

*Republic of Iraq
Ministry of Higher Education & Scientific Research
Supervision and Scientific Evaluation Directorate
Quality Assurance and Academic Accreditation
International Accreditation Dept.*

Academic Program Specification Form For The Academic

University: BAGHDAD

College :Engineering

Number Of Departments In The College :13

Date Of Form Completion : 2022-12-1

Dean ' s Name

Date: / /

Signature

*Dean ' s Assistant For
Scientific Affairs*

Date: / /

Signature

*The College Quality Assurance
And University Performance
Manager*

Date: / /

Signature

Quality Assurance And University Performance Manager

Date: / /

Signature

TEMPLATE FOR PROGRAMME SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

PROGRAMME SPECIFICATION

This Programme Specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It is supported by a specification for each course that contributes to the programme.

| | |
|--|---|
| 1. Teaching Institution | University of Baghdad |
| 2. University Department/Centre | College of Engineering / Department of Energy Engineering |
| 3. Programme Title | Heat Transfer- ENRE300 |
| 4. Title of Final Award | Bachelor's of Energy Engineering Science |
| 5. Modes of Attendance offered | Weakly |
| 6. Accreditation | Accreditation Board for Engineering and Technology (ABET) |
| 7. Other external influences | Training courses for students to develop professional skills in the English language / field visits // application in government institutions and the private sector. |
| 8. Date of production/revision of this specification | 2022-12-1 |
| 9. Aims of the Programme | |
| 1-Introduction to heat transfer | |
| 2-Steady state conduction heat transfer. | |
| 3- Fins. | |
| 4- Unsteady state conduction heat transfer . | |
| 5- Forced convection external flow. | |
| 6- Forced convection internal flow. | |
| 7- Natural convection heat transfer. | |
| 8- Heat exchange analysis and design. | |
| 9- Radiation heat transfer. | |

10. Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

- A1. To know basic concept of heat transfer phenomena.
- A2. To understand the parameters effecting heat transfer process.
- A3. To know how to determine the heat transfer boundary condition
- A4. To understand how to analyze and simulate heat transfer.
- A5. To know principle of different types of heat exchanger.
- A6. To know carefully radiation heat exchange.

B. Subject-specific skills

- B1. Analyze and give a complete description to heat transfer processes.
- B2. Capability of applying a correct model for heat transfer.
- B3. Give a scientific solution to the industrial problems.

Teaching and Learning Methods

- 1- Lecturing 2- Team work 3- home work 4- laboratory work

Assessment methods

- 1- Written and virtual exams monthly and quarterly.
- 2- Quizzes.
- 3- Writing scientific reports (laboratory and specialized in Heat transfer).
- 4- Seminars.
- 5- Homework.
- 6- Oral questions.
- 7- Social media and educational sites for the subject.

C - Affective and value goals:

- C1- To strive to build the student in a valuable, ethical and human way.
- C2 - Educating the student as the basic building block for the future of the country and relying on it for its advancement.
- C3 - Increasing students' skills in terms of engineering, linguistics and programming.
- C4- Ensuring the production of a high-quality product in order to be consistent with the requirements of the labor market.

Teaching and Learning Methods

- 1-Providing students a knowledge of engineering skill in heat transfer.
- 2-To make the students have the ability of scientific analysis methods.

Assessment methods

- 1- Personal interviews and correspondence.
- 2- Examination scores.
- 3- Practical tests.
- 4- Social media and educational sites.

D. General and Transferable Skills (other skills relevant to employability and personal development)

D1 - Directing students to specific sites on the Internet in order to learn about new and international resources.

D2 - Instructing students to view the websites of international universities and scientific centers.

D3 - Assigning students to complete specific projects in order to develop their scientific capabilities.

D4- Instructing students to master the English language and engineering programs

Teaching and Learning Methods

Assessment Methods

11. Programme Structure

| Level/Year | Course or Module Code | Course or Module Title | Credit rating | 12. Awards and Credits |
|------------|-----------------------|------------------------|---------------|---|
| THIRD | ENRE300 | HEAT TRA | 9 | Bachelor Degree Requires (x) credits |
| | | | | |
| | | | | |
| | | | | |
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13. Personal Development Planning

Personal development is through

- 1- Increasing knowledge of modern books in order to keep pace with the development in the field of specialization.
- 2- Keeping up with the knowledge of sober research in sober international journals.
- 3- Proficiency in modeling and simulation software in the field of specialization.
- 4- Attending seminars for professors and postgraduate students.

