- Present perfect passive
- Vocabulary
- Pronunciation
- Prepositions
- **Reading and speaking** (Dream jobs)
- **Listening and speaking** (The busy life of a retired man)
- **Writing** (A letter of application)

8.
- Conditionals 1 and time clauses
- Conditionals 2
- Vocabulary
- Pronunciation
- Phrasal verbs
- **Reading and speaking** (Who wants to be a millionaire)
- **Everyday English** (Making suggestions)
- **Writing** (Narrative 2)

9.
- Modal verbs of probability in the present
- Modal verbs of probability in the past
- Vocabulary
- Pronunciation
- Prepositions
- **Listening and speaking** (Brothers and sisters)
- **Writing** (A description 2)

10.
- Present perfect continuous
- Simple and continuous revision
- Time expressions
- Vocabulary
- Pronunciation
- Prepositions
- **Reading and speaking** (A big name in Hollywood)
- **Listening and speaking** (Collectors)
- **Writing** (Writing a biography)

11.
- Indirect questions
- Grammar revision
- Question tags
- Vocabulary and pronunciation
- Phrasal verbs
- **Listening and speaking** (The forgetful generation)
- **Writing** (Words that joint ideas)
- **Everyday English** (Informal English)

12.
- Reported statements and questions
- Reported commands

- Vocabulary
- Pronunciation
- Phrasal verbs
- Revision
- **Reading and speaking** (A death)
- **Listening and speaking** (My way)
- **Writing** (Correcting mistakes 2)

### Program and Course Outcomes :

- Develop academic essay writing proficiency
- Promote reading skills
- Expand academic vocabulary through reading
- Promote speaking ability through group discussions and debates
- Promote critical thinking skills

## DWE4102: English IV (2-2-0-0)

**Designation (required/elective):** Required

### Course Description :

This course is designed to enable the students to achieve academic oral and written communication to the standard required at university level. The course integrates all the language skills with emphasis on writing, and it stimulates students' imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse scientific topics. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as further readings in civil engineering.

### Recommended Textbook(s) :

John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

### Prerequisites:

- DWE1101 English II

### Course Topics:

1. 
   - **Grammar** (The tense system and spoken English)
   - **Vocabulary** (Compound of words lifestyle, home town, house-proud)
   - **Reading** (A home from home-two people describe their experiences of living abroad)
   - **Listening** ('things I miss from home')
   - **Speaking** (Exchanging information about people who live abroad)
   - **Everyday English** (Social expressions)
   - **Writing** (Applying for a job)

2.
- **Grammar** (Present perfect, simple and continuous, and spoken English)
- **Vocabulary** (Hot verbs, make, do make way, do damage)
- **Reading** ('Paradise Lost'- how tourism is destroying the object of its affection)
- **Listening** (An interview Tashi Wheeler about her travels as child with parents)
- **Speaking** (Information Gap)
- **Everyday English** (Exclamations)
- **Writing** (Informal letters and correcting mistakes)

3.
- **Grammar** (Narrative tenses, past simple, Conts, and Perfect)
- **Vocabulary** (books and films)
- **Reading** (Jane Austen-one of the world's most downloaded authors)
- **Listening** (The money jigsaw-a news item from BBC's radio)
- **Speaking** (Retelling a news story, responding to a news)
- **Everyday English** (Showing interest and surprise)
- **Writing** (Narrative writing 1)

4.
- **Grammar** (questions and negatives and spoken English)
- **Vocabulary** (Prefixes and Antonyms in context)
- **Reading** ('Diana and Elvis shot JFK!)
- **Listening** ('My most memorable lie'-people confess to untruths)
- **Speaking** (Discussion-good and bad lies)
- **Everyday English** (Being polite)
- **Writing** (Linking ideas)

5.
- **Grammar** (Future forms and spoken English)
- **Vocabulary** (Hot verbs-take, put)
- **Reading** ('Today's teenagers are just fine')
- **Listening** arranging to meet-three friends decide a time and a place to get together)
- **Speaking** (Future possibilities in your life)
- **Everyday English** (Telephone conversations)
- **Writing** (writing Emails)

6.
- **Grammar** (Expression of quantity)
- **Vocabulary** (Words with variable stress)
- **Reading** (A profile of two famous brands)
- **Listening** (Radio advertisements-what's the product? What are the selling points?)
- **Speaking** (A lifestyle survey)
- **Everyday English** (Business expression, Numbers, Fractions, decimals, date, time… )
- **Writing** (A consumer survey)

7.
- **Grammar** (Modals and related verbs 1, spoken English, Declarative questions, and Question expressing surprise)
- **Vocabulary** (Hot verb-get)
- **Reading** ('Meet the kippers'-an article about grown-up children who won't leave home)
- **Listening** (Getting married-an Indian lady talks about her marriage)
- **Speaking** (The pros and cons of arranged marriage)
- **Everyday English** (Exaggeration and understatement)
- **Writing** (Arguing your case)

8.
- **Grammar** (Relative clauses)
- **Vocabulary** (Adverb collocations and adverb adjectives)
- **Reading** ('Chukotka, the coldest place on earth'-an article about a remote territory of Russia)
- **Listening** (Extreme experiences-people describe their experiences in extreme weather conditions)

- **Speaking** (Making descriptions longer, talking about your experiences)
- **Everyday English** (The world around)
- **Writing** (Describing places)

9.
- **Grammar** (Expressing habit)
- **Vocabulary** (Homonyms and Homophones)
- **Reading** ('People and their money-an article about three very different people)
- **Listening** (A teacher I will never forget-people describe a teacher who made a lasting impression on them)
- **Speaking** (Discussion-a teacher I'll never forget)
- **Everyday English** (Making your point)
- **Writing** (Writing of talking)

10.
- **Grammar** (Modal auxiliary verbs 2)
- **Vocabulary** (Synonyms)
- **Reading** ('How the West was won'-the story of settlers in nineteenth -century America)
- **Listening** (Hilaire Belloc's Tales for children)
- **Speaking** (The murder game-one man drops dead in a country house :)
- **Everyday English** (Metaphors and idioms-the body)
- **Writing** (Formal and informal letters and Emails)

11.
- **Grammar** (Hypothesizing)
- **Vocabulary** (Word pairs)
- **Reading** ('Have you ever wondered'? -the answers to some important questions in life)
- **Listening** (The interpretation of dreams-paul's amazing dream)
- **Speaking** (Practicing a conversation and describing your dreams)
- **Everyday English** (Moans and groans)
- **Writing** (narrative writing 2)

12.
- **Grammar** (Articles)
- **Vocabulary** (Hot words-life and time)
- **Reading** ('you are never too old'-A life in the day of Mary Hobson, who gained her PhD aged)
- **Listening** (happy days-people talk about what make them happy and unhappy)
- **Speaking** (Discussion-the different ages of life, and their pros and cons)
- **Everyday English** (Linking and commenting)
- **Writing** (Adding emphasis in writing)

### Program and Course Outcomes :

- Develop academic essay writing proficiency
- Promote reading skills
- Expand academic vocabulary through reading
- Promote speaking ability through group discussions and debates
- Promote critical thinking skills

## DWE1103: Human Rights (1-1-0-0)

**Designation (required/elective):** Required

### Course Description :

This course is designed to give the student the definition of freedom and the right language and idiomatically and legitimacy of the user, Origin of the right in the eyes of Islamic law, Elements of the right and types of, Personal freedom, Intellectual freedom, Rights and economic

freedoms, Islam and Slavery, Human rights objectives, The use of freedom and the right general project, The right of a Muslim to his Muslim brother, Parental rights, Right neighbor, The right of women, Human rights in the heavenly religions, Religious tolerance in Islam .

### Recommended Textbook(s) :

By Topics

### Prerequisites:

None

### Course Topics :

- The definition of freedom and the right
- Origin of the right in the eyes of Islamic law
- Elements and Types of the Human right
- Rights and economic freedoms
- Islam and Slavery
- Human rights objectives
- The use of freedom and the right general project
- The right of a Muslim

### Program and Course Outcomes :

- Evaluate Human rights
- Preservation of human rights in Islam
- Evaluation of relationship between human rights and democracy

## DWE1105: Democracy (1-1-0-0)

**Designation (required/elective):** Required

### Course Description:

This course is designed to give the student the definition of freedom democracy, the concept of democracy, history of democracy, the properties of democracy, traditional Greek democracy, its principles, modern democracy, and pressure groups .

### Recommended Textbook(s) :

By Topics

### Prerequisites :

- DWE 1103 Human Rights

### Course Topics :

- The concept of democracy
- History of democracy
- The properties and principle of democracy

- Traditional Greek democracy and modern democracy
- The relationship between human rights and democracy
- Pressure groups

### Program and Course Outcomes :

- Learn what democracy ?
- Democratic approach in Islam and its applications
- Accepts differing views
- Evaluation of pressure groups

## DWE1101: Arabic Language (2-2-0-0)

**Designation (required/elective):** Required

### Course Description:

This course aims at building students' familiarity with and competence in Arabic literature in its various genres to increase their ability to appreciate literature and to develop their awareness of its concepts through the study of poetry, novel and the short story.

### Recommended Textbook(s) :

By Topics

### Prerequisites:

None

### Course Topics :

Study the text of the Quran and analyze its language, spelling, and rules. the rules of writing the hamza, Written verbatim by Arab and Za -Rules of number and numerical adjective, punctuation, the method of detection for words in Arabic Dictionaries, In the applications of grammar and language- the actor and his deputy, Debutante and the news Acts missing, Equated with the letters already Byproducts, The case and exception, Ancient literary studies, Definition of literature and its importance, Ages historical Arabic literature – Modern Literary Studies, Study the texts of poetic eras (pre-Islamic, Islamic, Umayyad, Abbasid, Andalusia), Study of ancient prose texts (speeches, messages), examine the texts of modern poetry and contemporary, examine the texts of modern prose (drama, novel, article)

### Program and Course Outcomes :

- Develop academic essay writing proficiency
- Promote reading skills
- Expand academic vocabulary through reading
- Promote critical thinking skills

## DWE4106: Management and Leadership Skills (2-2-0-0)

**Designation (required/elective):** Required

### Course Description:

This course is designed for engineering students who are interested in advancing into management and leadership roles. You will gain a perspective on what it is like to be an engineering leader. You will develop awareness of your own strengths and weaknesses as a leader when you are placed in charge of a project. You will learn how to leverage your strengths and control your weaknesses. You will also learn how to manage relationships with your team members and how to set up a creative environment for your team to motivate each team member to reach his or her potential. You will also learn how to deal with different ethical issues that are related to engineering field.

### Recommended Text Book:

1- Benator, Barry and Thumann, Albert "**Project Management and Leadership Skills for Engineering and Construction Projects**." 2003, The Fairmont Press, Inc., USA
2- Fleddermann, C. B. (2012). **Engineering Ethics**. Upper Saddle River, NJ: Prentice Hall.
3- Code of Ethics- Iraqi Engineers Association

**Prerequisites:** None

### Course Topics:

1. **Introduction to leadership**
   - Leadership definition
   - Can one person make a difference?
   - Why is leadership important for engineers?
   - Are leaders born or made?
   - Personality assessment
2. **Leadership and management styles**
   - Command leadership vs. servant leadership
   - Characteristics of servant leader
   - Management styles
   - Leader or manger?
   - The outstanding leader competencies
3. **Effective team leadership**
   - What is team
   - Why work in teams?
   - Different types of teams
   - Team roles
   - Role of team leader
4. **Practical Implementation**
   - Time management (first things first)
   - Project related activities
   - Conducting Effective Meetings
   - Giving effective feedback
   - Recognition and reward
5. **Communication**
   - Communication types
   - Thoughts emotion and communication (head, heart and hands)
   - What influences our communication
   - Damaging communication habits
   - Connecting with others

Peer communication assessment

6. **Leadership and management styles**
   - Management styles
   - Attributes of the engineering leader
   - Modern leadership
   - Characteristics of servant leader
   - Command leadership vs. servant leadership
7. **Professional Ethics**
   - Definition
   - Origins
   - Principles
8. **Introduction to Engineering Ethics**
   - Professional Codes of Ethics
9. **Ethical Issues in Engineering Practice**
   - 1 -Safety Considerations
   - 2- The Role of Good Design
     - A- Sustainable design and design for all
     - B- Safety and risk in Design
   - 3- Environmental Ethics
10. **Steps in Confronting Moral Dilemmas**
11. **Case Studies**

## Course Learning Outcomes:

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

1- Explain the basic concepts of leadership.
2- Build power and influence.
3- Add value to their sphere of influence
4- Give and receive feedback, actively listen, provide supportive communication, and coach and counsel their team members.

# Course Syllabus

# College Requirements

## DWE1201: Calculus I (3-3-1-0)

### Designation (required/elective): required

### Course Description:

This course provides a comprehensive guide and up-to-date treatment of engineering mathematics with an in-depth overview of the many mathematical. It is intended to introduce students of engineering, physics, mathematics, computer science, and related fields to those areas of applied mathematics that are most relevant for solving practical problems.

### Recommended Text Book:

1. Stewart, J., Clegg, D. K., & Watson, S. (2020). *Calculus: early transcendentals*. Cengage Learning.
2. Thomas, G. B., Haas, J., Heil, C., & Weir, M. (2018). *Thomas' Calculus*. Pearson Education Limited.
3. Stroud, K. A., & Booth, D. J. (2020). *Engineering mathematics*. Bloomsbury Publishing.

### Prerequisites:

None

### Course Topics:

1. Tangent line and slope problems.
2. Drawing of functions
3. Continuity and limit of functions
4. Limits at infinity, horizontal asymptote. infinite limits, vertical asymptotes and drawing of functions
5. Derivative of functions and rates of change. Differentiation of polynomials, product and quotient rules
6. Derivatives of exponential, logarithmic, and trigonometric functions
7. Chain rule and implicit differentiations
8. Applications of differentiation maximum and minimum values. the mean value theorem

9. Derivative of hyperbolic functions and indeterminate forms and l'hospital's rule.
10. Optimization problems and anti-derivative of functions

### Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. To develop mathematical skill so that students are able to sketch the graph of various functions and evaluate Limits by using different techniques including L'Hopital's Rule.
2. Apply mathematical methods and principals in solving various derivative problems from Engineering fields, involving applications of derivatives.
3. Demonstrate algebraic facility with algebraic topics including linear, quadratic, exponential, logarithmic, and trigonometric functions,
4. Compute derivative and anti- derivative of algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, and apply them to solve problems in a wide range of engineering applications.

## DWE 1202: Calculus II (3-3-1-0)

### Designation (required/elective): required

### Course Description:

This course provides a comprehensive guide and up-to-date treatment of engineering mathematics with an in-depth overview of the many mathematical. It is intended to introduce students of engineering, physics, mathematics, computer science, and related fields to those areas of applied mathematics that are most relevant for solving practical problems.

### Recommended Text Book:

1. Stewart, J., Clegg, D. K., & Watson, S. (2020). *Calculus: early transcendentals*. Cengage Learning.
2. Thomas, G. B., Haas, J., Heil, C., & Weir, M. (2018). *Thomas' Calculus*. Pearson Education Limited.
3. Kreyszig, E., Stroud, K. and Stephenson, G., 2008. Advanced engineering mathematics. *Integration*, *9*(4).

