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| EXC-01-02-02A | **Form Number** | **Form:**  **Course Syllabus** |
| 2/3/24/2022/2963  05/12/2022 | **Issue Number and Date** |
|  | **Number and Date of Revision or Modification** |
| 2/3/24/2023 | **Deans Council Approval Decision Number** |
| 23/01/2023 | **The Date of the Deans Council Approval Decision** |
| 06 | **Number of Pages** |

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| **1.** | **Course Title** | Applied Hydraulics |
| **2.** | **Course Number** | 0604211 |
| **3.** | **Credit Hours (Theory, Practical)** | 3 |
| **Contact Hours (Theory, Practical)** | 3 hrs Theory |
| **4.** | **Prerequisites/ Corequisites** | Principles of irrigation |
| **5.** | **Program Title** | Bachelor in Land, Water and Environment |
| **6.** | **Program Code** | 4 |
| **7.** | **School/ Center** | Agriculture |
| **8.** | **Department** | Land, Water and Environment |
| **9.** | **Course Level** | Second or Third year |
| **10.** | **Year of Study and Semester (s)** | 2022/2023 /First Semester |
| **11.** | **Other Department(s) Involved in Teaching the Course** | / |
| **12.** | **Main Learning Language** | English |
| **13.** | **Learning Types** | ☐Face to face learning √ Blended ☐Fully online |
| **14.** | **Online Platforms(s)** | ☐Moodle ☐Microsoft Teams |
| **15.** | **Issuing Date** | 22/1/2023 |
| **16.** | **Revision Date** |  |

**17. Course Coordinator:**

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| --- |
| Name: Hala Abdur Rauf Rawabdeh Contact hours: upon request  Office number: 058 Phone number: 22452  Email: [hl.rawabdeh@ju.edu.jo](mailto:hl.rawabdeh@ju.edu.jo) |

**18. Other Instructors:**

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**19. Course Description:**

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| This course is designed to be given to non-engineering students in the field of land and water, soils and irrigation, natural resources and water resources. It combines fluid mechanics and hydraulic engineering courses in a simple applied course. This course covers basic fluid mechanics and hydraulics, including the physical proprieties of fluid, the calculation of pressures and forces exerted by static fluids and the principles of conservation of mass, energy and momentum. In addition, it covers Bernoulli’s principle and the use of various energy loss equations. The hydraulic principles will have applied to understanding and solving problems related to: flow in pipes and pipe networks, characteristics and selection of pumps, uniform and non-uniform flow in open channel and flow measurement. Topics such as hydraulics of groundwater and dimensionless analysis will be covered if time permits |

**20. Program Intended Learning Outcomes:** (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

|  |
| --- |
| **Knowledge**  Kp1. Demonstrate comprehensive understanding of the scientific and theoretical knowledge of land, water and environment.  Kp2. Demonstrate problem solving skills and well developed linguistic and communication skills while upholding professional ethics  **Skills**  Sp1. Access land characteristics and their suitability for different agricultural uses.  Sp2. Tackle basic problems of water, land and agricultural environment.  Sp3. Develop​ innovative solution for tackling the adverse effects of water scarcity caused by climate change and desertification​  Sp4. Contribute to agricultural development, as well as food and water security.  **Competencies**  Cp1. Analyze and interpret soil and water quality parameters.  Cp2. Use sound scientific principles for the determination of crop water requirement, and design of irrigation systems for the proper management of agricultural water.  Cp3. Determine the optimal use of water and land to ensure the sustainability of resources and the environment. |