14. Admission criteria.

First - Conditions for admission to the college:

- 1- Adoption of the admission requirements according to the regulations of the Ministry of Higher Education and Scientific Research (central admission)
- 2- To pass any special test or scientific interview

Second - Conditions for admission to the scientific section

- 3- The preparatory stage graduate accepts the scientific branch (biological and applied) exclusively

Third - To be medically fit (medical examination)

15. Key sources of information about the programme

- 1- References approved by the university.
- 2- External references and various books.
- 3- Labor market needs.
- 4- Local trends.
- 5- Studies and questionnaires.
- 6- Conferences, seminars and specialized workshops with the beneficiaries.
- 7 - All institutions, individuals and entities that have an interest in the juvenile department and the educational scientific program, and that is meant by the faculty members in the department, students and workers in similar bodies.
- 8 - The Internet.

Curriculum Skills Map

please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed

[illegible]

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

| | |
|--|--|
| 1. Teaching Institution | UNIVERSITY OF BAGHDAD |
| 2. University Department/Centre | ENGINEERING COLLEGE / ENERGY ENGINEERING |
| 3. Course title/code | ENRE 335: Heat Transfer |
| 4. Modes of Attendance offered | weakly |
| 5. Semester/Year | year |
| 6. Number of hours tuition (total) | 90 |
| 7. Date of production/revision of this specification | 1/12/2022 |
| 8. Aims of the Course | |
| 1- Developing students' awareness by getting acquainted with heat transfer, their sources, and related statistics. | |
| 2- Knowing and evaluating methods of calculating heat transfer. | |
| 3- Learn how to evaluate candidate sites for installing heat transfer stations. | |
| 4- Development of engineering skills for students by getting acquainted with heat transfer systems and their development stages. | |
| 5- Learn about mathematical models for heat transfer. | |
| 6- Learn how to calculate the efficiency of heat transfer systems. | |
| 9. Learning Outcomes, Teaching ,Learning and Assessment Method | |

A- Cognitive goals.

A1- The student learns about the sources and basics of heat transfer.

A2- The student learns about heat transfer calculations.

A3- The student learns how to assess the heat transfer in candidate locations.

A4 - Students are introduced to heat transfer systems.

A5- The student is introduced to the evaluation of candidate sites for heat transfer farms.

B - The Program's Marital Objectives:

B1 - Solve basic problems with heat transfer.

B2 - Using video lectures of the heat transfer.

B3 - Conducting many experiments related to heat transfer

B4 - Use of e-learning and attendance (blended learning).

Teaching and Learning Methods

1- The theoretical lectures in addition to the video lectures (e-learning).

2- Team Project: Student groups to prepare reports and homework assignments.

3- Video learning. Video learning to expand the student's understanding of the curriculum vocabulary.

4- Laboratory Learning through conducting practical experiments.

5- Method of discussion and weekly duties.

Assessment methods

1- Written and virtual exams monthly and quarterly.

2- Quizzes.

3- Writing scientific reports (laboratory and specialized in heat transfer).

4- Seminars.

5- Homework.

6- Oral questions.

7- Social media and educational sites for the subject.

C. Affective and value goals:

C1- To strive to build the student in a valuable, ethical and human way.

C2 - Educating the student as the basic building block for the future of the country and relying on it for its advancement.

C3 - Increasing students' skills in terms of engineering, linguistics and programming.

C4- Ensuring the production of a high-quality product in order to be consistent with the requirements of the labor market.

Teaching and Learning Methods

1-Through daily and monthly tests.

2- By looking at sober international universities.

3- Discussions.

4- Practical and applied tests.

Assessment methods

1- Personal interviews and correspondence.

2- Examination scores.

3- Practical tests.

4- Social media and educational sites.

D. General and rehabilitative transferred skills(other skills relevant to employability and personal development)
D1 - Directing students to specific sites on the Internet in order to learn about new and international resources.
D2 - Instructing students to view the websites of international universities and scientific centers.
D3 - Assigning students to complete specific projects in order to develop their scientific capabilities.
D4- Instructing students to master the English language and engineering programs.

| 11. Course Structure | | | | | |
|----------------------|---------|---|--------------------------------------|------------------------|-------------------|
| Week | Hours | ILOs | Unit/Module or Topic Title | Teaching Method | Assessment Method |
| First | 3 hours | To recognize heat transfer conduction , convection and radiation in a simple examples | Introduction | Lecture and discussion | Testing |
| Second | 3 hours | To recognize heat transfer general conduction | Steady one-dimensional heat transfer | Lecture and discussion | Testing |
| Third | 3 hours | To recognizeMulti layer heat conduction for plane wall. | Multi layer heat conduction | Lecture and discussion | Testing |
| Fourth | 3 hours | To recognize Multi layer heat conduction for cylinder and sphere, | Multi layer heat conduction | Lecture and discussion | Testing |
| fifth | 3 hours | To recognize Possion equation for flat plate, cylindrical coordinate. | Conduction with heat generation | Lecture and discussion | Testing |
| sixth | 3 hours | To recognize critical thickness for cylinder and sphere | Insulation critical thickness | Lecture and discussion | Testing |
| seventh | 3 hours | To recognize straight fin performance long, adiabatic and connective on fin tip, | Constant cross-sectional area fins | Lecture and discussion | Testing |
| eight | 3 hours | To recognize variable cross-sectional area and annular fin. | Variable cross-sectional area fins | Lecture and discussion | Testing |
| ninth | 3 hours | To recognize analytical, graphical, numerical and electrical solution methods | Multi-dimensional heat conduction | Lecture and discussion | Testing |