### Prerequisites:

- DWE1201 Calculus 1

### Course Topics:

1. Fundamentals of Integrals
2. Definite and indefinite integrals
3. Integration Techniques -Integration by Parts.
4. Integration Techniques- Trigonometric Integrals.
5. Integration Techniques- Partial Fractions.
6. Applications of Integrals- Arc Length and Surface area
7. Applications of Integrals- Volumes (Disk, Washer, Shell)
8. Polar Coordinates - Common Polar Coordinate Graphs.
9. Polar Coordinates - Tangents with Polar Coordinates, Curves defined by parametric equations.
10. Sequences and Series.
11. Power series and their convergence test

### Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Evaluate of definite, indefinite and improper integrals by using different integration techniques.
2. To determine arc length, surface area and volume by using the applications of integration techniques.
3. Define polar coordinate graphs and solve related problems including area, arc length and volume.
4. Identify the properties of sequences and their limits with identifying standard convergent operations of power series.

## DWE1203: Physics (4-3-0-2)

**Designation (required/elective):** Required

### Course Description:

This is the first course in the two-semester sequence of calculus-based introductory physics courses designed to meet the needs of student majoring in Engineering. The course is a survey of the concepts, principles, methods and major findings of classical Physics. Primarily, it covers Newtonian mechanics, and thermal Physics, with topics include: Physics and measurement, Vectors, kinematics and dynamics of motion of a single particle in one and two dimensions, work and energy, system of particles, linear momentum and collisions, kinematics and dynamics of rotational motion, equilibrium of rigid bodies, and elasticity, fluid static and fluid dynamics, oscillatory motion, wave motion, and temperature and thermal equilibrium.

## Physics Lab.1

This is the Lab-based course covering the subject matter of PHY 109 .The course presents an introduction to the methods of experimental physics Emphasis is on developing student's skills in experimental techniques, data analysis, and scientific reporting of lab work. During the course students execute a series of experiments on Kinematics of motion, kinetic and potential energy, Oscillatory motion, Thermal properties of matter, and Viscosity. The course includes computer based experiments on Classical Mechanic

## Recommended Text Book:

R.D. Knight, Physics for Scientists and Engineers, 2nd ed., Pearson 2008

## For lab

Laboratory Manual, Compiled by Instructor

## Prerequisites:

Concurrent requirement with DWE1205 Calculus I

## Course Topics:

**1- Physics and Measurement**
1.1- Standards of Length , Mass and Time
1.2- Density of Atomic Mass
1.3- Dimensional Analysis
1.4- Conversion of Units
1.5- Estimate and Order of Magnitude Calculations
1.6- Significant Figures

**2- Motion in One Direction**
2.1- Particle Model
2.2- Position, Velocity and Speed
2.3- Instantaneous Velocity and Speed
2.4- Acceleration
2.5- One-Dimensional Motion with Constant Acceleration
2.6- Freely Falling Object

**3- Vectors**
3.1- Coordinate System
3.2- Vector and Scalar Quantity
3.3- Some Properties of Vectors
3.4- Adding Vectors
3.5- Subtracting Vectors
3.6- Component of Vectors and Unit Vectors

**4- Motion in Two Dimension**
4.1- The Position , Velocity and Acceleration Vectors
4.2- Two Dimensional Motion with Constant Acceleration
4.3- Projectile Motion
4.4- Horizontal Range and Maximum Height of a Projectile
4.5- Uniform Circular Motion

4.6- Tangent and Radial Acceleration
4.7- Relative Velocity and Relative Acceleration

**5- The Laws of Motion**
5.1- Newton's First Law and Inertial Frames
5.2- Mass
5.3- Newton's Second Law
5.4- The Gravitational Force and weight
5.5- Newton's Third Law
5.6- Forces and Friction
5.7- Experimental Observations

**6- Circular Motion and Other Applications of Newton's Law**
6.1- Non uniform Circular Motion
6.2- Resistance Force Proportional to Object Speed
6.3- Air Drag at High Speed

**7- Temperature**
7.1- Zeroth Law of Thermodynamics
7.2- Thermometers and The Celsius Temperature Scale
7.3- The Constant Volume Gas Thermometer and The Absolute Temperature Scale
7.4- Thermal Expansion and of Solids and Liquids
7.5- The Unusual Behavior of Water
7.6- Macroscopic Description of an Ideal Gas

**8- Energy and Energy Transfer**
8.1- Work Done by Constant Force
8.2- The Scalar Product of Two Vectors
8.3- Work Done by Varying Force
8.4- Work DONE by a Spring
8.5- Kinetic Energy and the Work-Kinetic Energy Theorem
8.6- Conservations of Energy
8.7- Situations Involving Kinetic Energy
8.8- Power
8.9- Energy and the Automobile

**Physics 1 Lab**
Mechanical Physics Experiments
1- Determination The Density of Solid Materials
2- Verification of Hooks Law
3- Determination the Value of Gravity Acceleration (Simple Pendulum)
4- Determination the Coefficient of Viscosity
5- Measurement of Liquid Density
6- Verification of Newton's Second Law
7- Verification of continuity Equation
8- Determination the Mechanical Equivalent of Heat
9- Determination the Specific Heat Capacity of a Solid

### Course Learning Outcomes:

Students will learn:

1. Describe the translational motion of a single particle in terms of position and inertial frames, inertia, velocity, acceleration, linear momentum and force.
2. Describe the rotational motion of a rigid body using the concepts of rotation angle, angular velocity, angular acceleration, angular momentum, moment of inertia, and torque.
3. Identify the forces acting on ordinary mechanical systems to be gravity and electromagnetis (Drag force, frictional force, normal force, etc.).
4. State the fundamental laws of kinematics and dynamics of rotational motion of a rigid body and use them to solve problems on simple rotational motion.
5. Analyze the translational and rotational motion using a scalar approach based on the concepts of work, conservative and non-conservative forces, potential energy and conservation of mechanical energy.
6. State the two conditions of static and dynamic equilibrium of a point particle and a rigid body, and use them to solve problems of static equilibrium.
7. Define and calculate the following parameters of oscillatory and wave motion: amplitude, period, frequency, angular frequency, speed of a wave, energy transported, Power and intensity;
8. Describe Simple Harmonic Motion qualitatively and quantitatively.
9. Recognize and analyze some wave characteristics: principle of superposition, interference, diffraction, reflection, transmission, refraction, standing waves and Resonance.
10. Define what is meant by: temperature, specific and molar heats of capacity.

## DWE1213: Engineering Mechanics- Statics (3-3-1-0)

**Designation (required/elective):** Required

### Course Description:

This course is an introduction to learning and applying the principles required to solve engineering mechanics problems. Concepts will be applied in this course from previous courses you have taken in basic math and physics. The course addresses the modeling and analysis of static equilibrium problems with an emphasis on real world engineering applications and problem solving.

### Recommended Text Book:

- R. C. Hibbeler, "Engineering Mechanics - Statics " 13th Edition, 2012

### Prerequisites:

- DWE 1203 Physics-I
- DWE 1201 Calculus-I

### Course Topics:

1. **General Principles:** Fundamental concepts, units of measurement, force vectors: force system resultants: moment of a force, moment of a couple, addition of a system of coplanar forces.
2. **Equilibrium of a Particle**: Condition for the equilibrium of a particle, free-body diagram and three-dimensional force systems.
3. **Equilibrium of a Rigid Body**: Conditions for rigid-body equilibrium, support reactions.
4. **Structure Analysis:** Simple trusses, the method of joints, zero-force members, the method of sections, frames and machines.
5. **Center of Gravity and Centroid:** Center of Gravity, Center of Mass, and the Centroid of a Body
6. **Moments of Inertia:** Definition of moments of inertia for areas, and parallel-axis theorem for an area.
7. **Friction:** Characteristics of dry friction, problems involving dry friction, and frictional forces on flat belts.

### Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. To understand the principles of mechanics to determine resultant forces of a system in rectangular or nonrectangular coordinates
2. To construct free-body diagrams and identify their appropriate equilibrium equations in terms of reaction forces in a frame structure and the connection forces in trusses.
3. An ability to analyse systems that include frictional forces.
4. An ability to locate centroid of an area and calculate second moments of inertia.

## DWE1205: Chemistry (4-3-0-2)

**Designation (required/elective):** Required

**Pre-requisite(s):** Chemistry and Calculus

### Course Description (as in the catalogue):

Chemistry and Measurement and significant figures. Atoms, molecules and ions. Formulas and names. Stoichiometry and chemical calculations. Chemical reactions. Thermochemistry and enthalpy changes. Quantum theory of the atom and electron configuration. Chemical bonding and molecular geometry. The Lab. Section presents Safety in the Lab. Measurement of mass, volume and density. Identification of an unknown compound. Qualitative analysis of anions.

Empirical formula of a compound. Thermal decomposition of hydrates. Stoichiometric determination. Acidbase and redox titrations. Enthalpy of reactions.

## Recommended Textbook(s):

• Chang R. & College W., Chemistry, McGraw Hill 9th ed., 2007 Laboratory Manual, Compiled by Instructor.

## Course Topics:

1. Measurements. Handling Numbers. Dimensional Analysis in Solving Problems Recognize chemical safety and hazardous materials icons, and apply laboratory safety rules.
2. Atomic Number, Mass Number, and Isotopes. The Periodic Table. Molecules and Ions.
   Describe laboratory instruments and some basic techniques used in the chemistry laboratory, including balances and standard volumetric equipment.
3. Chemical Formulas. Naming Compounds. Atomic Mass. Avogadro's number and Molar Mass of an Element.
   Describe and use UV/VIS spectrophotometric methods of analysis.
4. Molecular Mass. The Mass Spectrometer. Percent Composition of Compounds. Experimental Determination of Empirical Formulas. Chemical Reactions and Chemical Equations.
   Describe how to Prepare accurate laboratory reports of their experimental results.
5. Amounts of Reactants and Products. Limiting Reagent Calculations. Reaction Yield.
6. General Properties of Aqueous Solutions. Precipitation Reactions. Acid-Base Reactions. Oxidation-Reduction Reactions.
7. Concentration of Solutions. Acid-Base Titrations. Gases. Pressure.
8. The Ideal Gas Equation. Gas Stoichiometry. Partial Pressures
9. The Nature of Energy and Types of Energy. Energy Changes in Chemical Reactions. Introduction to Thermodynamics.
10. Enthalpy of Chemical Reactions. Calorimetry. Standard Enthalpy of Formation and Reaction.
11. From Classical Physics to Quantum Theory. Bohr's Theory of the Hydrogen Atom. Quantum Numbers. Atomic Orbitals.
12. Electron Configuration.
    Development of the Periodic Table. Periodic Classification of the Elements. Periodic Variation in Physical Properties.
13. Ionization Energy. Electron Affinity
    Lewis Dot Symbols. The Ionic Bond. The Covalent Bond. Electro negativity. Writing LewisStructures. Formal Charge and Lewis Structures.
14. The Concept of Resonance. Exceptions to the Octet Rule.
    Bond Energy. Molecular Geometry. Dipole Moment.
    Spectrophotometric Analysis of tetracycline
15. Valence Bond Theory.
    Hybridization of Atomic Orbital's. Hybridization in Molecules Containing Double and Triple Bonds. Delocalized Molecular Orbital's.

### Lab. Section

1. Safety, Lab Check-in
   Mass and Volume Measurements.
2. Qualitative Analysis of Anions: Part I
3. Qualitative Analysis of Anions: Part II
4. The Empirical Formula of a Metal Oxide
5. Volumetric Analysis: Standardization of Sodium Hydroxide and Determination of Molar Mass of an Acid
6. Applications of Volumetric Analysis: Determination of Active Ingredients of Commercial Bleach and Vinegar.
7. Evaluation of the Universal Gas Constant, R
8. Heat of Formation of Magnesium Oxide
9. UV/VIS Spectroscopy and Spectrophotometry
10. Spectrophotometric Analysis of Aspirin
11. Synthesis of Alum and Crystal Growth

### Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Define the structure of the atom in terms of the nucleus with protons and neutrons, and electrons.
2. Write and balance chemical equations, name inorganic compounds and ions and describe the properties of the main group elements.
3. Carry out chemical calculations, including mass relations in chemical reactions, limiting reagent and reaction yield calculations, and calculations involving reactions taking place in solution
4. Understand the concept of oxidation-reduction, calculate oxidation numbers, and balance redox reactions.
5. Apply the ideal gas law in solving problems involving the gas phase
6. Solve problems in chemical thermodynamics and calorimetry.
7. Predict the electronic structure of atoms and ions from quantum theory, and relate the position of an element in the periodic table to its electronic structure and to the physical and chemical properties of the elements.
8. Describe the principles of chemical bonding and write Lewis structures
9. Predict the geometry of the electron pairs and the shape of molecules using VSEPR theory, predict bond polarity and molecular dipoles
10. Describe the valence bond theory, predict the hybridization of atoms in molecules, and describe bonding in molecules with single, double and triple bonds in terms of and π bonds, and delocalized molecular orbitals

## DWE1209: Computer Science (3-2-0-2)

**Designation (required/elective):** Required

**Pre-requisite(s):** None

### Course Description:

**Recommended Textbook(s):**

**Prerequisites:** None

**Course Topics:**

1. Computer Fundamentals and safety
2. Computer Components
3. Operation system
4. Introduction to MS-Word
5. Insert objects in MS-Word
6. Additional tasks in MS-Word
7. Introduction to MS-Power Point
8. Introduction to MS-Excel

## DWE1210: Engineering Drawing (4-3-1-2)

**Designation (required/elective):** Required

**Course Description:** This course discusses the fundamental concepts of engineering graphics. It gives also an introduction to computer graphics using CAD software. The following topics are covered: Drawing conventions such as standards, line types and dimensioning; drawing of inclined and curved surfaces; deducting the orthographic views from a pictorial; drawing full and half sections; deducting an orthographic view from given two views; pictorial sketching (isometric and oblique).

**Recommended Textbook(s):**

- Interpreting Engineering Drawings, Jensen, C.H. and Helsel, G.D., 7th ed., Thomson Delmar Learning, 2007

**Prerequisites:** None

**Course Topics:**

- Introduction: graphic language, standards, instruments, letters…etc.
- Basics for interpreting drawings, line types, types of drawings and sketches
- Orthographic views. Deducing front, top, and side views from a pictorial Dimensioning
- Sectional views: full and half sections
- Drawing a missed view from given two
- Pictorial sketching: isometric and oblique

**Program and Course Outcomes:**

- Recognize the value of engineering graphics as a language of communication.

- Infer the nature of engineering graphics, the relationships between 2D and 3D environments.
- Comprehend and deduce orthographic projections of an object.
- Visualize wide variety of objects and drawing the missing views.
- Comprehend and deduce section views.
- Produce three dimensional drawings utilizing CAD software.

