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| EXC-01-02-02A | **Form Number** | **Form:****Course Syllabus** |
| 2/3/24/2022/296305/12/2022 | **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** |
| 10 | **Number of Pages** |

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| **1** | **Course title** | **Hydrology** |
| **2** | **Course number** | **0604212** |
| **3** | **Credit hours** | 3 |
| **Contact hours (theory, practical)** | Theory  |
| **4** | **Prerequisites/corequisites** | Calculus 1 |
| **5** | **Program title** | Land, Water and Environment |
| **6** | **Program code** | 4 |
| **7** | **Awarding institution**  | The University of Jordan  |
| **8** | **School** | School of Agriculture  |
| **9** | **Department** | Land, Water and Environment |
| **10** | **Level of course**  | Third/fourth years |
| **11** | **Year of study and semester (s)** | 2020/2021 First |
| **12** | **Final Qualification** | Bachelor in Land, Water and Environment |
| **13** | **Other department (s) involved in teaching the course** | - |
| **14** | **Language of Instruction** | English |
| **15** | **Teaching methodology** | ☐Blended ☐Online ☒in-person  |
| **16** | **Electronic platform(s)** | ☒Moodle ☒Microsoft Teams ☐Skype ☐Zoom ☐Others… |
| **17** | **Date of production/revision** | 22/1/2023 |

**16. Course Coordinator: Dr. Michel Rahbeh**

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| Office numbers) **:22442** ( , office hours, phone numbers, and email addresses**) m.rahbeh@ju.edu.jo(**  |

**17. Other instructors:**

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| Office numbers, office hours, phone numbers, and email addresses should be listed.Dr Fayha Al-Shibli Office number (22445)f.shibli@ju.edu.jo |

**18. Course Description:**

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| This course focuses on the measurement and quantification of the major components of the hydrological cycle and the basic understanding of the related physical processes and their interactions. The water cycle will be introduced and then the student will follow the water movement from the lower atmosphere to upper altitudes where it condenses and returns back to the earth’s surface as precipitation. Quantification of precipitation intensities and areal precipitation averages will be discussed, followed by a discussion of the solar energy balance in the context of evapotranspiration. During the course, students will learn how to estimate the infiltration, canopy, and other abstraction on a watershed scale. The learning activities also include the isolation of base flow from streamflow, derivation of unit hydrograph, and determination of runoff using unit hydrograph and synthetic unit hydrograph. If time permits GIS-based hydrological model and Rainfall-Runoff Models software will be introduced |

**19. Course aims and outcomes:**

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| 1. Aims:
2. This course provides the students with the necessary knowledge to describe the hydrological cycle and the interaction between its components.
3. Quantification of the major components of the hydrological cycle
4. Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to:

B-1 Quantify the amount of effective rainfall over the watershed using different methods.B-2 Be familiar with the hydrological components of systems and subsystems.B-3 Provide the students with hydrology science and applications, radiation energy and the corresponding evapotranspiration, main concepts of groundwater, quantify direct runoff after each storm and identify its source.  |
| **A-Knowledge and Understanding**A-1 Describe the water cycleA-2 Be familiar with the terminology commonly used in the hydrology literatureA-3 Differentiate and characterize the different types of precipitation, devices, mechanism of artificial rain, terminal velocity of a raindrop, thunderstorm cell model.A-4 Describe the runoff generation processes A-5 Describe the solar energy balance and its role in hydrologyA-6 Describe the principles behind the evapotranspiration equationsA-7 Understand the parameters used in the description and quantification of water vapour.And so, on |
| 1. **Intellectual Analytical and Cognitive Skills**

C-1 Explain the interaction between the different components of the hydrological cycleC-2 Explain the reasons for spatial variability of rainfallC-3 Understand the methods used for the isolation of baseflow from streamflowC-4 Understand how air density and atmospheric pressure respond to altitude and temperature changes.C-5 solar radiation and spectrum. energy balance by earth, atm and space. …**And so, on** |
| 1. **Subject-Specific Skills**

D-1 Formulate a simple water balance equationD-2 Carry out basic calculations such as water volumes, rates and dischargesD-3 Determine the average areal rainfallD-4 Determine infiltration depth and canopy and other abstractionsD-5 Determine the evapotranspiration rates.D-6 Derive a unit hydrographD-7 Change the time interval of the unit hydrographD-8 Construct a synthetic unit hydrographD-9 Determine the air density, saturated and actual vapour pressure……And so, on |
| **E- Transferable Key Skills**E-1Subjectively select the appropriate coefficients (SCS-CN) for the determination of runoff.E-2 Determine runoff at ungauged catchmentsE-3 Select the appropriate parameters from a meteorological record for the determination of evapotranspiration.E-4. Determine missing precipitation values**…..****And so, on** |