| | | | | | |
|-----------------|---------|--|--|------------------------|---------|
| tenth | 3 hours | To recognize numerical method and how to write the finite difference equations | Multi-dimensional heat conduction | Lecture and discussion | Testing |
| eleventh | 3 hours | To recognize lumped capacity analysis method | Unsteady state heat transfer | Lecture and discussion | Testing |
| twelfth | 3 hours | To recognize analysis for semi finite solid, | Unsteady state heat transfer | Lecture and discussion | Testing |
| thirteenth | 3 hours | To recognize Heisler chart for flat plate, cylinder and sphere and applied this charts for multi-dimensional heat conduction | Unsteady state heat transfer graphical method | Lecture and discussion | Testing |
| fourteenth | 3 hours | To recognize the implicit and explicit numerical method for unsteady state heat conduction | Unsteady state heat transfer numerical method | Lecture and discussion | Testing |
| fifteenth | 3 hours | Exam cover all above first term subjects. | First term exam | Lecture and discussion | Testing |
| sixteenth | 3 hours | To recognize the flow over the flat plate regimes | Introduction to convection | Lecture and discussion | Testing |
| seventeenth | 3 hours | To recognize the general shape of continuity momentum and energy equation in laminar flow | Principle of forced convection | Lecture and discussion | Testing |
| eighteenth | 3 hours | To recognize the exact solution to general continuity and momentum equations | Integral form to continuity and momentum equations | Lecture and discussion | Testing |
| nineteenth | 3 hours | To recognize the exact solution to general energy equation | Integral form to energy equation | Lecture and discussion | Testing |
| twentieth | 3 hours | To recognize the two boundary layer (hydrodynamic and thermal) thicknesses and drag force | Laminar and turbulent boundary layers | Lecture and discussion | Testing |
| Twentieth-one | 3 hours | To recognize Colburn and Reynolds analogy | Heat transfer analogy | Lecture and discussion | Testing |
| Twentieth-two | 3 hours | To recognize turbulent and laminar flow inside tubes with different geometry | Internal flow empirical formula | Lecture and discussion | Testing |
| Twentieth-three | 3 hours | To recognize turbulent and laminar flow over flat plate and | External and cross flow empirical | Lecture and discussion | Testing |

| | | | | | |
|-----------------|---------|--|---|------------------------|---------|
| | | outsidebank of tubes with different geometr | formula | | |
| Twentieth-four | 3 hours | To recognize analytical formulas for natural convection heat transfer | Natural convection heat transfer | Lecture and discussion | Testing |
| Twentieth-five | 3 hours | To recognize empirical formulas for natural convection heat transfer for different geometry, | Natural convection heat transfer | Lecture and discussion | Testing |
| Twentieth-six | 3 hours | To recognize different types of heat exchangers and concentrate of log-mean temperature difference method. | Heat exchanger Design (LMTD) | Lecture and discussion | Testing |
| Twentieth-seven | 3 hours | Design effectiveness-NTU methods.To recognize | Heat exchanger Design effectiveness-NTU methods | Lecture and discussion | Testing |
| Twentieth-eight | 3 hours | To recognize the principle of radiation heat transfer | Radiation heat transfer | Lecture and discussion | Testing |
| Twentieth-nine | 3 hours | To recognize effect of shape factor on heat exchange. | Radiated heat exchange between bodies | Lecture and discussion | Testing |
| Thirty | 3 hours | Exam cover all above second term subjects | Second term exam | Lecture and discussion | Testing |

| 11. Infrastructure | |
|--|--|
| 1. Books Required reading: | Fundamentals of heat and mass transfer/6 edition/Incropera Heat Transfer (in SI units) eight edition/J P Holman |
| 2. Main references (sources) | |
| A- Recommended books and references (scientific journals, reports...). | |
| B-Electronic references, Internet sites... | |

12. The development of the curriculum plan

The course is developed through the following:

- 1- Continuous access to recent books on international websites.
- 2- Continuous access to modern research in reputable international journals.
- 3- Participation and attendance in conferences, seminars and seminars.