## DWE2212: Calculus -III (3-3-1-0)

**Designation (required/elective):** Required

**Course Description:**

Advanced topics in calculus, including vectors and vector-valued functions, partial differentiation, Lagrange multipliers, multiple integrals, and Jacobians; application of the line integral, including Green's Theorem, the Divergence Theorem, and Stokes' Theorem.

**Recommended Text Book:**

1. Thomas' Calculus Early Transcendentals 12th Edition.by George B. Thomas Jr. (Author), Maurice D. Weir (Author), Joel R. Hass (Author).
2. Calculus, by H. Anton, I. Bivens, and S. Davis, 8th Edition, 2002, Wiley

**Prerequisites:**

- DWE1201 Calculus I
- DWE1202 Calculus II

**Topics:**

1- Vectors and the Geometry of Space
Three-Dimensional Coordinate Systems
Vectors
The Dot Product
The Cross Product
Lines and Planes in Space
Cylinders and Quadric Surfaces

2- Vector-Valued Functions and Motion in Space
Curves in Space and Their Tangents
Integrals of Vector Functions; Projectile Motion
Arc Length in Space
Curvature and Normal Vectors of a Curve
Tangential and Normal Components of Acceleration

3- Partial Derivatives
Functions of Several Variables
Limits and Continuity in Higher Dimensions
Partial Derivatives

The Chain Rule
Directional Derivatives and Gradient Vectors
Tangent Planes and Differentials
Extreme Values and Saddle Points
Lagrange Multipliers

4- Multiple Integrals
Double and Iterated Integrals over Rectangles
Double Integrals over General Regions
Area by Double Integration
Triple Integrals in Rectangular Coordinates

5- Integration in Vector Fields (Vector Analysis)
Vector Fields and Line Integrals
Green's Theorem in the Plane
Stokes' Theorem
The Divergence Theorem and a Unified Theory

### Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Perform calculus operations on vector-valued functions, including derivatives, integrals curvature, displacement, velocity, acceleration, and torsion.
2. Perform calculus operations on functions of several variables, including partial derivatives, directional derivatives, and multiple integrals.
3. Find extrema and tangent planes.
4. Solve problems using the Fundamental Theorem of Line Integrals, Green's Theorem, The Divergence Theorem and Stokes' Theorem.
5. Apply the computational and conceptual principles to the solutions of real-world problems.

## DWE2212: Calculus-IV (3-3-1-0)

**Designation (required/elective):** Required

**Prerequisites:** DWE 2202 – Calculus-3

### Course Description:

Differential Equations, begins with some definitions and terminology and mathematical models used in a differential equations course. First-order and higher-order differential equations, along with the methods of solutions and their applications are introduced. Modeling with higher-order, Laplace transform, and systems of linear first-order differential equations are covered. At the end, students learn series solutions of linear equations. Numerical methods are covered throughout the course. This course focuses on differential equations and their applications in science and engineering.

## Recommended Text Book:

• Differential Equations with Boundary-Value Problems, seventh edition. Dennis G. Zill, Michael R Cullen. Copyright 2009, Brooks/Cole. ISBN-13: 978-0-495-10836-8

• Differential Equations with Boundary-Value Problems Student Solutions Manual. Warren S. Wright, Dennis G. Zill, Carol D. Wright. Copyright 2009, Brooks/Cole Publishing Company. ISBN 978-0-495-38316-1.

## Course Topics:

1. Ordinary differential Equations
   Classify differential equations by order, linearity, and homogeneity
2. First order linear differential equations
   use separation of variables to solve differential equations
   solve exact differential equations
   use variation of parameters to solve differential equations
   solve first order linear differential equations
   Bernoulli equation
   Application of first Order Differential Equations
3. Higher order Differential Equations
   Solutions of Homogeneous Linear D.E with constant coefficients
   Solutions of Inhomogeneous Linear D.E with constant coefficients
   The Method of Undetermined Coefficients
   Method of Variation of Parameters
   The Euler-Cauchy Differential Equations
   Reduction of Order
   Applications of Higher Order Differential Equations
4. Simultaneous Linear Differential Equations
   Elimination of dependent variables by differentiation
   Elimination of dependent variables using operator equation
   Solution by Cramer rule
5. Fourier series
   Periodic functions
   Trigonometric series
   Bounds of a Function
   Continuity of a Function
   Euler Coefficients
   Even and Odd Functions
   Half Range Expansion
   Applications
6. Laplace Transforms
   Properties of Laplace Transforms
   Inverse of Laplace transforms
   Solution of Ordinary D.E's by Laplace transforms
   D.E's with constant coefficients
   D.E's with variable coefficients:
   Solution of Simultaneous Linear D.E's by Laplace transforms

## Course Learning Outcomes

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

1. Classify differential equations by order, linearity, and homogeneity
2. Solve first order linear differential equations
3. Solve linear equations with constant coefficients
4. Use separation of variables to solve differential equations
5. Solve exact differential equations
6. Use variation of parameters to solve differential equations
7. Use the method of undetermined coefficients to solve differential equations
8. Determine whether a system of functions is linearly independent using the Wronksian
9. Model real-life applications using differential equations
10. Use power series to solve differential equations
11. Use Laplace transforms and their inverses to solve differential equations
12. Solve systems of linear differential equations using matrix techniques and eigenvalues
13. Use numerical methods to solve differential equations

## DWE3213: Engineering Statistics (2-2-0-1)

**Designation (required/elective):** Required

**Prerequisites:** DWE 1206 – Calculus-II

### Course Description:

Statistical Engineering models are based on mathematics and probability theory. This course provides students with a working knowledge of fundamental statistics principles and probability in addition to a preface to the regression and correlation analysis. By the end of the semester, students should be able to determine when each of the various topics we have covered is appropriate to use, and to apply them to practical engineering situations or problems. This course will cover techniques on data collection and presentation, descriptive statistics, basic elements of probability theory, sampling techniques and theory, statistical estimation, hypothesis testing and regression analysis.

### Recommended Textbook(s):

1. Elementary Statistics A Step by Step Approach, Eighth Edition, By Allan G. Bluman.
2. Probability and Statistics For Engineers and Scientists, Fourth Edition, By Sheldon Ross.

### Course Topics:

**Fundamentals (Introduction to Statistics)**

1. Introduction
2. Descriptive and Inferential Statistics
3. Variables and Types of Data
4. Data Collection and Sampling Techniques
5. Observational and Experimental Studies

**Presentation of a Statistical Data**

1. Introduction
2. Organizing Data
3. Grouped Frequency Distributions or Frequency Distributions Table
4. Graphs: Histograms, Frequency Polygons, and Ogive
5. Other Types of Graphs

**Data Description**

1. Measures of Central Tendency (Mean, Median and Mode)
2. Measures of Variation
   2.1. Population Variance and Standard Deviation
   2.2. Sample Variance and Standard Deviation
   2.3. Variance and Standard Deviation for Tabulated Data
   2.4. Range
3. Coefficient of Variation

**Probability and Counting Rules**

1. Sample Spaces and Probability
2. Tree diagram
3. Basic Probability Rules
4. Venn Diagram
5. The Addition Rules for Probability
6. The Multiplication Rules and Conditional Probability
7. Conditional Probability
8. Counting Rules
   8.1. Permutations
   8.2. Combinations
9. Probability and Counting Rules

**Discrete Probability Distributions**

1. Probability Distributions
2. Mean, Variance, Standard an Deviation
3. The Binomial Distribution
4. The Poisson Distribution

**Continuous Probability Distributions**
**The Normal Distribution**

1. Normal Distributions
2. Applications of the Normal Distribution
3. Normal Distributions Formula
4. The Standard Normal Distribution
5. Finding Areas Under the Standard Normal Distribution Curve (Table Method)
6. A Normal Distribution Curve as a Probability Distribution Curve
7. Applications of the Normal Distribution
8. Determining Normality
9. The Normal Distribution Approximation to the Binomial Distribution

**Confidence Intervals and Sample Size**

1. Preface
2. Confidence Intervals for the Mean When σ is Known
   2.1. A point estimate

2.2. An interval estimate
2.3. Confidence Intervals
3. Sample Size
4. t-Distribution
3. Confidence Intervals for the Mean When σ is Unknown
4. The chi-square Distribution
5. Confidence Intervals for Variances and Standard Deviations
5.1. Confidence Interval for a Variance
5.2. Confidence Interval for a Standard Deviation

**Hypothesis Testing**

1. Preface
2. Steps in Hypothesis Testing—Traditional Method
2.1. The null hypothesis ($H_0$)
2.2. The alternative hypothesis ($H_1$)
2.3. The level of significance
3. *z* Test for a Mean
4. P-Value Method for Hypothesis Testing
5. t Test for a Mean
6. z Test for a Proportion
7. $X^2$ Test for a Variance or Standard Deviation

**Testing the Difference Between Two Means, Two Proportions, and Two Variances**

1. Preface
2. Testing the Difference Between Two Means: Using the z Test
3. Testing the Difference Between Two Means of Independent Samples: Using the t Test
4. Testing the Difference Between Two Means: Dependent Samples
5. Testing the Difference Between Two Variances

**Correlation and Regression**

1. Preface
2. Scatter Plots and Correlation
3. Regression
4. Coefficient of Determination and Standard Error of the Estimate.

## Program and Course Outcomes:

On completion of this course, the student should be able to:

- use a number of methods and techniques for collecting and presentation the sets of data;
- calculation and demonstration the center tendency and variation of data;
- compute the probabilities in a simple cases and using the rules of probability in computing;
- give an account of the concept random variable and be able to use some common probability distributions;
- understand the meaning of the central limit theorem;
- use point and interval estimates for some typical statistical problems;
- apply elementary regression for fitting measured data.

# DWE3214: Engineering Numerical Methods (3-2-1-2)

**Designation (required/elective):** Required

## Course Description:

The numerical methods course involves solving engineering problems drawn from all fields of engineering. The numerical methods include: Error analysis, roots of nonlinear algebraic equations, solution of linear and transcendental simultaneous equations, matrix and vector manipulation, curve fitting and interpolation, numerical integration and differentiation, solution of ordinary and partial differential equations.

## Recommended Text Book:

- Numerical Methods for Engineers, S. C. Chapra and R. P Canale, McGraw-Hill, 6th edition 2010.

## Prerequisites:

- DWE 1209 Computer Science
- DWE 2212 Calculus IV

## Course Topics:

**Part-I: Basic Tools**

**Unit-1:** Error Analysis
- Measuring Errors
- Sources of Error
- Consistency, Order, Smoothness and Convergence

**Unit-2:** Roots of equations (**Nonlinear Equations)**
- Bisection Method
- False-Position Method (Optional)
- Newton-Raphson Method
- Secant Method (Optional)

**Unit-3:** Simultaneous Linear algebraic Equations
- Direct Methods
  - Review of Determinants and Matrices
  - Cramer's Rule
  - Gauss-Elimination method (simple and partial pivoting methods)
  - Gauss-Jordan Method
  - Matrix Inversion method
- Indirect (Iterative) Method
  - Jacobi Method

- Gauss-Seidel Method
- Successive Over-Relaxation Method

**Unit-4:** Numerical Differentiation and Integration
- Numerical differentiation using difference method
- Numerical Integration, Trapezoid and Simpson's Rules
- Extrapolation of Errors

**Unit-5:** Interpolation and Curve Fitting
- Direct Fit Polynomial
- Least Squares Method
- Logarithmic regression (Optional)
- Exponential regression (Optional)
- Linear interpolation , Quadratic Interpolation
- Lagrange Interpolation (Optional)
- Newton Divided Difference Interpolation (Optional)

**Part-II: Numerical Solutions of Ordinary Differential Equations**

**Unit-6:** Initial Value Problem
- Euler's Method
- Runge-Kutta 2nd
- Runge-Kutta 4th
- Higher Order Equations

**Unit-7:** Boundary Value Problem
- Equilibrium (Finite Difference) Method

**Part-III: Numerical Solutions of Partial Differential Equations**

**Unit-8: PDEs**
- Elliptic Equations
- Parabolic Equations
- Hi-parabolic Equations
- Advanced Application (Case Studies based on each department interests).

## Course Learning Outcomes:

1. Be aware of the mathematical background for the different numerical methods introduced in the course.

2. Understand the different numerical methods to solve the algebraic equations and to solve system of linear and non linear equations.

3. Understand the different numerical methods for interpolation, differentiation, integration and solving set of ordinary differential equations.

4. Understand how numerical methods afford a mean to generate solutions in a manner that can be implemented on digital computers.

5. Use the built in functions in MATLAB and EXCEL.

6. Create MATLAB functions for solving numerical engineering problems.

7. Work on multidisciplinary projects.

## DWE1212: Fundamentals of Electrical Engineering (2-1-0-2)

**Designation (required/elective):** Required

### Course Description:

This course introduces the basics of electric circuits, series and parallel connection, and DC circuit analysis. Additionally, the course presents ohms law, Kirchhoff laws for solving series parallel circuits. Furthermore, it introduces circuit theorem and their analysis; including mesh, nodal, and superposition theorems. Thevenin and Norton theorems are also included. Finally, the course introduces capacitors and inductor into the circuit and how to deal with it under dc condition.

### Recommended Textbook(s):

• Alexander and Sadiku "Fundamentals of Electric Circuits" Third Edition McGraw Hill.

• Boylestad, R. L., Introductory Circuit Analysis (10th Edition).

### Prerequisites:

• DWE1201 CALCULUS I

### Course Topics:

1. Introduction to electrical engineering
2. Charge, current, and voltage
3. Ohms law
4. Kirchhoff laws
5. Star delta analysis
6. Nodal analysis
7. Mesh analysis
8. Source transformation
9. Superposition theorem
10. Thevenin circuits
11. Norton circuits
12. Capacitor C
13. Inductor L
14. Circuit analysis including R, L, and C

### Program and Course Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Understand the basic concept of electrical circuits.
2. Solve series and parallel DC circuits.
3. Apply Methods of Analysis and Circuit Theorems to solve DC circuits.
4. Solve series/parallel circuits with capacitors and inductors.

## Laboratory

| | |
|---|---|
| 1 | Introduction to the LAB |
| 2 | Ohm's law |
| 3 | Kirchhoff's current and voltage law |
| 4 | series-parallel network |
| 5 | Superposition theorem |
| 6 | Thevenin's theorm |
| 7 | Norton's theorm |
| 8 | LAB final exam |

# Course Syllabus

# Department Requirements

## DWE1303: Engineering Geology (3-2-0-2)

**Designation (required/elective):** Required

**Course Description:**

Interpretation of geology for the purpose of planning, siting, design, and construction of engineered facilities. Includes an overview of geology, engineering geologic mapping, and specific consideration of engineering applications such as dams, reservoirs, and tunnels.

**Prerequisites:** None

**Recommended Text Book:**

- Terry R. West, Geology Applied to Engineering, Waveland Press, 1995.
- Engineering Mechanics ( Statics & Dynamics) / Fourth Addition By : R. C. HIBBELER

**Course Topic:**

**Introduction**

- Definition, purpose and scope
- The Earth and Its Systems

**Minerals**

-Types and clasifications of minerals

**Rocks**

-Types and cycle of rock formation

- geological folds, faults and joints

-Engineering & physical properties of rocks

**Engineering Maps**

(Topographic & Geological Maps)

**Geohazards**

-ground movements

-ground failure

-slope unstability

-seisms

## Introduction to Geology of Tunnels & Dams

I- tunnels

-types of tunnels.