**21. Course Intended Learning Outcomes:** (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

|  |
| --- |
| **A. Knowledge:**  **K1.**Understand the physical properties and the interaction between properties of fluid.  **K2.**Understand and sketch the energy and hydraulic grade lines from the energy equation  **K3.**Understand the principles of friction and local head loss in pipes and relate them to the energy equation and the parameters used in the design of open channels. |
| **B. Skills:**  **S1.**Differentiate between absolute and gauge pressures and Determine the pressure in a pipe system using manometers.  **S2.**Describe the forces associated with pressures under static conditions and determine the magnitude and location of pressure forces on surfaces.  **S3.**Carry out basic calculations such as friction factor, pipe diameter, head loss, and discharge and the dimensions of open channels based on friction, slope, and flow rate and derive the specific energy principles in it  **S4.** Calculate the water surface profile determine their types and differentiate between gradually and rapidly varied flows.  **S5.** Select the appropriate pump based on the characteristics curve. |
| **C. Competences:**  **C1.**Determine pipe sizes in series and parallel systems  **C2.**Select the appropriate location of pumps based net positive suction head  **C3.** Identify the type of the water surface profile. |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Course ILOs | The learning levels to be achieved | | | | | |
| Remembering | Understanding | Applying | Analysing | evaluating | Creating |
| K1 | √ | √ | √ |  |  |  |
| K2 | √ | √ |  |  |  |  |
| K3 | √ | √ | √ | √ |  |  |
| S1 |  | √ | √ |  | √ |  |
| S2 |  | √ | √ | √ |  |  |
| S3 |  | √ | √ | √ |  |  |
| S4 |  |  | √ | √ |  |  |
| S5 |  | √ | √ |  |  |  |
| C1 |  |  | √ | √ |  |  |
| C2 |  |  | √ | √ |  |  |
| C3 |  |  | √ | √ |  |  |

**22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Program ILOs  Course ILOs | ILO  (1) | ILO (2) | ILO (3) | ILO (4) | ILO  (5) | ILO  (6) | ILO  (7) | ILO  (8) | ILO  (9) |
| **K1.**Understand the physical properties and the interaction between properties of fluid. | √ |  | √ |  | √ | √ |  |  |  |
| **K2.**Understand and sketch the energy and hydraulic grade lines from the energy equation | √ |  |  |  |  |  |  |  |  |
| **K3.**Understand the principles of friction and local head loss in pipes and relate them to the energy equation and the parameters used in the design of open channels. | √ |  | √ | √ | √ |  |  | √ |  |
| **S1.**Differentiate between absolute and gauge pressures and Determine the pressure in a pipe system using manometers. | √ |  | √ |  |  |  |  |  |  |
| **S2.**Describe the forces associated with pressures under static conditions and determine the magnitude and location of pressure forces on surfaces. | √ |  | √ |  |  |  |  |  |  |
| **S3.**Carry out basic calculations such as friction factor, pipe diameter, head loss, and discharge and the dimensions of open channels based on friction, slope, and flow rate and derive the specific energy principles in it | √ |  |  |  | √ |  | √ |  |  |
| **S4.** Calculate the water surface profile determine their types and differentiate between gradually and rapidly varied flows. | √ |  | √ |  |  |  |  |  |  |
| **S5.** Select the appropriate pump based on the characteristics curve. |  |  |  |  |  |  | √ |  |  |
| **C1.**Determine pipe sizes in series and parallel systems |  |  |  |  |  |  | √ |  |  |
| **C2.**Select the appropriate location of pumps based net positive suction head |  |  |  |  |  |  | √ |  |  |
| **C3.** Identify the type of the water surface profile. |  |  |  |  | √ |  |  |  |  |