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Academic Program Specification Form For The Academic

University: BAGHDAD
College : ENGOINRING
Number Of Departments In The College : 13
Date Of Form Completion :2022/12/1

Dean's Name

Date: / /

Signature

*Dean's Assistant For
Scientific Affairs*

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*The College Quality Assurance
And University Performance
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TEMPLATE FOR PROGRAMME SPECIFICATION

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PROGRAMME SPECIFICATION

This Programme Specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It is supported by a specification for each course that contributes to the programme.

| | |
|--|--|
| 1. Teaching Institution | UNIVERSITY OF BAGHDAD |
| 2. University Department/Centre | College Of Engineering / Department of Energy Engineering |
| 3. Programme Title | Hydroelectric power systems |
| 4. Title of Final Award | Bachelor of Energy Engineering Science |
| 5. Modes of Attendance offered | WEAKELY |
| 6. Accreditation | Accreditation Board for Engineering and Technology (ABET) |
| 7. Other external influences | 1 Training courses for students to develop professional skills in the English language / field visits / / application in government institutions and the private sector. |
| 8. Date of production/revision of this specification | 2022-12-1 |
| 9. Aims of the Programme | |
| <ul style="list-style-type: none">1- Students learn the basic concepts of systems that use water as a working fluid.2- Students learn the types of hydroelectric stations, their advantages and disadvantages3- Students learn the types of turbines used in operating the hydroelectric station4- The level of student development to solve the problem of dealing with power plants5- Developing students' level to understand the advantages and disadvantages of | |

| |
|---|
| different power plants |
| 6- The student learned about the concept of dams, its types, and its role in hydroelectric stations |
| A- A- Cognitive goals. 1.The student learns how to deal with hydroelectric power stations 2 The student learns the benefits of hydroelectric plants 3. That the student identifies how to solve any problem that deals with the efficiency of power generating stations and their advantages and disadvantages for all power plants. |
| B - The Program's Marital Objectives: B 1. Dealing with hydroelectric power stations B 2. A complete analysis of the station and the role of each part of the system |
| Teaching and Learning Methods |
| The method of lecturing. Team Project. The method of discussion and weekly assignments. |
| Assessment methods |
| C. Thinking Skills C1.Inference. C2. Solve the problems. C3.Learn the benefit of every power plant |
| Teaching and Learning Methods |
| 1-Through daily and monthly tests. 2- By looking at sober international universities. 3- Discussions. 4- Practical and applied tests. |
| Assessment methods |
| 1- Personal interviews and correspondence. 2- Examination scores. 3- Practical tests. 4- Social media and educational sites. |

D. General and Transferable Skills (other skills relevant to employability and personal development)

D. Giving students the knowledge and skill of the meaning of power and energy

D2. Solving engineering problems in a manner theory by students

| 11. Programme Structure | | | | 12. Awards and Credits |
|-------------------------|-----------------------|-----------------------------|---------------|---|
| Level/Year | Course or Module Code | Course or Module Title | Credit rating | |
| THIRD | | Hydroelectric power systems | 8 | Bachelor Degree Requires (x) credits |
| | | | | |
| | | | | |
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13. Personal Development Planning

Personal development is through

- 1- Increasing knowledge of modern books in order to keep pace with the development in the field of specialization.
- 2- Keeping up with the knowledge of sober research in sober international journals.
- 3- Proficiency in modeling and simulation software in the field of specialization.
- 4- Attending seminars for professors and postgraduate students.

14. Admission criteria.

First - Conditions for admission to the college:

- 1- Adoption of the admission requirements according to the regulations of the Ministry of Higher Education and Scientific Research (central admission)
- 2- To pass any special test or scientific interview

Second - Conditions for admission to the scientific section

- 3- The preparatory stage graduate accepts the scientific branch (biological and applied) exclusively

Third - To be medically fit (medical examination)

15. Key sources of information about the programme

- 1- References approved by the university.
- 2- External references and various books.
- 3- Labor market needs.
- 4- Local trends.
- 5- Studies and questionnaires.
- 6- Conferences, seminars and specialized workshops with the beneficiaries.
- 7 - All institutions, individuals and entities that have an interest in the juvenile department and the educational scientific program, and that is meant by the faculty members in the department, students and workers in similar bodies.
- 8 - The Internet.