- Methods of tunnel.

-tunnel (opening) in massive rock, two dimensional case.

-stress distribution around circular opening.

- required studies for tunnels construction (effect of layers, flods and fault).

II- dams

-dams importance.

-dams types.

-required studies for dams construction.

-forces affecting dams.

-rocks classification according to their suitability for dams construction.

**Lab Work**

1. Minerals description
2. Minerals classification
3. Rocks description
4. Rocks classification
5. Physical properties of rocks 1:
6. Volume & Density measurement of rocks
7. Physical properties of rocks 2:
8. Specific Gravity & porosity measurement of rocks
9. Engineering properties of rocks:
10. Uniaxial Compressive Strength
11. Drawing Engineering Geological Maps

# DWE1304: Applied Physics (4-3-0-2)

**Designation (required/elective):** Required

## Course Description:

This course introductory concepts of the physics and mathematics of flow and covers basic observations, mass conservation, vorticity, stress, hydrostatics, rate of strain, momentum conservation, and simple viscous and inviscid flows. Primarily, it covers Newtonian mechanics, and thermal Physics, with topics include: kinematics and dynamics of motion of a single particle in one and two dimensions, work and energy, system of particles, linear momentum and collisions, kinematics and dynamics of rotational motion, equilibrium of rigid bodies, and elasticity, fluid static and fluid dynamics, oscillatory motion, wave motion, and temperature and thermal equilibrium.

Theory hours: 2

Tutorial hours: 2

Lab hours: 3

## Recommended Text Book:

R.D. Knight, Physics for Scientists and Engineers, 2nd ed., Pearson 2008

Laboratory Manual, Compiled by Instructor.

## Prerequisites:

- DWE 1201 Calculus-I
- DWE 1203 Physics

## Course Topics:

1. Physics and Measurements
2. Motion in one Dimension
3. Vectors
4. Motion in two Dimensions
5. Mid-term Exam
6. State the Newton's three laws of motion and apply them to solve problems on one and two dimensional translational motion.
7. Circular Motion
8. Laws of motion
9. State the two conditions of static and dynamic equilibrium of a point particle and a rigid body, and use them to solve problems of static equilibrium.
10. Analyze the problems of static fluid in terms of density and pressure, and fluid at motion using the continuity equation and Bernoulli's equation.
11. Describe Simple Harmonic Motion qualitatively and quantitatively

12. Define what is meant by: temperature, specific and molar heats of capacity.
13. State zeroth and first laws of thermodynamics and use them to solve some related problems.
14. Explain the theory of heat energy transfers and apply it in some simple situations.
15. Energy and Energy Transfer

### Applied Physics Lab

### Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Understand the basic Physics and measurement; Kinematics of motion of a single particle in one and two dimensions; Kinematics of projectile and circular motion.
2. Understand the Newton's Laws; Free body diagrams; various types of mechanical forces; Application on the use of Newton's Laws
3. Understand the Phases of matter; Pressure and density, Equations of Fluid static; Equations of fluid dynamics: Continuity and Bernoulli's equations
4. Understand the Work done and energy.
5. Understand the concept of temperature and thermal equilibrium, Measuring temperature, Thermal expansion.

## DWE2305: Fluid Mechanics

**Designation (required/elective):** Required

### Course Description:

Fundamental concepts. Properties of fluids. Fluid Statics. Momentum and energy equations, applications. Bernoulli equation, applications. Dimensional analysis and similitude. Introduction to viscous flows. Internal flows, laminar and turbulent flows. Head loss and friction factor. Flow over immersed bodies (external flow).

Theory hours: **2**

Tutorial hours: **1**

Lab hours: **3**

### Recommended Text Book:

Fluid Mechanics, Streeter

### Prerequisites:

- DWE 1203 Physics 1
- DWE 1202 Calculus-II

## Course Topics:

1. Introduction,
2. Properties of fluids
3. Fluid in static pressure
4. Hydrostatic force on submerged surface
5. Acceleration fluids mass
6. Liquid in motion
7. Rate of change of momentum,
8. Energy and hydraulic grade lines
9. Pipes flow
10. Losses in flow of fluid
11. Friction factor in pipes
12. Simple pipe problems
13. Pipes in series and in parallel
14. Branch of pipes lines

## Course Learning Outcomes:

15. Fluid properties
16. Fluid statics
17. Borden gage
18. Center of pressure
19. Bernoulli equation
20. Sluice gate
21. Conservation of momentum
22. Losses of flow
23. Weir flow

## Course Learning Outcomes:

1. The students should be able to define and describe the following basic properties of fluid such as relative density or specific density, viscosity, surface tension, atmospheric pressure as well as Newtonion and Non-Newtonion fluids.
2. The students will be able describe and define the hydrostatic forces on submerged surface, and calculate it.
3. The student will be able to identify the laminar and turbulent flow.
4. The students should demonstrate an understanding of the following concepts relating to fluid in motion: Quntiuity equation, Bernolli equation, Momentume concept
5. The student will be able to apply the fundamental concepts to problems of flow in pipes.
6. The student will be able to determine the losses of flow in pipes.
7. The students will learn the differences and similarities between pipe flow systems like, pipes in series, pipe in parallel and brach pipes and how solve these problems.
8. The student will be able to draw energy and hydraulic grade lines.
9. The students will be able to use the principals of simulation and dimensional analysis in design of model studies and nonlinear equations.

# DWE2315: Open Chanels

**Designation (required/elective):** Required

## Course Description:

Open channel flow and its classification. , Properties of open channel flow, energy and momentum principals, critical flow with computation and applications, uniform flow with computation and applications, design of channel for uniform flow. Types of water surface profile, control sections

Theory hours: **2**

Tutorial hours: **1**

Lab hours: **-**

## Recommended Text Book:

Textbook:

Open Channel Hydraulics, Ven.Te Chow.

## Prerequisites:

- DWE 1202 Calculus-II
- DWE 2305 Fluid mechanics

## Course Topics:

1. Introduction
2. Types, state, and regims of flow
3. Kinds of open channel
4. Channel geometry
5. Velocity-distribution coefficients
6. Pressure distribution in a channel section
7. Effect of slope on pressure distribution
8. Energy, and specific energy in open channel
9. Critical flow
10. Uniform flow
11. Erodible and non-erodible channels
12. Best hydraulic section
13. Determination of section dimensions

## Course Learning Outcomes:

1. Ability to identify the types and rigims of flow in open channel.
2. Ability to identify the principals of momentum in open channel.
3. Ability to identify the energy and specific energy in open channel
4. Ability to analyze the problems of open channel flow and design open channel.
5. Ability to solve analysis and design problems related to bed material.

# Engineering Mechanics (Dynamics)

**Course Code:** DWE2304

**Designation (required/elective):** Required

**Course Description:**

Fundamental concepts of kinematics and kinetics with application of particles and plane motion of rigid bodies, Rectilinear and curvilinear motion of particles. Newton's second law, impulse and momentum methods, impact, Dynamics of systems of particles, Kinematics of rigid bodies. Plane motion of rigid bodies: Forces and accelerations.

Theory hours: **3**

Tutorial hours: **1**

Lab hours: **0**

**Recommended Text Book:**

Engineering Mechanics: Dynamics, J.L. Meriam and L.G. Kraige, 6$^{th}$ edition.

**Prerequisites:**

- DWE 1203 Physics-1
- DWE 1202 Calculus-II
- DWE 1303 Statics.

**Course Topics:**

1. Kinematics of particles:

   -Rectilinear motion

   -Curvilinear motion

2. Kinetics of particles

   Section A: Force, Mass and Acceleration

   - Newton's second law.

   - Equation of motion and solution of problems

   - Rectilinear motion

   - Curvilinear motion

   Section B: Work and Energy

- Work and kinetic energy.

- Potential energy.

Section C: Impulse and Momentum

- Linear impulse and linear momentum.

- Angular impulse and angular momentum.

Section D: Special Applications

- Impact

- Central-force motion

- Relative motion

3- Introduction to Dynamics of Rigid Bodies:

- Plane kinematics of rigid bodies.

- Plane kinetics of rigid bodies.

### Course Learning Outcomes:

1- Use rectangular, normal-tangential, and polar coordinate systems to describe the motion (kinematics) of a particle, system of particles, and rigid bodies.

2- Use Newton's Second Law, Work-Energy, and Impulse-Momentum principles to determine the kinetics of particles, systems of particles, and rigid bodies.

3- Developing the basic understanding of how to apply the above principles and continue to develop a systematic, orderly procedure for solving engineering problems that take dynamics into considerations such us dynamic design of buildings, bridges and hydraulic structures.

## Strength of Materials

**Course Code:** DWE2314

**Designation (required/elective):** Required

### Course Description:

This is a required course for the D.W.R Engineering Program. It deals with: External forces and concept of stress, types of stresses. Stresses and strains relationship, Hook's law. Axial loading and axial deformation. Statically indeterminate members. Internal forces in beams, pure bending. Transverse loading and shear stresses in beams. Beam deflection.

Unsymmetrical beam sections. Transformation of stresses and strains, principal stresses and Mohr's circle. Axially compressed members and buckling of columns.

Theory hours: **2**

Tutorial hours: **1**

Lab hours: **3**

## Recommended Text Book:

Ferdinand P. Beer and others "Mechanics of materials", 7th edition, 2015

## Prerequisites:

- DWE 1303 Statics

## Course Topics:

1. Introduction.
2. Equilibrium.
3. Stresses, types of stresses.
4. Strains, stress-strain relationships, Hook's Law, Mechanical Properties.
5. Axial loading and axial deformation.
6. Statically indeterminate members.
7. Internal forces in beams, pure bending.
8. Shear force and bending moment diagrams.
9. Bending and Shear stresses in beams.
10. Unsymmetrical beam sections.
11. Beam deflection.
12. Transformation of stresses and strains.
13. Principal stresses and Mohr's circle.
14. Axially compressed members and buckling of columns.

## Laboratory

Lab hours: **3**

1- Support Reactions for Simply Supported Beam

2- Tension Test

3- Compression Test

4- Verification of the Theory of Pure Bending

5- Torsion Test

6- Deflection of Beam

7- Impact Test

8- Fatigue

9- Hardness Test

### Course Learning Outcomes:

1. Understand concept of stress and strain.
2. Understand relation between stress and strain.
3. Ability to identify and solve statically indeterminate problems.
4. Ability to analyze stress conditions in beams under general loading conditions.
5. Ability to determine shear stress and shear flow in beams under transverse loading
6. Ability to transform stress
7. Ability to solve analysis and design problems related to material response to load.

### Additional Notes:

Suggested Syllabus for Strength of Materials Lab:

Constructing lab tests on: Tension, compression, Bending, torsion, impact, fatigue, and hardness, Nondestructive testing of materials (NDT).

## Surveying Engineering 1

**Course Code:** DWE2306

**Designation (required/elective):** Required

### Course Description:

This course presents basic concepts and practical material in each of the areas fundamental to modern surveying (geomatics) practice. Topics include basic principle of surveying and theory of errors; methods of distance measurement; theory and methods for leveling; method of angle measurements; bearing and azimuth computation. Then this course ends with an introduction to traversing, traverse computations and coordinate geometry.

Theory hours: 2

Tutorial hours: 0

Lab hours: 2

### Recommended Text Book:

Elementry Surveying An Introduction to Geomatics by Charles D. Ghilani & Paul R. Wolf

### Prerequisites:

DWE 1202 Calculus-II

### Course Topics:

1. General concept of Surveying.
2. Measurements and Errors
3. Measurements of Horizontal Distance
4. Leveling Applications
5. Topographic Surveying
6. Angles and Directions
7. Traversing and traverse computations
8. Ccoordinate Geometry

### Course Learning Outcomes:

1. Show the student the necessity of redundant information and methods for determining and evaluating errors.
2. Understand the principles of leveling, measure vertical distances and apply the skills of leveling.
3. Determine the positioning of objects as well as monitoring of the structures and engineering works on, above or below the surface of the earth..
4. Develop, test and calibrate of sensors, instruments and systems for the surveying purposes.
5. Define the importance of traverse computation in omitted measurement and compute area of plots by using different types of area computation techniques.
6. Plane, measure and manage of construction works, including the estimation of costs.

### Laboratory

1. Determination and establishing points using conventional taping.
2. Measuring distances using pacing and conventional taping.
3. Leveling with an autolevel and high rod.
4. Direct differential leveling.
5. Profile leveling.
6. Cross section.
7. Theodolite.
8. Measuring horizontal angle by repetation method.
9. Measuring horizontal angle by direction method.
10. Trigonometric leveling.
11. Traversing measuring and adjustment.
12. Total station application.

## Surveying Engineering 2

**Course Code:** DWE2311

**Designation (required/elective):** Required

### Course Description:

This course introduces knowledge about areas and volumes. Then, it moves to horizontal curves and types of horizontal curves. Also, this course presents astronomical surveying, GPS, type of measurements using GPS, and basic principles of remote sensing. Then this course ends with hydrographic surveying

Theory hours: **2**

Tutorial hours: **1**

Lab hours: **2**

## Recommended Text Book:

Elementry Surveying An Introduction to Geomatics by Charles D. Ghilani & Paul R. Wolf

## Prerequisites:

- DWE 1202 Calculus-II
- DWE2306 Engineering surveying I

## Course Topics:

1. Areas
2. Volume computations.
3. Horizontal curves.
4. Global Position System (GPS)
5. Basic principle of remote sensing
6. Introduction to Geographic Information System (GIS).
7. Hydrographic surveying.

## Course Learning Outcomes:

1. Students in this class will use basic mathematical skills in real world Calculations.
2. The planning, measurement and management of construction works, including the estimation of costs.
3. The positioning of objects in space and time as well as the positioning and monitoring of physical features, structures and engineering works on, above or below the surface of the earth
4. The acquisition and use of spatial information from close range, aerial and satellite imagery and the automation of these processes
5. The design, establishment and administration of geographic information systems (GIS) and the collection, storage, analysis, management, display and dissemination of data.
6. The planning, development and redevelopment of water resources projects.

## Laboratory

1. Measuring distances using total station.
2. Area computation using total station.
3. Area computation (map)

4. Total station application.
5. Volume computation using total station.
6. Laying out of circular curve by deflection angles method.
7. GPS applications.
8. Types of remote sensing data.
9. GIS programs

## Soil physics

**Course Code:** DWE2317

**Designation (required/elective):** Required

**Course Description:**

Provides the theoretical basis for understanding and quantifying the physical, hydrological, geotechnical, and thermal properties of soil in relation to environmental processes. Topics include general soil properties as a porous media, particle size, soil structure and aggregation, water retention and potential, flow in saturated soil, flow in an unsaturated soil, soil temperature and heat flow, soil mechanics, infiltration, and soil-plant-water relations.

Theory hours: **2**

Tutorial hours: **2**

Lab hours: **2**

**Recommended Text Book:**

- Environmental Soil Physics, by Daniel Hillel, 1998. Academic Press, Inc. San Diego,Lal, R. and M.K. Shukla (2004) Principles of Soil Physics. Marcel Dekker, New York, 716 pp.