**20. Topic Outline and Schedule:**

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| **Topic** | **Week** | **Instructor** | **Achieved ILOs** | **Evaluation Methods** | Reference |
| Introduction* Definition of hydrology Science and applications
* Hydrological cycle
* Water balance equations
 | 3/ 1stwk3/ 1stwk**3/ 1stwk** | Dr. Fayha Al-Shibli | **A1,A2, B1, C1** | Exams | Chow et al. 1988 (Chapter 1) |
| Atmospheric water* Vapor pressure
* Water vapor
* Solar Radiation
* Precipitable water
* Groundwater concepts
 | **7/ 2nd, 3rd, 4thwk** | Dr. Fayha Al-Shibli | **A2, A7, B4, C9,D3** | Exams | Chow et al. 1988 (Chapter 3) |
| Precipitation* Formation
* Types
* Measurements
* Areal averages
 | **6/5thand 6th wk** | Dr. Fayha Al-Shibli | **A2,A3,B2,C3,D4** | Exams | Chow et al. 1988 (Chapter 3 and 6) |
| Infiltration and storm abstractions * The process of infiltration
* φ-index
 | **4/7thand 8th wk** | Dr. Fayha Al-Shibli | **A1,A2,A4,B1,C4,D1** | Exams | Chow et al. 1988 (Chapter 4) |
| Midterm Exam | **1/8th wk** | Dr. Fayha Al-Shibli |  |  |  |
| Infiltration and storm abstractions (cont’d)* Soil Conservation Services (SCS) method
 | **3/9th and 10thwk** | Dr. Fayha Al-Shibli | **A1,A2,A4,B1,C4,D1** | Exams | Chow et al. 1988 (Chapter 4) |
| Streamflow * Sources of streamflow; overland flow, subsurface flow and base flow
* Runoff generation
* Streamflow hydrograph
* Base flow separation
* Derivation of the unit hydrograph
* Construction of the synthetic unit hydrograph
 | **9/11th,12th,13thand 14thwk** | Dr. Fayha Al-Shibli | **A1,A2,A4,B1,B3,C2,C6,C7,C8,D1,D2** | Exams | Chow et al. 1988 (Chapters 4,5,6,7) |
| Evaporation and plant transpiration* Energy balance
* Radiation
* Combination method
* Potential evapotranspiration
 | **3/15th wk** | Dr. Fayha Al-Shibli | **A2,A5,A6,C5,D3** | Homework  | Chow et al. 1988 (Chapter 3), Allen et al. 1999 |
| Final Exam week | **16th wk** | Dr. Fayha Al-Shibli |  | Exams | FinalExam as scheduled by the University registration |

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**21. Teaching Methods and Assignments:**

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| The development of ILOs is promoted through the following teaching and learning methods:The question-and-answer teaching method will be used in this course; therefore, the students are encouraged to participate in classroom discussions. All study material will be circulated electronically and made available on the instructor’s website. The lectures will focus on a comprehensive understanding of the course material and problem-solving. The homework problem sets are designed to help the students to widen their understanding of the course material and practice their problem-solving skills.  |

**22. Evaluation Methods and Course Requirements:**

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

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| **Evaluation Activity** | **Mark** | **Topic(s)** | **Period (Week)** | **Platform** |
| First Exam | 30 | Chp 1, 2, & 3 | 14/11/2022 | In-person exam |
| Midterm | 1010 | Chp 4,5 | 10/12/202224/12/2022 | homework and quiz  |
| Final | 50 | Chp 3,4,5,6 | 22/01/2023 | In-person exam |

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**23. 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:** Web**,** in library and book shopG-Honesty policy regarding cheating, plagiarism, misbehavior:* **Use of cell phone in prohibited.**
* **Zero tolerance for cheating and plagiarism**

H- Grading policy:

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| **From**  | **To** | **Grade** | **Interval** |
| **86** | **100** | **A** | **15** |
| **83** | **85** | **A-** | **3** |
| **80** | **82** | **B+** | **3** |
| **74** | **79** | **B** | **6** |
| **71** | **73** | **B-** | **3** |
| **68** | **70** | **C+** | **3** |
| **62** | **67** | **C** | **6** |
| **59** | **61** | **C-** | **3** |
| **56** | **58** | **D+** | **3** |
| **50** | **55** | **D** | **6** |
| **47** | **49** | **D-** | **3** |
| **0** | **46** | **H** | **0** |

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**24. Required equipment: (** Facilities, Tools, Labs, Training….)

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| Whiteboard, and data show. |

**25. References:**

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| **Required book (s), assigned reading and audio-visuals:**Chow, V. T., Maidment, D. R. and Mays, L. W. 1988. *Applied hydrology*. McGraw-Hill**Recommended books, materials, and media:**1. Warren Jr, V., and L. Gary. "2003." *Introduction to Hydrology Fifth Edition University of Florida*.
2. Allen, R. G.,Pereira, L. S., Raes, D. and Smith, M. 1998. *FAO Irrigation and drainage paper NO. 56: Crop Evapotranspiration (guidelines for computing crop water requirement.* FAO, Water resources, development and management services, Rome Italy.
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**26. Additional information:**

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| Name of the Instructor or the Course Instructor…Dr Fayha Al-Shibli… | 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: ……..………… |