Curriculum Skills Map

please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed

[illegible]

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

| | |
|--|--|
| 1. Teaching Institution | UNIVERSITY OF BAGHDAD |
| 2. University Department/Centre | ENGINEERING COLLEGE / ENERGY ENGINEERING |
| 3. Course title/code | Hydroelectric power systems |
| 4. Modes of Attendance offered | weakly |
| 5. Semester/Year | Semester |
| 6. Number of hours tuition (total) | 60 |
| 7. Date of production/revision of this specification | 1/12/2022 |
| 8. Aims of the Course | |
| 1- Students learn the basic concepts of systems that use water as a working fluid. 2- 2- Students learn the types of hydroelectric stations, their advantages and disadvantages 3- 3- Students learn the types of turbines used in operating the hydroelectric station 4- 4- The level of student development to solve the problem of dealing with power plants 5- 5- Developing students' level to understand the advantages and disadvantages of different power plants 6- The student learned about the concept of dams, its types, and its role in hydroelectric stations | |

9. Learning Outcomes, Teaching ,Learning and Assessment Method

B- Cognitive goals.

- 1.The student learns how to deal with hydroelectric power stations
- 2 The student learns the benefits of hydroelectric plants
3. That the student identifies how to solve any problem that deals with the efficiency of power generating stations and their advantages and disadvantages for all power plants.

B - The Program's Marital Objectives:

B 1. Dealing with hydroelectric power stations

B 2. A complete analysis of the station and the role of each part of the system

Teaching and Learning Methods

The method of lecturing
way discussion and duties weekly

Assessment methods

A daily and monthly tests and tests the practical and theoretical

C. Affective and value goals:

C1- To strive to build the student in a valuable, ethical and human way.

C2 - Educating the student as the basic building block for the future of the country and relying on it for its advancement.

C3 - Increasing students' skills in terms of engineering, linguistics and programming.

C4- Ensuring the production of a high-quality product in order to be consistent with the requirements of the labor market.

Teaching and Learning Methods

- 1-Through daily and monthly tests.
- 2- By looking at sober international universities.
- 3- Discussions.
- 4- Practical and applied tests.

Assessment methods

- 1- Personal interviews and correspondence.
- 2- Examination scores.
- 3- Practical tests.
- 4- Social media and educational sites.

D. General and rehabilitative transferred skills(other skills relevant to employability and personal development)

D. Giving students the knowledge and skill of the meaning of power and energy

D2. Solving engineering problems in a manner theory by students

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| Week | Hours | ILOs | Unit/Module or Topic Title | Teaching Method | Assessment Method |
|------|-------|--|--|---|---|
| 1 | 4 | The student is introduced to the concept of hydroelectric power | Introduction / Concept of Hydroelectric Power - Statistics and Comparisons | Lecture and discussion | Conducting theoretical tests and requesting special reports |
| 2 | 4 | Knowing the types of hydroelectric stations | Types of hydroelectric stations | Lecture, discussion, videos and practical experiments | Conducting theoretical and practical tests and requesting special reports |
| 3 | 4 | Knowledge of traditional energy types | Conventional energy | Lecture, discussion, and video lectures | Conducting theoretical tests and requesting special reports |
| 4 | 4 | Knowing the parts of the hydroelectric station | Parts of hydroelectric stations | Lecture, discussion, and video lectures | Conducting theoretical tests and requesting special reports |
| 5 | 4 | Knowing how to operate the hydroelectric station and the most important factors affecting the plant's efficiency | Plant height and amount of water flow | Lecture, discussion, videos and practical experiments | Conducting theoretical and practical tests and requesting special reports |
| 6 | 4 | Knowing the types of turbines used in the hydroelectric stations | Types of turbines | Lecture and discussion | Conducting theoretical tests and requesting special reports |
| 7 | 4 | Knowing how to work with mathematical calculations for hydroelectric stations | Mathematical calculations for hydroelectric stations | Lecture and discussion | Conducting theoretical tests and requesting special reports |
| 8 | 4 | Knowing the general properties and mathematical relationships of motive variation | Turbine propellant | Lecture, discussion, videos and practical experiments | Conducting theoretical and practical tests and requesting special reports |
| 9 | 4 | Knowledge of the general properties and mathematical relationships of interactive turbine | Reaction turbine | Lecture, discussion, videos and practical experiments | Conducting theoretical and practical tests and requesting special reports |
| 10 | 4 | Learn about the concept of dams and their types | Introduction to dams and their types | Lecture and discussion | Conducting theoretical tests and requesting special reports |
| 11 | 4 | Knowledge of mathematical calculations for dams | Mathematical calculations | Lecture, discussion, and video lectures | Conducting theoretical tests and requesting special reports |
| 12 | 4 | Knowledge about the concept of water drainage in hydroelectric stations | Introduction / Concept of water drainage and its types | Lecture, discussion, and video lectures | Conducting theoretical tests and requesting special reports |
| 13 | 4 | Knowledge of mathematical calculations related to water drainage in hydroelectric stations | Mathematical calculations | Lecture and discussion | Conducting theoretical tests and requesting special reports |