**Prerequisites:**

- DWE1302 Engineering Geology
- DWE1205 Chemistry
- DWE 1201 Calculus-1
- DWE1202 Calculus-2

**Course Topics:**

Soil properties: Introduction

Soil properties: Mass-volume relationship

Soil properties: Soil texture

Soil properties: Soil structure

Soil moisture: Fluid properties

Soil moisture: Energy state

Soil moisture: Total water potential and components

Soil moisture: Soil-water characteristic curves

Water flow in soil: Saturated flow

Midterm Examination

Water flow in soil: Unsaturated flow

Composite Phenomena: soil temperature and heat flow

Composite Phenomena: Stress, strain, and strength

Field water: Soil-water-plant relationship

Final Examination

## LABORATORY SCHEDULE/EXPERIMENTS

**I. Soil Texture/Volume Mass Relationships**

1. Soil bulk density and particle density (Lab and Field)

2. Volumetric water content (Gravimetric and Volumetric, Lab and Field)

3. Particle-density (Lab)

**II. Water Flow in Soils**

**1.** Mariotte Device

1. Saturated hydraulic conductivity, permeability and fluidity (Lab)

2. One-dimensional infiltration in homogeneous and layered soils (Lab-simulation models)

3. Estimation of hydraulic conductivity and diffusivity functions (Lab-simulation models)

4. Instantaneous profile method for infiltration, redistribution of water and tracers, and measurement of soil hydraulic conductivity functions (Field-simulation models).

## Course Learning Outcomes:

After completion of this course, students will gain working knowledge of soil physical properties and how to manage them to optimize crop growth and minimize environmental problems.

Through field and laboratory practicals and homework assignments, the student will learn methods of evaluating soil physical properties. The practicals will include assessment of soil compaction, porosity and pore-size distribution, plant-available water reserves, water movement within soil and the overland flow, soil temperature regime, aeration and gaseous diffusion, and plant-water relations.

## Building Materials Technology

**Course Code:** DWE2307

**Designation (required/elective):** Required

**Course Description:**

This course is designed for students to understand compositions, engineering behaviors, and design methods of various civil engineering materials, including steel; wood, soil, aggregate, Portland cement concrete, and asphalt cement concrete.

Theory hours: **2**

Tutorial hours: **1**

Lab hours: **3**

**Recommended Text Book:**

Foundations of Materials Science and Engineering 3rd Ed.,W.F.Smith ,Mc Graw Hill,2004

**Prerequisites:**

None

**Course Topics:**

1. Theories of Failure
2. Materials Engineering Concepts
3. Nature of Materials
4. Steel
5. Aluminum
6. Aggregates
7. Portland Cement
8. Portland Cement concrete (It can be taken in concrete technology)
9. Masonry
10. Asphalt Binders and Asphalt Mixtures
11. Wood

12. Composites
13. Sustainable building materials

### Laboratory:

1. Initial and Final Time of Setting of Cement
2. Standard Consistency of Cement Paste
3. Specific Gravity and Absorption of Coarse Aggregate
4. Specific Gravity and Absorption of fine Aggregate
5. Sieve Analysis of fine and coarse aggregates
6. Steel Tensile Test
7. Wood Compressive Test
8. Water Absorption Test of Bricks.
9. Compressive Strength of Bricks.
10. Presence of Soluble Salts or Effloresces
11. Fineness Test of Gypsum
12. Consistency of Gypsum Paste
13. Gypsum Setting Time
14. Gypsum Compressive Strength
15. Gypsum Modulus of Rupture

### Course Learning Outcomes:

After participating in the course, students would be able to:

1. To obtain the essential knowledge all information on both physical and chemical properties of building materials and their appropriate use in dams construction.
2. Use of test method and skills to determine the properties of building materials.
3. Be able to appreciate the criteria for choice of the appropriate materials and the various tests for quality control in the use of these materials.

## Concrete Technology

**Course Code:** DWE2309

**Designation (required/elective):** Required

### Course Description:

The course on “Concrete Technology” focuses on concrete making materials including supplementary cementitious materials. Concrete production process also forms a part of the discussion. Going through the course one would develop first-hand knowledge on concrete production process and properties and uses of concrete as a modern material of construction. The course will enable student to make appropriate decision regarding ingredients selection and use of concrete.

Theory hours: **2**

Tutorial hours: **1**

Lab hours: **3**

## Recommended Text Book:

Neville, A.M. and Brooks, J.J.," CONCRETE TECHNOLOGY", ELBS .1990.

## Prerequisites:

- DWE1205 Chemistry
- DWE2307 Technology Building Materials

## Course Topics:

1. This item can be studied in building materials technology.
2. Aggregates-Classification-Mechanical properties -Grading requirements.
3. Quality of water for use in concrete.
4. Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers-Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline-Their effects on concrete properties.
5. Principles of Mix Proportioning-Properties of concrete related to Mix Design- Physical properties of materials required for Mix Design-Design Mix and Nominal, Mix-BIS and ACI Methods of Mix Design-Mix Design Examples.
6. Workability, Segregation and Bleeding.
7. Light weight and Heavy weight concretes-High strength concrete-Fibre reinforced concrete- Ferrocement-Ready mix concrete-SIFCON-Shotcrete-Polymer, concrete-High performance concrete-Their production, properties and applications.
8. Durability of concrete.
9. Maintenance of concrete structures and use of non-destructive tests.
10. Sustainability of concrete.

## Laboratory:

1. Gradation of fine aggregate
2. Gradation of coarse aggregates
3. Workability of concrete (Slump and Compaction factor tests)
4. Density of hardened concrete
5. Compressive strength of cubic concrete specimens
6. Compressive strength and modulus of elasticity of concrete cylinders
7. Determine splitting tensile strength of cylindrical concrete specimen
8. Determine Flexural Strength of Prismatic Specimens
9. Non-destructive tests (Schmidt hammer and Ultrasonic pulse velocity)
10. Core test

### Course Learning Outcomes:

1. Students are introduced to the concrete as construction materials.
2. Students will learn about the constituent materials of concrete include-aggregates, cements, and water.
3. Students will learn about the behavior and properties of concrete.
4. Students will introduce to the mix design procedure.
5. Students will learn about the properties and behavior of special type of concrete and their applications.

## Construction for Water Resources Projects

**Course Code:** DWE2308

**Designation (required/elective):** Required

### Course Description:

The students should have learnt about the various materials, both conventional and modern, that are commonly used in dams and water resources engineering construction. Further he should be able to identify the different equipment that it needed for construction of various types of structures from foundation to super structure. Students shall have a reasonable knowledge about the various construction procedures for buildings above and below ground level.

Theory hours: **2**

Tutorial hours: **0**

Lab hours: **0**

### Recommended Text Book:

Building construction,Zuhir Sako

### Prerequisites:

- DWE2308 Construction for Water Resources Projects

### Course Topics:

1. Introduction
2. Construction materials
3. Equipment used in the creation of buildings
4. The buildings above ground level
5. The buildings below the level of the earth's surface
6. Lining.

### Course Learning Outcomes:

After completion of this course students will be able to:

a. apply engineering design to produce solutions and apply new knowledge resulted from studying of:
The buildings above ground level

The buildings below the level of the earth's surface

Lining.

b. communicate effectively with a range of audiences throughout:
Knowing the equipment used in the creation of buildings by field visits to work sites.

c. work as a team together:
Select and test the suitable construction building materials

## DWE2310: Computer Programming

**Designation (required/elective):** Required

**Pre-requisite(s):** None

### Course Description:

This course introduces the student to computer concepts, control structures, functions, and arrays: single and multidimensional, and string processing found in Visual Basic. The course also examines input/output statements including data file I/O, arithmetic, logical and comparison operators, along with an introduction to classes.

### Recommended Textbook(s):

- Byron s. Gottfried, Theory and Problems of Programming with Visual Basic, Schaum's Outline Series McGraw-Hill, Inc., 2001.

**Prerequisites:** None

### Course Topics:

• Visual Basic Statements and Expressions,

• Visual Basic Data Types, Variable Declaration, Visual Basic Symbolic Constants

• Visual Basic Looping, Visual Basic Branching - If Statements, for … next do while, and select case

• Visual Basic Functions, Procedure

• Arrays, Control Arrays Database Access and Management, Database Structure and Terminology

• ADO Data Control, Data Links Bound Data Tools, Creating a Virtual Table, Data Manager

• Custom Data Aware Controls

• Creating a Data Report, accessing data report Creating a Data Environment Adding menus to the application

• Laboratory: Programming Exercises and a group project

### Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Manipulate the basic components of the Visual Basic language: Constants, Variables, Built-in data types, Arrays, Control Structure, Looping and Functions, Classes.
2. Analyze algorithms and computer code.
3. Design, write, and test a complete program that solves a given problem.
4. Process input data files, analyze them, and make output files using Visual Basic.
5. Use the software environment for coding, compiling, and executing a program.
6. Work productively with peers as a member of an engineering team to implement an Engineering programming project.

## Engineering Hydrology

**Course Code:** DWE3318

**Designation (required/elective):** Required

### Course Description:

Hydrology is concerned with the distribution and dynamics of water and water quality on or near the surface of earth. As fundamental engineering sciences, hydrology plays an important role in developing technical skills in water engineering and in understanding many of the contemporary water management issues. The course covers fundamental hydrologic processes such as rainfall, evaporation, infiltration, surface and ground water, and hydrologic extremes i.e. floods and droughts. In addition, the course develops technical skills to apply some basic techniques for hydrologic analysis and design with particular emphasis on flood estimation, flood frequency analysis, and flood routing. Learning activities include lectures, workshops, and half-day field trip.

Theory hours: **2**

Tutorial hours: **1**

Lab hours: **0**

## Recommended Text Book:

1. Viessman, Jr. W., Lewis, G. R., and Knapp, J. W., 1989. Introduction to hydrology. Harper & Ow publishers. 3th Ed. New York, 780 p.
2. Subramanya, K., 1988. Engineering hydrology. Tata McGraw Hill Publishing Company Limited. 2th Ed. New Delhi, 316 p.
3. Chow, V. T, D. R. Maidment, and L. W. Mays. 1988. Applied Hydrology. McGraw-Hill, Inc.
4. McCuen, R.H., 1998. Hydrologic Design and Analysis; Prentice Hall, New Jersey, 814 pages.

## Prerequisites:

- DWE 2305 Fluid mechanics
- DWE2213 Engineering Statistics

## Course Topics:

Introduction of hydrology

The hydrological cycle

Meteorological Data

Precipitation

Evaporation and transpiration

Infiltration and percolation

Surface Runoff

Hydrograph analysis

Flood routing

Reservoir routing

Hydrological Forecasting

Sediment transport

Introduction to sediment transport

## Course Learning Outcomes:

- The course will assist students in developing an ability to identify, formulate, and solve engineering problems.
- The students will learn how to define hydrologic cycle, return periods, and design floods in an engineering way.
- The students will learn precipitation and streamflow measurements and their relationships to engineering designs.
- The students will learn the basics of statistical theories and their applications in frequency analysis for engineering designs.
- The students will learn theories of frequency analysis for design storms and design floods. These theories will be illustrated by examples of engineering applications.
- The students will learn the theory of water infiltration and evaporation and their effects on estimation of available water and flood analysis.
- The students will learn theories of unit hydrograph and applications on flood forecast including peak discharge and time of peak occurrence.
- The students will learn theories of flood routing including reservoir and channel routing in flood forecasting.
- The students will learn hydrology, hydrologic cycle, precipitation, streamflow, evaporation, infiltration, aquifer and groundwater.
- The students will become familiar with applications of binominal distribution used for defining the return period in engineering design.
- The students will learn history of normal distribution and its application and relationship to hydraulic designs.
- The students will be exposed to other statistical distributions including Pearson and log-Pearson distributions and their applications in flood analysis.

## Groundwater Hydrology

**Course Code:** DWE3338

**Designation (required/elective):** Required

**Course Description:**

Study of fundamental principles governing fluid flow in porous and fractured media, provides necessary foundation for advanced studies in hydrogeology and contaminant hydrology. Includes Darcy's law, the continuity equation, aquifers, flow in the saturated zone, flow nets, wells and well hydraulics, flow in fractures, flow in the unsaturated zone, groundwater modeling.

Theory hours: **2**

Tutorial hours: **1**

Lab hours: **0**

## Recommended Text Book:

1- Todd, D. K., 2005 Groundwater Hydrology. John Wiley & Sons. New York.
2- Sen, Z., 1995. Applied Hydrogeology for Scientists and Engineers. Lewis Publications, Boca Raton.
3- Kruseman G.P.& DeRidder, N. A., 1990. Analysis and Evaluation of Pumping Test Data. International Institute for Land Reclamation and Improvement, Wageningen, the Netherlands.
4- Raghunath, H. M., 1982. Groundwater. Wiley Eastern Ltd., New Delhi.

## Prerequisites:

- DWE 2305 Fluid mechanics
- DWE2213 Engineering Statistics

## Course Topics:

Introduction of hydrology

The hydrological cycle

Meteorological Data

Precipitation

Evaporation and transpiration

Infiltration and percolation

Surface Runoff

Hydrograph analysis

Flood routing

Reservoir routing

Hydrological Forecasting

Sediment transport

Introduction to sediment transport.

## Course Learning Outcomes:

- The course will assist students in developing an ability to identify, formulate, and solve engineering problems.
- The students will learn how to define hydrologic cycle, return periods, and design floods in an engineering way.
- The students will learn precipitation and streamflow measurements and their relationships to engineering designs.

- The students will learn the basics of statistical theories and their applications in frequency analysis for engineering designs.
- The students will learn theories of frequency analysis for design storms and design floods. These theories will be illustrated by examples of engineering applications.
- The students will learn the theory of water infiltration and evaporation and their effects on estimation of available water and flood analysis.
- The students will learn theories of unit hydrograph and applications on flood forecast including peak discharge and time of peak occurrence.
- The students will learn theories of flood routing including reservoir and channel routing in flood forecasting.
- The students will learn hydrology, hydrologic cycle, precipitation, streamflow, evaporation, infiltration, aquifer and groundwater.
- The students will become familiar with applications of binominal distribution used for defining the return period in engineering design.
- The students will learn history of normal distribution and its application and relationship to hydraulic designs.
- The students will be exposed to other statistical distributions including Pearson and log-Pearson distributions and their applications in flood analysis.

## Hydraulic Structures

**Course Code:** DWE3321

**Designation (required/elective):** Required

**Course Description:**

Principles of Hydraulic Systems Analysis, Classification and Use of Structures for Flow Control, Channel Regulating Structures, Channel Intake and Outlet, Flow Measurement Structures, Dam Spillways and Outlet Works, Energy Dissipation Structures, Culverts.