**23. Topic Outline and Schedule:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Week** | **Lecture** | **Topic** | | | **ILO/s Linked to the Topic** | | **Learning Types**  **(Face to Face/ Blended/ Fully Online)** | **Platform Used** | | **Synchronous / Asynchronous Lecturing** | | **Evaluation Methods** | **Learning Resources** |
| 1 | 1.1 | | **Properties of Fluids**   * Units used in Hydraulics * Physical properties of fluids * Surface tension and capillarity * Forces in a fluid field | K1 | | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 1) |
| 1.2 | | Blended | | |  |
| 2 | 2.1 | | **Water pressure and pressure forces**   * Absolute and gauge pressure * Manometers | S1,  S2 | | Blended | | | e-learning,    Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 2) |
| 2.2 | | Blended | | |  |
| 3 | 3.1 | | * Hydrostatic forces on flat surfaces * Buoyancy and flotation | Blended | | | e-learning,    Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 2) |
| 3.2 | | Blended | | |  |
| 4 | 4.1 | | **Fluids in motion**   * Velocity and flow rate * Classification of fluid flow | K1,  K2 | | Blended | | | e-learning,    Teams |  | Homework  Quiz  Exams | | Evett and Liu, 1988  (Chapter 5) |
| 4.2 | | Blended | | |  |
| 5 | 5.1 | | * Conservation of energy * Bernoulli and energy equations * Conservation of momentum | Blended | | | e-learning,    Teams |  | Homework  Quiz  Exams | | Evett and Liu, 1988  (Chapter 5) |
| 5.2 | | Blended | | |  |
| 6 | 6.1 | | **Water flow in pipes**   * Description of pipe flow * Flow regimes | K2,  K3,  S3,  C1 | | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 3) |
| 6.2 | | Blended | | |  |
| 7 | 7.1 | | * Energy in pipe flow * Friction head loss in pipes. | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 3) |
| 7.2 | | Blended | | |  |
| 8 | 8.1 | | * Equations for friction head loss. * Local loss in pipe system. | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 3) |
| 8.2 | | Blended | | |  |
| 9 | 9.1 | | * Branching of pipe systems * Solving pipeline problems * Introduction to water hammer. | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 3) |
| 9.2 | | Blended | | |  |
| 10 | 10.1 | | **Water pumps**   * Classification of pumps * Centrifugal pumps * Pump characteristics curves. * Pumps in parallel or in series | S5,  C2 | | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 4) |
| 10.2 | | Blended | | |  |
| 11 | 11.1 | | * Pumps and pipe systems. * Cavitations in water pumps. * Pump selection | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 4) |
| 11.2 | | Blended | | |  |
| 12 | 12.1 | | **Water flow in open** **channels**   * Classification of flow * Uniform flow in open channels | K3,  S3,  S4,  C3 | | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 6) |
| 12.2 | | Blended | | |  |
| 13 | 13.1 | | * Open channels flow formulas * Energy in open channels | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 6) |
| 13.2 | | Blended | | |  |
| 14 | 14.1 | | * Hydraulic jump. * Nonuniform flow in open channels. | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 6) |
| 14.2 | | Blended | | |  |
| 15 | 15.1 | | * Classification of gradually varied flow. * Computation of water surface profiles. | Blended | | | e-learning,  Teams |  | Homework  Quiz  Exams | | Houghtalen, R. J, 2010  (Chapter 6) |
| 15.2 | | Blended | | |  |

**24. Evaluation Methods:**

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Evaluation Activity** | **Mark** | **Topic(s)** | **ILO/s Linked to the Evaluation activity** | **Period (Week)** | **Platform** |
| First Exam | 30 | Until water pressure and pressure force | K1, K2, S1, S2 | 5 | On class |
| Second Exam | 30 | Until water flow in pipe | K2, K3, S3, C1 | 10 | On class |
| Final Exam | 40 | From water flow in pipe to the end | K3, S3, S4, S5, C2, C3 | 15 | On class |

**25. Course Requirements:**

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| (e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform…etc.):  computer, internet connection, account on Microsoft Teams |

**26. Course Policies:**

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| **A- Attendance policies:** Attendance List on Microsoft teams **(**Laws, regulations and instructions of the University of Jordan)  **B- Absences from exams and submitting assignments on time:** Laws, regulations and instructions of the University of Jordan  **C- Health and safety procedures:** According to global health guidelines and instructions **)**Laws, regulations and instructions of the University of Jordan(  **D- Honesty policy regarding cheating, plagiarism, misbehavior:** Laws, regulations and instructions of the University of Jordan  **E- Grading policy:** Laws, regulations and instructions of the University of Jordan  **F- Available university services that support achievement in the course:** in library and book shop |

**27. References:**

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| A- Required book(s), assigned reading and audio-visuals:   * Houghtalen, R. J., Hwang N. H.C. and Akan A. O.; 2010, Fundamentals of Hydraulic Engineering systems, 4th edition; Pearson. (text book) * Evett J.B. and Liu Ch. , Fundamental of Fluid Mechanics; McGraw-Hill   B- Recommended books, materials and media:  Street, R., G. Watters and J. Vennard; 1997, Fundamental of Fluid Mechanics; 7th edition, Wiley |

**28. Additional information:**

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| Name of the Instructor or the Course Coordinator:  ………………………………………………… | Signature:  …………...……………… | Date:  ……..………… |
| Name of the Head of Quality Assurance Committee/ Department  …………………………………………………. | Signature:  …………...……………… | Date:  ……..………… |
| Name of the Head of Department  …………………………………………………. | Signature:  …………...……………… | Date:  ……..………… |
| Name of the Head of Quality Assurance Committee/ School or Center  …………………………………………………. | Signature:  …………...……………… | Date:  ……..………… |
| Name of the Dean or the Director  …………………………………………………. | Signature:  …………...……………… | Date:  ……..………… |