| | | | | | |
|----|---|---|--|------------------------|---|
| 14 | 4 | Knowing the multiple impacts of hydroelectric stations on the environment | The effect of dam construction in hydroelectric stations | Lecture and discussion | Conducting theoretical tests and requesting special reports |
| 15 | 4 | Knowing the multiple impacts of hydroelectric stations on the environment | The effect of dam construction in hydroelectric stations | Lecture and discussion | Conducting theoretical tests and requesting special reports |

| 11. Infrastructure | |
|--|---|
| 1. Books Required reading: | Power plants engineering, third edition By P.K. Nag |
| 2. Main references (sources) | Power plants engineering, A.K. Raja 2006 |
| A- Recommended books and references (scientific journals, reports...). | |
| B-Electronic references, Internet sites... | |

12. The development of the curriculum plan

The course is developed through the following:

- 1- Continuous access to recent books on international websites.
- 2- Continuous access to modern research in reputable international journals.
- 3- Participation and attendance in conferences, seminars and seminars.

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| | |
|---|--|
| 1. Teaching Institution | UNIVERSITY OF BAGHDAD |
| 2. University Department/Centre | ENERGY |
| 3. Programme Title | Fuel cell and hydrogen technology |
| 4. Title of Final Award | BACALORIOUS OF ENERGY ENGINERING SCIENCE |
| 5. Modes of Attendance offered | yearly |
| 6. Accreditation | Accreditation Board for Engineering and Technology (ABET) |
| 7. Other external influences | 1 Training courses for students to develop professional skills in the Renewable energy. |
| 8. Date of production/revision of this specification | 2022-12-1 |
| 9. Aims of the Programme | |

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification. Encouraging and developing scientific research in the fields of Nuclear Radiation Detection And Treatment.

Graduation of an elite group of students who have the ability to pursue higher education to supplement higher education. More intelligent in renewable energy

10. Learning Outcomes, Teaching, Learning and Assessment Methods

A. Cognitive goals A1. Enabling the student to gain an understanding of Fuel cell and hydrogen technology and the devices designed to measure performance efficiency

A2 - Preparing qualified engineers to work in government institutions

A3 - Preparing a high-quality energy engineer

A- He shall be able to understand the basics of laboratory equipment used in fuel cell and hydrogen technology measurements

A6 - That the student understands the modern advanced scientific topics in the specialization of hydrogen production

B. The skills goals special to the programme . B1. that the student acquires the skill of mathematical operations of hydrogen technology

B-2 - That the student acquires a skill in the methods of proof and thinking

B3 - That the student is able to link the information

B4 - is able to solve problems and find successful solutions to them with the possibility of using fuel cell parameters measuring devices and treating them using a computer

Teaching and Learning Methods

1-The theoretical lectures given by the professor

2- Special discussion lectures in the field of nuclear measurements

3- Practical lectures in the field of nuclear measurements

4- Seminars (scientific seminars) by students (graduate and undergraduate students)

5- Graduation research projects for students of the completed stage and their discussion

6- Seminar done by small educational groups

7- Using e-learning to deliver ONLINE lectures on the Google Classroom platform

8- Paper lectures pdf

Assessment methods

1- Written and virtual exams monthly and quarterly

2- Rapid exams (QUIZZES)

3- Writing scientific reports (laboratory or archaeological specialized in nuclear radiation and related materials)

4- Seminars (scientific seminars)

5- Homework

6- Committees for graduation research projects for students of the completed stage and their discussion

7- Oral questions

8- Social media and educational sites for the subject

- C. Affective and value goals
- C1. Employing the information acquired
- C2. Personal development through reading and updating knowledge
- C3. Engaging in the teaching profession
- C4 .Participation in seminars, conferences and specialized workshops

Teaching and Learning Methods

- 1-Through daily and monthly tests
- 2- By looking at the experiences of different universities
- 3- Discussions
- 4- Practical and practical tests

Assessment methods

- 1-Graduation research discussion committees for students of the end stage
- 2- Specialized workshops
- 3- Personal interviews and correspondence
- 4- Exam scores
- 5- Practical tests
- 6- Social media and educational sites