Theory hours: **2**

Tutorial hours: **2**

Lab hours: **2**

**Recommended Text Book:**

Textbook:

Open Channel Hydraulics Ven.Te Chow

**Prerequisites:**

- DWE 2305 Fluid mechanics
- DWE3316 Soil Mechanics I

**Course Topics:**

1. Introduction
2. Principles of Hydraulic Systems Analysis
3. Classification and Use of Structures for Flow Control
4. Channel Regulating Structures (weirs, barrages, sluice gates, etc.)
5. Channel Intake and Outlet (Diversion) Structures
6. Flow Measurement Structures
7. Dam Spillways and Outlet Works
8. Energy Dissipation Structures
9. Culverts
10. Stochastic Analysis of Hydraulic Structures

### Laboratory

1- Hydrostatic Force & Center of Pressure

2- Buoyancy & Floatation – Metacentric Height

3- Impact of Jets

4- Flow Measurement

5- Flow through small orifice discharging to atmosphere:

6- Flow Over Weirs

7- Centrifugal Pump

8- Open Channel Flow

9- Hydraulic jump

### Course Learning Outcomes:

1. To develop an understanding of the principles of hydraulic system analysis and types of hydraulic structures,
2. To develop an understanding of the principles of using hydraulic structures as flow measurement structures.
3. To develop an understanding of the principles of design of different hydraulic structures (weirs, culverts, intake and outwork structures spillways, and energy dissipation.

## Hydraulic Machines

**Course Code:** DWE3316

**Designation (required/elective):** Required

### Course Description:

Hydraulic machine is one of the important subject for the engineering of the water resource that use to study, analysis and design the turbine and pumps.

Theory hours: **2**

Tutorial hours: **2**

Lab hours: **0**

## Recommended Text Book:

Hydraulic machines and systems by:Nagathan

Hydraulic machines by :khurmi

## Prerequisites:

- DWE2304 Fluid Mechanics
- DWE2305 Open Chanel

## Course Topics:

Properties of Fluids
Dimension analysis
Turbines
Water hammer
Performance for turbines
Hydroelectric power plant
Pump Management
Cavitation

## Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Understand the fluid properties and Dimension analysis to carry out professional engineering activities in the field of fluids.
2. Use Rayleigh method and Buckingham pi Theorem to use in modeling.
3. Apply scientific method strategies to the hydraulic machines: analyses qualitatively and quantitatively the problem situation, propose hypotheses and solutions.
4. Use specific vocabulary and terminology and the appropriate means to effectively communicate knowledge, procedures, results, skills and aspects inherent to fluid mechanics.
5. Develop semester-long interaction with students on homework and design submittals.
6. learn the students how to select the suitable turbine based on the hydraulic design of dam,
7. Identify the right pumps for the water projects.
8. Conduct external research for design and creation of design tools.

# Environmental Engineering

**Course Code:** DWE3320

**Designation (required/elective):** Required

## Course Description:

The Original course were called (sanitary and environmental engineering), Modified course will separate to sanitary engineering course and environmental engineering course.

Theory hours: 2

Tutorial hours: 0

Lab hours: 0

## Recommended Text Book:

1- Environmental Engineering, Peavy etal.
2- Fundamental of environmental engineering, James.
3- Warren Viessman Jr., Mark J. Hammer, Elizabeth M. Perez, Paul A. Chadik, Water Supply & Pollution Control, Prentice Hall, 8th ed., 2009.
4- Wastewater treatment for pollution control and reuse, Soli .J. Arceivala.
5- Wastewater Engineering (treatment and Reuse) by Metcalf and Eddy,2003

## Prerequisites:

- DWE1205 Chemistry
- DWE3312 Water Quality Control
- DWE2305 Fluid Mechanics

## Course Topics:

Introduction-Environment, environmental Engineering, environmental Engineering Rule, Pollution, pollution types, Wastewater, wastewater characteristics, wastewater sources, Effluent wastewater quality, wastewater treatment plant, Air pollution , Air pollutant types, Air pollution effects , Air quality Standards ,dispersion equations ,Air pollution treatment Solid Waste Management: Types, characteristics, sources and quantities of solid waste; Collection disposal and recycling. Environmental Legislation and Regulations Sustainable environmental engineering Sustainability, Sustainable Engineering, and Sustainable Engineering Design.

## Laboratory:

Lab hours: 2

1. Measurement of TS

2. Measurement of D.O. by Wrinkler's methods
3. Measurement of BOD test for water and waste water
4. Measurement of Microbiological
5. Measurement of COD test for water and waste water
6. Measurement of Ammonia Nitrogen
7. Measurement of Sulphate

### Course Learning Outcomes:

1- To know the basics, importance, and methods of Wastewater treatment.
2- To learn the objectives and methods of Air treatment and to study the features and function of different Air treatment units.
3- To study the features and function of different Solid waste management.
4- To learn the principles of Sustainable environmental engineering.

## Sanitary Engineering

**Course Code:** DWE3323

**Designation (required/elective):** Required

### Course Description:

The Original course were called (sanitary and environmental engineering), Modified course will separate to sanitary engineering course and environmental engineering course.

Theory hours: 3

Tutorial hours: 1

Lab hours: 0

### Recommended Text Book:

1- Peavy etal.' Environmental Engineering'
2- Warren Viessman Jr., Mark J. Hammer, Elizabeth M. Perez, Paul A. Chadik, Water Supply &Pollution Control, Prentice Hall, 8th ed., 2009.
3- Wastewater treatment for pollution control and reuse , Soli .J. Arceivala.
4- Wastewater Engineering (treatment and Reuse) by Metcalf and Eddy,2003

### Prerequisites:

- DWE1205 Chemistry
- DWE3312 Water Quality Control
- DWE2305 Fluid Mechanics

### Course Topics:

Introduction , Sewage &Drinking Water Relation, Future Population Estimation, Water consumption Estimation , Design Period ,Water Pipes and Channels, Types, Fitting, Corrosion, Analysis and design small drinking water network , Valves and gauges, Fire systems , Install and maintenance pipes Drinking water treatment Units , intake , River intake , Lakes intake , Rapid Mixing Tanks, Settling tanks , coagulation and flocculation , filtration, disinfection, softening, color and taste removal , Desalination Technology, Water Pipes , Types, Fitting, Corrosion, Analysis and design drinking water network , Valves and gauges, Fire systems , Install and maintenance pipes.

Storm water quantity and drain estimation by rational method, storm water intensity , Manholes , Sewer pipes types , connection, sewer system safety, sewer system Fitting, Septic tanks, , sewers materials, sewers discharges, Dry and weather flow, velocity , Gradient , Hydraulics , sewer Network design

Wastewater , wastewater characteristics , wastewater quantity , wastewater sources , wastewater treatment , primary ,screens, Grit removal chamber, floating tank, preaeration tanks, primary sedimentation tanks, biological treatment , biological treatment types, Aerobic , Anaerobic, BOD , COD, Trickling Filter, High rate trickling filter , Activated Sludge tanks , Attached growth system, suspended growth system, mixed liquor, mixed liquor suspended solid , mixed liquor volatile suspended solid, Activated sludge types

Final sedimentation, extended aeration tanks, sludge age, Oxidation ditches, Sludge stabilization, sludge disposal

### Course Learning Outcomes:

1- To know the basics, importance, and methods of water supply.
2- To study the various sources and properties of water.
3- To understand the various methods of conveyance of water.
4- To know the basics of sewage, types of sewers and sewer material.
5- To learn the features of various sewer appurtenances
6- To learn the objectives and methods of water treatment and to study the features and function of different water treatment units.
7- To learn the objectives and methods of sewage treatment and to study the features and function of different primary treatment units.
8- To study the features and function of different secondary treatment units.
9- To learn the objectives and methods of sewage disposal.
10- To learn the objectives and methods of sludge treatment.

## Soil Mechanics

**Course Code:** DWE3319

**Designation (required/elective):** Required

## Course Description:

In this course students are introduced to the fundamental concepts of soil mechanics that will be used to analyze problems related to foundations, retaining walls, earth structures, and highways. Specifically, the physical, mechanical, and hydraulic properties of soils will be discussed. The laboratory component of this course will provide hands-on experience with characterizing soils for engineering purposes and help to familiarize the student with ASTM geotechnical laboratory testing procedures and standards.

Theory hours: **2**

Tutorial hours: **2**

Lab hours: **3**

## Recommended Text Book:

Fundamental of geotechnical Engineering, Braja Das McGraw-Hill, 6th edition 2006.

## Prerequisites:

- DWE3313: Strength of Materials
- DWE2305 : Fluid Mechanics
- DWE2310: Soil Physics

## Course Topics:

Soil classification, compaction, permeability and seepage, stresses within soil mass, settlement, shear strength, and slope stability.

## Course Learning Outcomes:

After completion of this course students will be able to:

1- Soil classification and seepage were added here because they cannot be within the Soil Physics course.
2- Earth pressure and retaining walls topic moved to foundation class because it is a design topic.
3- Additional laboratory tests were added here
4. Determine total stresses, pore water pressures and effective stresses for in-situ soils.
5. Predict the vertical stress increase caused by foundation loads at various locations in a soil mass using Boussinesq-type stress distribution solutions.
6. Estimate the magnitude (settlement) and time-rate of primary consolidation for clay soils.

## Laboratory

Lab hours: 3

1- Consolidation test

2 .Direct shear test

3 .Unconfined compression test

4 .Unconsolidated-undrained triaxial compression (UU) test

## Foundation Engineering

**Course Code:** DWE3328

**Designation (required/elective):** Required

**Course Description:**

Foundation engineering combines the study of soil behavior with topics from engineering mechanics and structures (structural analysis, concrete, and steel design) in order to design all manner of geotechnical structures. In general, practical concepts of soil properties, soil behavior, and basic mechanics are applied in this course to the design of earth structures and foundations.

Theory hours: **2**

Tutorial hours: **2**

Lab hours: **0**

**Recommended Text Book:**

Foundation Engineering, Braja Das McGraw-Hill, 7th edition 2010.

**Prerequisites:**

- DWE3318 Soil Mechanic

**Course Topics:**

- Soil Exploration and Site Characterization
- Design and Analysis of Shallow Foundations
- Design and Analysis of Retaining Structures
- Design and Analysis of Deep Foundations

**Course Learning Outcomes:**

After completion of this course students will be able to:

a. Material behavior and site characterization:
Plan a subsurface Exploration
Select drilling, sampling and field property measurement tools
Specify necessary laboratory tests
Interpret field and laboratory data to get design properties
b. Design and Analysis of Shallow Foundations:
Idealize a soil profile for analysis and design
Use Bearing Capacity Equations correctly
Determination of Correction Factors

Evaluate the effects of water and layered soil systems on foundation performance
Predict foundation settlement (consolidation, elastic)
Geometric and flexural design of spread footings

c. Design and Analysis of Retaining Structures:
Select proper earth pressure calculation method
Calculate earth pressures for layered systems
Evaluate the effects of water and drainage provisions
Determine internal stability requirements of MSE walls

d. Design and Analysis of Deep Foundations
Identify major deep foundation types
Calculate side and tip capacity of driven piles in clay (alpha)
Calculate side and tip capacity of driven piles in sand (beta)
Specify pile material types for various applications
Evaluate pile capacity in the field

## Water quality control

**Course Code:** DWE3313

**Designation (required/elective):** Required

**Course Description:**

The student first learn about Pollution , types and sources ,water needs and water quality , natural water characteristics ,physical , chemical , radiation and biological water quality parameters . Then go into water pollution and its control, then learn about salinity in water and distillation processes, sediment and its control, finally present wastewater reuse for industrial, agricultural, municipal and other uses. In addition to some important water lab. Tests.

Theory hours: **3**

Tutorial hours: **1**

Lab hours: **0**

**Recommended Text Book:**

- Fundamental of environmental engineering, James.
- Water supply and pollution control, Hammer.
- Wastewater treatment for pollytion control and reuse, Soli .J. Arceivala.

**Prerequisites:**

- (Calculus 1 ,2,3,4 ),Fluid Mechanics and Chemistry

**Course Topics:**

Introduction, water needs , Water storage, water quality
Environmental engineering rules

Water characteristics, water quality parameters , Physical water quality , sources ,impacts ,standards , control
Chemical water quality, & standards of water, Water Pollution Regulations , Ion Balance ,Alkalinity species, Softening (Lime-Soda Ash) ,
Biological water quality , BOD, COD, Radiation pollution , Water quality Index
Pollution system, spreading of pollutants , Types of pollutants, Surface water pollution , River Characteristics
The Oxygen sag Curve, Streeter –Pheleps Equations , Lake Characteristics, Overturns, Eutrophication, Groundwater pollution
Self-purification, Dilution, Reaeration , Water reclamation, Municipality water reuse, Municipality water characteristics,
storm water reuse , Municipality water reuse, industrial wastewater characteristics, industrial wastewater reuse,
wastewater reuse for agricultural, Desalination ,Salinity sources
Salinity measurements reuse saline water, desalination control, processes, separate water from solution, Distillation and evaporation, Multiple effect long tube multi-stage flash, Vapor compression.
humidification, freezing , Direct freezing, indirect freezing , hydrates, reverse osmosis, solvent extraction, processes , separate salts from solution, Hydrialysis, Osmosion, absorbtion
Sedimentation control, Sedimentation control in rivers, Sedimentation control in lakes , probable life of reservoirs
Engineering control , eutrophication control
viruses bacteria algae control , thermal pollution control

## Laboratory:

1. Measurement of pH,
2. Measurement of Conductivity
3. Measurement of Alkalinity by EDTA method
4. Measurement of Acidity by EDTA method
5. Measurement of Optimum Coagulant Dose by Jar Test
6. Measurement of Hardness by EDTA method
7. Measurement of Residual Chlorine.
8. Measurement of Chlorides
9. Determination of Turbidity by using Nephlometer.

## Course Learning Outcomes:

The objective of this course is to provide the student with sufficient water quality and pollution background .By this course the student will be able to solve many engineering problems through applying the analytical methods in solving these problems. In addition to learn some important water lab. Tests.

By the end of successful completion of this course, the student will be able to:

1- Know the basics, importance, of water Characteristics.
2- Study the various sources of water pollution and pollutants.
3- Learn the objectives and methods of water treatment and to study the features and function of different water treatment units.

4- 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.
5- The graduate is able to collect and process data, information and knowledge to answer specific questions or generate new conceptual models and hypotheses. The graduate evaluates these models and hypotheses using the appropriate experimental, mathematical and statistical approaches.
6- The graduate recognizes ethical issues, considers multiple points of view, and uses critical ethical reasoning to determine the appropriate behavior to follow. The graduate thus demonstrates a high level of integrity and a positive work ethic combined with a thorough understanding of the ethical implications and obligations associated with the practice of engineering.
7- Conduct external research for design and creation of design tools

## Theory of Structures

**Course Code:** DWE3322

**Designation (required/elective):** Required

**Course Description:**

This is a required course for the D.W.R Engineering Program. It deals with: Classification of structures; loads, Uncertainty in load calculations; Statically determinate structures, stability and indeterminacy ; truss analysis, internal forces in structures, shear and moment diagrams for beams and frames; moving loads and influence lines for statically determinate structures; deflections of structures by energy method; analysis of statically indeterminate structures ( classical methods), Introduction to matrix (stiffness) method of structural analysis, computer software for structural analysis.

Theory hours: **3**

Tutorial hours: **1**

Lab hours: **0**

**Recommended Text Book:**

R. C. Hibbeler, "Structural Analysis", 8th Edition, 2012

**Prerequisites:**

- DWE 1303 Statics
- DWE3313 Strength of materials

**Course Topics:**

1. Introduction, Classification of structures. Loads, Uncertainty in load calculations.
2. Analysis of statically determinate structures, stability and indeterminacy
3. Analysis Trusses (simple, compound and complex).
4. Internal forces in beams and Frames.

5. Shear and moment diagrams for beams and frames.
6. Moving loads and influence lines for statically determinate structures.
7. Deflections of Beams, trusses and Frames by Energy Method (unit load method).
8. Analysis of statically indeterminate structures by classical methods.
9. Introduction to matrix (stiffness) method of structural analysis and computer software for structural analysis

### Course Learning Outcomes:

1. Understand classification of structures, types of loads and stability of structures.
2. Ability to analyze statically determinate Trusses.
3. Ability to identify and calculate internal forces in structures, shear and moment diagrams for beams and frames.
4. Ability to analyze moving loads and influence lines for statically determinate structures.
5. Ability to determine deflections of beams, trusses and Frames.
6. Understand and identify methods of analysis of statically indeterminate structures.
7. Ability to solve and analyze statically indeterminate structures by classical methods.
8. Be familiar with matrix and computer methods in structural analysis.

## DWE3315: Engineering Management

**Designation (required/elective):** Required

### Course Description:

This course inculcates the fundamental principles of construction planning; study the key project management skills. Critical path scheduling, durations, logic, resource allocation, and the calculation of costs. Typical contract formats: project planning with emphasis on legal aspects, cash flows, related costs and agreements. Cost control. Linear programming as applicable in Civil Engineering Projects.

### Recommended Text Book:

### Textbook:

- Daniel W. HalpinPurdue University,Bolivar A. Senior Colorado State University, Construction Management, John Wiley & Sons, Inc. 4th ed., 2011
- Clifford J. Schexnayder, Richard E. Mayo, Construction Management Fundamentals, McGraw-Hill, 2nd ed., 2008.

### Prerequisites:

- DWE2213 Engineering Statistics
- Engineering Program

### Course Topics:

1. Construction Technology and Construction
2. Construction Industry

3. Construction planning and scheduling
4. Gantt chart and Activity Precedence Diagrams
5. Program evaluation & review technique
6. Progress reporting
7. Line of Balance Applied to Construction
8. Work Breakdown Structure
9. Earned Value Method
10. Major Construction Contract Types
11. Project Delivery Methods
12. Project Cost Control Systems
13. Value Engineering
14. Resource Planning& Allocation
15. Optimization techniques

### Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. To introduce a concepts of projects formulation

2. To impart the idea about planning and scheduling of activities.

3. To introduce the concepts of resource planning, allocation and control.

4. To provide a bird's eye view of optimization techniques

## Reinforced Concrete Design

### Course Code: DWE3324

### Designation (required/elective): Required

### Course Description:

Reinforced Concrete Design. Behavior of reinforced concrete elements under different natural and physical conditions and under normal force, shear, moment and torsion. Ultimate Design of Reinforced Concrete, Working Strength Design used in this course to help the student develop an intuitive feeling about structural and material wise behavior and design of reinforced concrete systems .The codes related of the American Concrete Institute for reinforced concrete buildings

Theory hours: **2**

Tutorial hours: **2**

### Recommended Text Book:

- د.جمال عبد الواحد فرحان الظاهر(تصاميم المنشآت الخرسانية المسلحة وفقا لمتطلبات الكود

(ACI 318-02).

- Design of reinforce concrete structure by winter.
- جامعة الموصل د.سعد علي الطعان (اساسيات الخرسانة المسلحة )

**Prerequisites:**

- DWE 2309 Concrete Technology
- DWE 3313 Strength of materials

**Course Topics:**

- Introduction
- Analysis by WSDM.
- Design by WSDM.
- Analysis by USDM
- Design by USDM
- Design of Doubly R.R.B
- Shear &Diagonal Tension
- Shear &Diagonal Tension
- One –Way Solid Slab.
- Tow –Way Solid Slab.
- Analysis& Design of columns.

**Course Learning Outcomes:**

1- Students will be able to understand the crack control of reinforced concrete members.
2- Students will understand the general mechanical behavior of reinforced concrete.
3- Students will be able to analyze and design reinforced concrete flexural members.
4- According to Shear Requirements for structures. The student will be able to design and analysis members to reach adequate case for shear.
5- Design and Analysis the Slabs by using Ultimate Stress Design Method USDM by calculate distribute the area of steel with slab thickness according to ACI-Code Requirements.

## Design of Dams

**Course Code:** DWE4327

**Designation (required/elective):** required

**Course Description:**

Environmental and lifestyle considerations, hydrology for design , choose the type of the dam, , earth dams , rock dams , concrete dams, the design consideration of dams, spillway design, outwork design, energy dissipation. Dams and Sustainable Development

Theory hours: **3**

Tutorial hours: **1**

Lab hours: **0**

### Recommended Text Book:

**Hydraulic Structures,** P. Novak, A.I.B. Moffat and C. Nalluri, School of Civil Engineering and Geosciences, University of Newcastle upon Tyne, UK and R. Narayanan Formerly Department of Civil and Structural Engineering, UMIST, University of Manchester, UK Fourth edition published 2007 by Taylor & Francis

### Prerequisites:

- DWE2305 Fluid mechanics
- DWE3317 Engineering Hydrology
- Open Channel Hydraulics
- Hydraulic Structures

### Course Topics:

1. Introduction,
2. Environmental and lifestyle considerations,
3. Hydrology for design ,
4. Choose the type of the dam, ,
5. concrete dams,(Gravity, arch, buttress)
6. earth dams
7. Rock-fill dams
8. Spillway (introduction & types of Spillway)
9. Spillway design consideration,
10. Dams and Sustainable Development,

### Course Learning Outcomes:

1. The student will know the basics, and consideration of dam design.
2. The student will develop an understanding of the principles of hydrology for design.
3. Students will gain tools for planning, analysis and design for different types of dams,
4. Students will gain tools for planning, analysis and design for spillways,

## Safety and Operation of Dams

**Course Code:** DWE4334
**Designation (required/elective):** Required

### Original Course Description:

Dam outlet works, Energy dissipation of Dams, Reservoirs:, Types of Reservoirs, Zones of Storage: Reservoir Yield: Selection of Distribution-Reservoir Capacity for a Given Yield, Selection of Capacity for a River Reservoir, Monitoring of dam operation, Dam safety (instrumentation and surveillance), Emergency Operation Plan Sustainable management of reservoirs, A Tools of Sustainable management and management of water resources

Theory hours: **3**

Tutorial hours: **1**

Lab hours: **0**

## Recommended Text Book:

**1-Water-resources engineering /**

Ray K. Linsley, Joseph B. Franzini, Fourth Edition, New York: McGraw-Hill, - McGraw-Hill series in water resources and environmental engineering, 1992.

**2-Hydraulic Structures**

Fourth Edition, P. Novak, A.I.B. Moffat and C. Nalluri, School of Civil Engineering and Geosciences, University of Newcastle upon Tyne, UK and R. Narayanan Formerly Department of Civil and Structural Engineering, UMIST, University of Manchester, UK, Fourth edition published 2007 by Taylor & Francis

## Prerequisites:

- DWE2305Fluid mechanics
- DWE3317 Engineering Hydrology
- Open Channel Hydraulics
- Hydraulic Structures

## Course Topics:

1. Dam outlet works,
2. Energy dissipation of Dams
3. Introduction of Reservoirs,
4. Types of Reservoirs,
5. Zones of Storage ,
6. Reservoir Yield
7. Selection of Capacity for a River Reservoir,
8. Monitoring of dam operation,
9. Dam safety (instrumentation and surveillance)
10. Emergency Operation Plan
11. Dam failure
12. Sustainable management of reservoirs
13. A Tools of Sustainable management and management of water resources.

## Course Learning Outcomes:

1. The student will know the basics, and consideration of dam operation.
2. The student will develop an understanding of the principles of selection of reservoirs capacity.
3. Students will gain tools for planning, and analysis reservoir storage and types of reservoirs,
4. Students will gain tools for Monitoring of dam operation
5. The student will know the main reasons of Dam failure
6. The student will know the basics tests for the maintenance of the dam

## Irrigation Engineering

**Course Code:** DWE4326

**Designation (required/elective):** Required

**Course Description:**

To develop understanding about water requirement of crops, irrigation methods, and irrigation engineering works like weir/barrage, storage and outlet works, distribution works, regulating and cross drainage works and importance of drainage in irrigated areas.

Theory hours: **2**

Tutorial hours: **2**

Lab hours: **0**

**Recommended Text Book:**

1. Asawa, G.L., "Irrigation Engineering", New Age International Publishers, 2000.
2. Punima B.C. & Pande B.B .Lal Irrigation and Water Power Engineering, Laxmi Publishing, New Delhi 2007.
3. Michael, A.M, Irrigation Theory and Practical, Vikas Publishing Pvt Ltd, 2006.
4. Gupta, B.L, & Amir Gupta, "Irrigation Engineering", Satya Praheshan, New Delhi.

**REFERENCES**

1. Dilip Kumar Majumdar, "Irrigation Water Management (Principles & Practices)", Prentice Hall of India (P), Ltd, 2000.
2. Basak, N.N, "Irrigation Engineering", Tata McGraw-Hill Publishing Co. New Delhi, 1999.
3. Sharma R.K.. "Irrigation Engineering", S.Chand & Co. 2007.

**Prerequisites:**

- DWE2305Fluid mechanics
- DWE3317 Engineering Hydrology

- DWE3314 Open Chanel
- DWE3320 Hydraulic Structures

### Course Topics:

1. INTRODUCTION
   Irrigation – Need and mode of irrigation – Merits and demerits of irrigation – Crop and crop seasons – consumptive use of water – Duty – Factors affecting duty – Irrigation efficiencies – Planning and Development of irrigation projects.
2. IRRIGATION METHODS
   Canal irrigation – Lift irrigation – Tank irrigation – Flooding methods – Merits and demerits – Sprinkler irrigation – Drip irrigation. Relation between depth of water, depth of soil, and water content. Net depth of irrigation, gross depth of irrigation and irrigation efficiency, Conveyance efficiency
3. CANAL IRRIGATION
   Alignment of canals – Classification of canals – Canal drops – Hydraulic design of drops – Cross drainage works – Hydraulic design of cross drainage works – Canal Head works – Canal regulators – River Training works.
4. IRRIGATION WATER MANAGEMENT
   Need for optimization of water use – Minimizing irrigation water losses – On farm development works - Participatory irrigation management – Water users associations – Changing paradigms in water management

### Course Learning Outcomes:

After learning the course, the students should be able to:

1. Types of irrigation canals-contour canal, ridge canal, side sloping canals, Canal sections, Losses of canal water, Silting and scouring of canals,
2. Method of design of unlined section of irrigation canal, Silt theories, Lined canals, Design of lined canal, Canal escapes, Irrigation outlets and types of
3. Calculate Net Irrigation Requirement (NIR), Field Irrigation Requirement (FIR) and Gross Irrigation Requirement (GIR).

## Drainage Engineering

**Course Code:** DWE4332

**Designation (required/elective):** Required

### Course Description:

Drainage and wetlands design for agricultural and natural resources applications. Water table modification for nonpoint sources pollution control.

Theory hours: 3

Tutorial hours: 1

Lab hours: 0

### Recommended Text Book:

Irrigation and Drainage Engineering, Waller, Peter, Yitayew, Muluneh, Springer International Publishing 2016

### Prerequisites:

- DWE2305Fluid mechanics
- DWE3317 Engineering Hydrology
- DWE4325 Irrigation engineering
- Soil mechanics

### Course Topics:

1. Introduction to drainage engineering in natural and agricultural environments. Benefits and problems of drainage.
2. Plant requirements. Aeration. Salinity effects. Plant response.
3. Soil-water relationships. Soil-water statics and dynamics.
4. Steady state approach. Derivation of steady state equation. Crop and soil parameters. Applications.
5. Un-steady state approach. Falling water table methods.
6. Sub-surface drainage design. Drain capacity, slope and size. Layout of systems. Interceptor drains.
7. Surface drainage design.
8. Salinity control.

### Course Learning Outcomes:

1. To gain an understanding of soil water movement, drainage and water table control, the underlying theory and its applications.
2. To be able to use the above information to investigate, analyze and solve drainage and wetlands problems.
3. To design drainage and wetlands systems for agricultural and natural resource applications, including surface, subsurface and water table control systems, and removal of pollutants from nonpoint sources.

## Design and Evaluation of On-farm Irrigation systems

**Course Code:** DWE4333

**Designation (required/elective):** Required

### Original Course Description:

Irrigation systems principles and design procedures for design and operation of sprinkler, trickle, and surface irrigation systems.

Theory hours: **2**

Tutorial hours: **1**

Lab hours: **0**

## Recommended Text Book:

1. Hoffman, G.J., R.G. Evans, M.E. Jensen, D.L. Martin, and R.L. Elliott. (2007). Design and Operation of Farm Irrigation Systems. 2nd Ed., ASABE, St. Joseph, MI, 1040 pp. ISBN: 1-892769-64-6.
2. M. H. Ali., Fundamentals of Irrigation and On-farm Water Management: Volume 1, ISBN 978-1-4419-6335-2, 2010
3. Class Handouts and directed readings.

## Prerequisites:

- DWE2305 Fluid Mechanics
- DWE3316 Soil Physics
- DWE3317 Engineering Hydrology

## Course Topics:

1. Overview of irrigation and soil-water-plant relationships.
2. Irrigation water requirements and system capacity.
3. Types of irrigation systems and their selection criteria.
4. Performance criteria of irrigation systems.
5. Principles of pressurized irrigation systems.
6. Sprinkler irrigation design of fixed and hand move systems.
7. Sprinkler irrigation design of fixed and hand move systems.
8. Pumps and system curves (design of pumping units).
9. Design of self-move (Pivot & Lateral) sprinkler irrigation systems.
10. Trickle irrigation design and operation.
11. Precision Irrigation concepts and application.
12. Surface irrigation systems – design principles.
13. Design of surface irrigation systems (e.g., basin, border, and furrow).

## Course Learning Outcomes:

On completion of the course, the student will understand and be able to:

1. Select a suitable irrigation system for a given situation.
2. Assess the performance of irrigation systems.
3. Complete the basic design of irrigation systems: sprinkler, trickle, and surface.
4. Conceptualize the basis of a precision irrigation system.

# Water Resources Planning and Management

## Course Code: DWE4331

## Designation (required/elective): Required

## Modified Course Description: (DWE4330 Water Resources Planning and Management)

Assessment of surface and groundwater resources, water resources planning, water resources management, water demand management, integrated water resources management, water resource systems (Linear and Dynamic programming techniques).

Theory hours: 3

Tutorial hours: 1

Lab hours: 0

## Recommended Text Book:

- Water Resources Systems Planning and Management, Daniel P. Loucks and Eelco van Beek, UNESCO 2005.
- Water resources systems analysis / Karamouz, Szidarovszky, Zahraie. Lewis Publishers, 2003.