D. General and Transferable Skills (other skills relevant to employability and personal development)

D1. Employing the information acquired

D2. Personal development through reading and updating knowledge

D3. Engaging in the teaching profession

D4. Participation in seminars, conferences and specialized workshops

Teaching and Learning Methods

1-Through daily and monthly tests

2- By looking at the experiences of different universities

3- Discussions

4- Practical and practical tests

Assessment Methods

1-Graduation research discussion committees for students of the end stage

2- Specialized workshops

3- Personal interviews and correspondence

4- Exam scores

5- Practical tests

6- Social media and educational sites

11. Programme Structure

| Level/Year | Course or Module Code | Course or Module Title | Credit rating | 12. Awards and Credits |
|------------|-----------------------|-----------------------------------|---------------|---|
| THIRD | ENRE 415 | Fuel cell and hydrogen technology | 2 | Bachelor Degree Requires (x) credits |
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13. Personal Development Planning

C1. Employing the information acquired

C-2 - Personal development through reading and updating knowledge

C-3 - Engaging in the teaching profession

C4 - Participation in seminars, conferences and specialized workshops

C5 - through the preparation of scientific research for the teaching and following up the latest scientific sources

14. Admission criteria.

First - Conditions for admission to the college:

1- Adoption of the admission requirements according to the regulations of the Ministry of Higher Education and Scientific Research (central admission)

2- To pass any special test or scientific interview

Second - Conditions for admission to the scientific section

3- The preparatory stage graduate accepts the scientific branch (biological and applied) exclusively

Third - To be medically fit (medical examination)

15. Key sources of information about the programme

1- THE UNIVERSITY PROSPECTS

2- THE UNIVERSITY AND DEGREE PROGRAMME REGULATION

3- THE DEGREE PROGRAMME HANDBOOK

4- Sources approved by the university (Sectoral Committee)

5- External sources and various books

6- Labor market needs

7- Local trends

8- Studies and questionnaires

9- Conferences, seminars and specialized workshops with the beneficiaries

10- All institutions, individuals and entities that have an interest in the juvenile department and the educational scientific program, and it is meant by the faculty members in the department, students and workers in similar bodies

11- Internet

Curriculum Skills Map

please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed

[illegible]

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

| | |
|---|--|
| 1. Teaching Institution | UNIVERSITY OF BAGHDAD |
| 2. University Department/Centre | ENGINEERING COLLEGE / ENERGY ENGINEERING |
| 3. Course title/code | Fuel cell and hydrogen technology |
| 4. Modes of Attendance offered | weekly |
| 5. Semester/Year | year |
| 6. Number of hours tuition (total) | 90 |
| 7. Date of production/revision of this specification | 1/12/2022 |
| 8. Aims of the Course | |
| Fuel cells cleanly and efficiently convert chemical energy from hydrogen-rich fuels into electrical power and usable high quality heat in an electrochemical process that is virtually absent of pollutants. Similar to a battery. Each individual cell contains an anode, a cathode and a electrolyte layer. | |
| Graduation of an elite group of students who have the ability to pursue higher education to supplement higher education. | |
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9. Learning Outcomes, Teaching ,Learning and Assessment Methode

A- Cognitive goals .

A-1 - Enabling the student to gain an understanding of nuclear and radiation measurements and the devices designed to measure them

A2 - Preparing qualified engineers to work in government institutions

A3 - Preparing a high-quality energy engineer

A- He shall be able to understand the basics of laboratory equipment used in nuclear radiation measurements

A5- To acquaint himself with the computer programs that are used in the field of analysis and theoretical applications

A6 - That the student understands the modern advanced scientific topics in the specialization of nuclear radiation

B. The skills goals special to the course.

B1. That the student acquires the skill of mathematical operations

B-2 - That the student acquires a skill in the methods of proof and thinking

B3 - That the student is able to link the information

B4 - is able to solve problems and find successful solutions to them with the possibility of using nuclear radiation measuring devices and treating them using a computer

Teaching and Learning Methods

1-Theoretical lectures given by the professor

2- Special discussion lectures in the field of nuclear measurements

3- Practical lectures in the field of nuclear measurements

4- Seminars (scientific seminars) by students (graduate and undergraduate students)

5- Graduation research projects for students of the completed stage and their discussion

6- Methods of small educational groups

7- Using e-learning to deliver ONLINE lectures on the Google Classroom platform

8- Paper lectures pdf

Assessment methods

1-Written and virtual exams monthly and quarterly

2- Quick Exams (QUIZZES)

3- Writing scientific reports (laboratory or archaeological specialized in nuclear radiation and related materials)

4- Seminars (seminars)

5- Homework

6- Committees for graduation research projects for students of the completed stage and their discussion

- 7- Oral questions
- 8- Social media and educational sites for the subject

C. Affective and value goals

C1. Employ the information gained

C2. Personal development through reading and updating knowledge

C3. Engaging in the teaching profession

C4. Participation in seminars, conferences and specialized workshops

Teaching and Learning Methods

- 1-Through daily and monthly tests
- 2- By looking at the experiences of different universities
- 3- Discussions
- 4- Practical and practical tests