## Prerequisites:

- DWE 1209 Computer Science
- DWE 2212 Calculus IV
- DWE3214 Engineering Numerical Methods
- DWE2213 Engineering Statistics
- DWE4324 Engineering Optimization

## Course Topics:

**Water Resources Planning**

1 Planning Concepts and Definitions.

2 Risk and Uncertainty

3 Storage Reservoirs

**Water Resources Management**

1 Functions of Water Resources Management

2 Water Shortages vs. WRM

**Water Demand Management**

1 The Demand Management Approach

2 Water Demand and Water Quality Management

**Integrated Water Resources Management**

1 Definition of IWRM

2 IWRM Principles

3 How to Implement IWRM

**Water Resource Systems**

1 Optimization - General model for water resources

2 Reservoir Operation

3 Linear Programming - General applications

4 Groundwater Management - Basics and Principles

5 Optimization in Water Quality Management

### Course Learning Outcomes:

1. The students should be able to assess the potential of groundwater and surface water resources. This will include learning different mathematical techniques about sustainable yields of the water resources.
2. The students should be able to start developing master and strategic water resources planning.
3. The students should be able to deal with water Supply/Demand issues including water demand management, reservoir storage and other structural and non-structural methods.
4. The students should be able to know how to implement IWRM in different regions.
5. The students should be able to use LP, DP and TSM for water resources management and planning.

## Engineering Optimization

**Course Code:** DWE4325

**Designation (required/elective):** Required

### Modified Course Description: (Engineering Optimization)

Introduce methods of optimization to engineering students, including linear programming, integer programming, and interior point methods. Numerous applications are presented in water resources, civil, environmental engineering. The goal is to maintain a balance between theory, numerical computation, and problem setup for solution by optimization software, and applications to engineering systems.

Theory hours: 3

Tutorial hours: 1

Lab hours: 0

## Recommended Text Book:

Engineering Optimization - Theory and Practice; S.S. Rao

## Prerequisites:

- DWE 1209 Computer Science
- DWE 2212 Calculus IV
- DWE3214 Engineering Numerical Methods
- DWE2213 Engineering Statistics

## Course Topics:

1. Introduction to methods of optimization; optimality and convexity.
2. General optimization algorithm; necessary and sufficient conditions for optimality
3. Introduction to linear programming—a geometric perspective
4. Standard form in linear programming; basic solutions; fundamental theorem of linear programming
5. Simplex method; multiple solutions; tie-breaking procedures; two-phase method
6. Duality theory in linear programming; complementary slackness; economic interpretation of the dual
7. Sensitivity analysis; right-hand-side and cost ranging
8. Linear Programming: Extensions

THE REVISED SIMPLEX METHOD

9. Applications (cont.): optimal estimation in environmental and water resources engineering;
10. Integer Programming: The Transportation Algorithm
11. Integer Programming: The Assignment Problem.
12. Non-, linear programming

## Course Learning Outcomes:

Upon successful completion of this course, the student will be able to understand:

(1)basic theoretical principles in optimization;

(2)formulation of optimization models;

(3)solution methods in optimization;

(4)methods of sensitivity analysis and post processing of results

(5) Applications to a wide range of engineering problems.

## Methods of Construction and Estimation

**Course Code:** DWE4330

**Designation (required/elective):** Required

### Original Course Description:

Introduction to the various construction techniques, practices and the equipment needed for different types of construction activities. It also covers the various aspects of estimating of quantities of items of works involved in buildings, water supply and sanitary works, and irrigation works, the rate analysis, valuation of properties and preparation of reports for estimation of various items.

### Recommended Text Book:

Textbook:

- Estimating and costing in civil Engineering By:B.N.DUTTA 2012
- Civil Estimating. costing and voluation
  Quantity Surveying for building and civil eng.works:Byp.LBhasin and S.Chand New Delhi
- CIVIL ESTIMATING and Costing :A.K.UPADHYAY 2010

### Prerequisites:

- DWE2307 Technology Building Materials
- DWE 1210Engineering Drawing

### Course Topics:

1. Construction practices
2. Sub structure construction
3. Super structure construction
4. Repair and rehabilitation
5. Construction equipment
6. Introduction to estimates
7. Estimate of buildings
8. Estimate of other structures
9. Specification and tenders
10. Valuation
11. Report preparation

### Course Learning Outcomes:

1. Students shall have a reasonable knowledge about the various construction procedures for sub to super structure.
2. Students shall have a reasonable knowledge about the equipment needed for construction of various types of structures from foundation to super structure.
3. Students shall be able to estimate the material quantities, prepare a bill of quantities, make specifications and prepare tender documents.
4. Students should also be able to prepare value estimates.

# Course Syllabus

# Elective Classes

## Remote Sensing& GIS Applications in Hydrology

**Course Code:** DWE4336

**Designation (required/elective):** Elective

**Course Description:**

This course introduces knowledge about concepts and foundations of Remote Sensing, elements of Photograph systems, remote sensing scanning systems. Then, it moves to understand the principle of interpretation of aerial photographs. Also, this course introduces basic principle of GIS. Then this course ends with the application of remote sensing in water resources (water pollution Detection - Lake Eutrophication Assessment - Flood Damage - Water Quality and Turbidity - Water Penetration and depth measurement-Soil Moisture-Ground Water). It includes computer applications.

Theory hours: **2**

Tutorial hours: **0**

Lab hours: 0

**Recommended Text Book:**

Remote sensing and image interpretations, Lillisand 12 edition 2014.

**Prerequisites:**

- DWE2306 Engineering surveying I
- DWE2310 Engineering surveying II

**Course Topics:**

1. Concepts and foundations of Remote Sensing
2. Elements of Photograph systems
3. Remote Sensing scanning systems
4. Interpretation of Aerial Photographs for Site Investigations.
5. Basic principle of GIS
6. Application of remote sensing in dams and water resources.

**Laboratory:**

1- GIS data models and sources

2- Map scale and projections
3- Coordinate systems
4- Satellite image
5- Arc catalog tool
6- Arc map tool
7- Arc toolbox
8- Raster and vector graphic
9- Type of Remote sensing data
10- Georefrencing mapping
11- Georefrenced line, area, point
12- Hydrological applications
13- Hydrological applications
14- Hydrological applications

### Course Learning Outcomes:

1. Students will gain tools for planning, analysis and design for water resources systems

2. Science – Scientific procedures in remote sensing show the student the necessity of types of remote sensing data to extract different information for dams and water resources

3. Engineering – remote sensing is one of the original and most recognized dams and water resources engineering skills

4. - Students will learn to use different type of remote sensing data to extract data for dams and water resources projects.

5. Students will use GIS tools for drawing thematic maps for water resources projects.

## Steel Structures

### Course Code: DWE4313

### Designation (required/elective): elective

### Modified Course Description:

Design of structural steel structures using AISC LRFD code, analysis and design of tension members, compression members, beam members; combined axial and bending; bolted and riveted connections, design of hydraulic steel structures,and use of software to design typical systems.

Theory hours: 2

Tutorial hours: 1

Lab hours: 1

### Recommended Text Book:

W. Segui, Steel Design, Global Engineering, 5th edition, 2013

Design of hydraulic steel structures, ASCE

### Prerequisites:

- DWE3313 Strength of materials
- DWE3321 Theory of Structures

### Course Topics:

1. Structural Design Philosophy, an introduction to the LRFD method.
2. Properties and behavior of structural steel.
3. Strength of tension members, design by codes and specifications.
4. Strength of compression members, design by codes and specifications.
5. Strength of beams in bending, design by codes and specifications.
6. Bending and axial forces in beam-columns, design by codes and specifications.
7. Introduction to collapse mechanism.
8. Steel member connections, design by codes and specifications.
9. Design of hydraulic steel structures.
10. Use of commercial software for the design of structural elements.

### Course Learning Outcomes:

1. Students should be able to use AISC LRFD Code design procedures to analyze and design the main structural elements of steel structures.
2. Students will also be familiar with the use of LRFD method to design of hydraulic steel structures
3. Students will learn to use commercial software to analyze and design steel structural elements

## River Mechanics

**Course Code:** DWE4314

**Designation (required/elective):** Elective

### Course Description:

Rivers and estuaries provide people with food, water, energy, communication paths and ports. However, they can also cause major damage through flooding. Understanding and engineering rivers is thus immensely important. River beds are composed of granular material that can be displaced by the water flow and transported from one location to another. Quantitative prediction of sediment erosion and accumulation rates is crucial for many applications in Civil and Environmental Engineering, including dam silting and bridge scouring, to name just a few., river training and bank protection works; Navigation and dredging; Sediment movement in river channels and flow regimes.

Theory hours: **3**

Tutorial hours: **1**

Lab hours: **0**

## Recommended Text Book:

1. River Behaviour Management and Training (Vol. I & II), CBI&P, New Delhi.

2. Irrigation & Water Power Engineering- B. C. Punmia and Pande B. B. Lal.

3. River Engineering by Margeret Peterso

4. Principles of River Engineering by (the non tidel alluvial) PH Jameen

5. P. Julien, “River Mechanics”, Cambridge University Press, 2002

## Prerequisites:

- DWE2305Fluid mechanics
- DWE3317 Engineering Hydrology
- DWE3314 Open Chanel

## Course Topics:

1. Introduction, classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology and various classification schemes.
2. Behavior of Rivers: Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control.
3. Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics of stream restoration.
4. Analysis of flow, Sediment and channel geometry data.
5. River Training and Protection Works: Introduction, Classification of River Training, Types of training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampeners and other river/ flood protection works.

## Course Learning Outcomes:

1. The student knows the terminology used in river engineering and knows the operation and construction techniques of water bound infrastructure.
2. The student understands the physical processes in river engineering.
3. The student understands the processes and construction techniques of soft (beaches, dunes,) and hard (weirs, locks, quay walls, offshore structures, culverts, cofferdams, breakwaters,) water bound infrastructure.
4. The student can select a proper solution, based on an objective approach, even if not all boundary conditions are fully known or controllable.
5. The student can design in a scientific way a water bound structure, hereby using proper calculation methods and/or software tools.

## Engineering Economy

**Course Code:** DWE4316

**Designation (required/elective):** Elective

### Course Description:

Principles of Engineering Economy. Equivalence and compound interest formula. Single payment model. Uniform payment model. Gradient payment model. Decision criteria for single and multiple alternatives: Present worth, annual worth, future worth, internal rate of return, and benefit cost ratio. Before and after-tax analysis.

### Recommended Textbook(s):

- Leland Blank and Anthony Tarquin, Engineering Economy, McGraw-Hill, 6th ed., 2005.

### Prerequisites:

- DWE1202 Calculus II

### Course Topics:

- 1. Introduction: Investment Explained.
- Interest and Financial Mathematics. Simple interest. Compound interest. Graphical Conventions
- 3.Single Payment. Uniform Series. Arithmetic Gradient
- Nominal and Effective Interest Rates
- Interest and Principal Separation
- Present Worth Analysis. Present Worth Analysis.
- Investment in Bonds.
- Use computer software (MS Excel) to perform basic economic analyses
- Annual Worth Analysis
- 10 Rate of Return Analysis3
- Analysis of Public Projects. The Benefit-Cost-Analysis
- Depreciation Methods
- Depreciation Analysis using Computer software (MS Excel)
- Income Taxes. After tax analyses
- Effects of Inflation, Loans
- Breakeven Analysis

### Program and Course Outcomes:

• Understand the basic concepts and terminology used in engineering economics. This includes single payment, uniform series, arithmetic gradient, and nominal and effective interest rates.

• Evaluate alternatives based on

• Present worth analysis

• Annual worth analysis

• Benefic/Cost analysis

• Internal rate of return analysis

• Calculate depreciations and understand the impact of inflation

• Use computer software to perform economic analyses

• Perform before and after-tax analysis

• Perform breakeven analysis for a single project and between two alternatives

• Recognize the economic impact of engineering solution.

## Irrigation and Drainage Networks

**Course Code:** DWE4318

**Designation (required/elective):** Elective

**Course Description:**

The aim of the subject is to give information about theoretic basis of irrigation of field crops and fruit orchards, and about using of existing and building of new irrigation systems. The aim of the subject is also present drainage systems and possibilities of their renovation. After completion of the subject, students will be able in practice solve projects concerning with proposal of irrigation and drainage systems

Theory hours: **3**

Tutorial hours: **1**

Lab hours: **0**

**Recommended Text Book:**

1- P.Waller, M. Yitayew., Irrigation and Drainage Engineering 1st ed. 2016 Edition, ISBN-13: 978-3319056982
2- Food and Agriculture Organization of the United Nations, Design and Optimization of Irrigation Distribution Networks, ISBN-13: 978-9251026663, FAO (January 30, 1995)

**Prerequisites:**

- DWE2305 Fluid Mechanics
- DWE3316 Soil Physics
- DWE3317 Engineering Hydrology

**Course Topics:**

Irrigation units. Irrigation and drainage networks. Layout of irrigation and drainage networks. Discharges of water courses and distributaries.

Discharges of collector drains. Water levels in water courses, and in collector drains. Longitudinal slopes in irrigation and drainage networks.

Lining of canals. Synoptic diagrams.

### Course Learning Outcomes:

- ability to construct drainage system
- ability to determine the irrigation regime of crops
- Ability to solve problems in irrigation and drainage
- knowledge of different methods of irrigation
- Knowledge of drainage methods of wet land

## Computer Applications in Water Engineering

### Course Code: DWE4315

### Designation (required/elective): Elective

### Modified Course Description:

"The ability to use computers for water resources engineering applications". Computer software, and particularly spreadsheets such as Microsoft's Excel product, is very well suited to developing tabular and graphical solutions to problems commonly encountered within this course. Students will be required to employ software in the completion of their class assignments.

Theory hours: **2**

Tutorial hours: **0**

Lab hours: **3**

### Recommended Text Book:

Haested Methods, 2007. Computer Applications in Hydraulic Engineering, 7th Edition, Haested Press.

### Prerequisites:

- DWE1209 Computer Science
- DWE2305 Fluid Mechanics
- DWE3317 Engineering Hydrology
- DWE3320 Hydraulic Structures

## Course Topics:

1. Computers as Engineering Tools.
2. Advanced Excel routines in problem solving.
3. Optimization.
4. Matlab as computing engine.
5. Linear equations and applications to engineering problems.
6. Creating Matlab Functions.
7. Decisions and loops in Matlab.
8. Solving Differential Equations.

9. HEC and Bentley computer programs.

10 ArcGIS Geographic Information System.

11. Watershed Modeling System and stream network delineation using WMS model.

12. Using global mapper program.

## Course Learning Outcomes:

Students should be able to:

- Identify the operational features of computer program
- Create user-defined functions (Excel and Matlab)
- Use of computer models to support hydraulic engineering design
- Develop of hydraulic engineering design projects
- Construct, interpret and solve simple optimization problems (Excel Solver)
- Develop and program simple engineering analyses (Matlab and Excel)
- Design of water resources engineering projects.