Assessment methods

- 1-Committees for discussing graduation research for students of the end stage
- 2- Specialized workshops
- 3- Personal interviews and correspondence
- 4- Exam scores
- 5- Practical tests
- 6- Social media and educational sites

D. General and rehabilitative transferred skills (other skills relevant to employability and personal development)

D1. PProviding the student with the information and skills related to using the detection devices for all radiation and information on the effects of X-rays and pollution

D2 - Analyzing test results

D3 - The ability to write and formulate reports on the results of scientific experiments and tests

D4- The ability to draw conclusions

[illegible]

| 11. Course Structure | | | | | |
|----------------------|-------|----------------------------------|---------------------------------|-----------------|-------------------|
| Week | Hours | ILOs | Unit/Module or Topic Title | Teaching Method | Assessment Method |
| ١ | ٣ | History of hydrogen | Hydrogen isotopes | Lectures | Discussions |
| ٢ | ٣ | Hydrogen energy | Kinetics and thermo. | Lectures | Discussions |
| ٣ | ٣ | Physical and chemical properties | Properties of hydrogen elements | Lectures | Discussions |
| ٤ | ٣ | Advantages and disadvantages | Hydrogen fuel | Lectures | Discussions |
| ٥ | ٣ | Preparing of hydrogen gas | Methods of production | Lectures | Discussions |
| ٦ | ٣ | Uses of hydrogen gas | Hydrogen manufacturing | Lectures | Discussions |
| ٧ | ٣ | Safety and handling | Potential | Lectures | Discussions |
| ٨ | ٣ | Hydrogen storage | Hydrogen handling | Lectures | Discussions |
| ٩ | ٣ | Synthetic of Hydrogen | Production of hydrogen | Lectures | Discussions |
| ١٠ | ٣ | Hydrogen delivery | Fact of hydrogen | Lectures | Discussions |
| ١١ | ٣ | Fuel cell | Fuel cell –basics | Lectures | Discussions |
| ١٢ | ٣ | Hydrogen fuel cell | Types of cells | Lectures | Discussions |
| ١٣ | ٣ | Methanol fuel cell | Direct fuel cell | Lectures | Discussions |
| ١٤ | ٣ | Alkaline fuel cell | PH cell | Lectures | Discussions |
| ١٥ | ٣ | Phosphoric acid fuel cell | Acid cell | Lectures | Discussions |
| ١٦ | ٣ | Fuel cell system | Combined heat and power | Lectures | Discussions |
| ١٧ | ٣ | Heat recovery system | Fuel cell work | Lectures | Discussions |
| ١٨ | ٣ | Application of fuel cells | Busies , boats | Lectures | Discussions |
| ١٩ | ٣ | Fuelling station | Markets and economics | Lectures | Discussions |
| ٢٠ | ٣ | Health effects of hydrogen | Environmental effects | Lectures | Discussions |
| ٢١ | ٣ | Redox reactions | Balancing equations | Lectures | Discussions |
| ٢٢ | ٣ | Calvanic cell | Standard potentials | Lectures | Discussions |
| ٢٣ | ٣ | Effects of concentration | Cell EMF | Lectures | Discussions |
| ٢٤ | ٣ | Batteries | Types | Lectures | Discussions |
| ٢٥ | ٣ | Dry cell battery | Alkaline battery | Lectures | Discussions |
| ٢٦ | ٣ | Lead storage battery | Acidic battery | Lectures | Discussions |
| ٢٧ | ٣ | Electrolysis | Of water | Lectures | Discussions |
| ٢٨ | ٣ | Aspects of electrolysis | Quamtitative | Lectures | Discussions |
| ٢٩ | ٣ | Calculations | Standard EMF | Lectures | Discussions |
| ٣٠ | ٣ | Half reaction electrode | Equations | Lectures | Discussions |
| ٣١ | ٣ | Danial cell | Calvanic cell | Lectures | Discussions |

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| 12. Infrastructure | | |
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| Required reading: · CORE TEXTS · COURSE MATERIALS · OTHER | 1. Energy Dept. Fuel cell Lab 2. Applicable project. | |
| Special requirements (include for example workshops, periodicals, IT software, websites) | Conduct experiments in chemistry lab and learn at their own experiences and scientific .programs | |
| Community-based facilities (include for example, guest Lectures , internship , field studies) | Practical training for students in the laboratories of the Ministry of Science and Technology / Renewable Energy Department, as well as .lecturing | |
| 13. Admissions | | |
| Pre-requisites | | ٢٥ |
| Minimum number of students | | ١٠ |
| Maximum number of students | | ٣٠ |

12. The development of the curriculum plan

Course development plan Preparation of mathematics modeling for some applications (case studied)