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| **Al-Balqa Applied University**  **Faculty of Graduate Studies**  **Dept. Water Resources & Environmental Management** |  | **جامعة البلقاء التطبيقية**  **كلية الدراسات العليا**  **قسم إدارة موارد المياه والبيئة** |
| **تأسست سنة 1997** |

**COURSES DESCRIPTION**

(*Thesis Track*)

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| **Course No.** | **Course Description** | **Credit Hours** |
| **504009721** | **Unit process operation of water treatment**  Physiochemical and transformation processes in natural and engineered environmental systems. Process modeling and design of operations involving state and phase transformation. Chemical oxidation, reduction, sorption, stripping, and exchange processes. Membrane separations, particle aggregation, and coagulation. Sedimentation and filtration.  **Text Book:** Davis, M.L. 2010. Water and Wastewater Engineering: Design Principles and Practice. McGraw-Hill Education, USA.  **Recommended References:** Stensel, H.D., Burton, F.L., Tchobanoglous, G., Metcalf and Eddy 2003, Wastewater engineering: treatment and reuse, McGraw-Hill, Boston. | **3(2-3)** |
| **504009722** | **Water pollution control**  Physical, chemical, biological, and hydrological characteristics of surface water system in junction to water quality management issues. Reaction kinetics and material balances in modeling contaminant movement in the environment. Water quality problem domains in stream and river systems, lake and reservoir systems.  **Text Book:** Alley, E.R. 2007. Water quality control handbook. 2nd Edition. McGraw-Hill, NY, USA.  **Recommended References:**  -Helmer, R. and I. Hespanhol. 1997. Water Pollution Control: A Guide to the Use of Water Quality Management Principles. 1st Edition. CRC Press, USA.  - Nesaratnam, S.T. 2014. Water pollution control. The Open University, UK. | **3(3-0)** |
| **504009723** | **Advanced waste management**  Rate processes, energetic and kinetics of chemical, physical, and biological processes. Design of wastewater treatment facilities. Identification of industrial and hazardous waste sources. Industrial wastewater treatment, In plant management and wastewater reuse, cleaner production concept.  **Text Book:** Worrell, W.A., P. Aarne Vesilind, C. Ludwig. 2016. Solid Waste Engineering: A Global Perspective. 3rd Edition. Cengage Learning, USA.  **Recommended References:** Tchobanoglous, G. and F. Kreith. 2002. Handbook of Solid Waste Management. 2nd Edition. McGRAW-HILL, USA. | **3(3-0)** |
| **504009725** | **Environmental impact assessment**  Concepts, procedures and methodology of EIA. Factors affecting the use of EIA in project management in legislative and regulatory context. The origin and the commonly used definition of EIA. Procedure and methodology that characterize current EIA practice. Preparation of terms of reference TORs. Methodology for writing EIA reports. Methods and steps for reviewing EIA. EIA case studies.  **Text Book:** Tromans, S. 2012. Environmental Impact Assessment, 2nd Edition. Bloomsbury Professional, UK.  **Recommended References:** Glasson, J., Therivel, R. Chadwick, A. (2012). Introduction to Environmental Impact Assessment, 4th Edition, Taylor & Francis Ltd. UK**.** | **3(3-0)** |
| **504009731** | **Water resources**  Advanced descriptive and quantitative hydrology. Groundwater development and planning management. Reservoir, lakes, and dam characteristics. Water supply system, flood damage mitigation, surface and groundwater models. Water law.  **Text Book:** Mays, L.W. 2019. Water Resources Engineering, 3rd Edition.  Wiley, USA.  **Recommended References:** Droogers, P. 2013. Water-Food-Energy Nexus: Towards a widening of the water agenda. FutureWater Report 128  <https://www.futurewater.nl/wp-content/uploads/2013/11/Nexus_Publication.pdf> | **3(3-0)** |
| **504009733** | **Groundwater hydraulics**  Groundwater flow, mechanical energy, force potential and hydraulic head. Steady flow in confined and unconfined aquifers. Groundwater flow to wells. Well hydraulics and non-equilibrium equations. Flow in semi-confined aquifer, pumping test design, and fresh water-saline water relations.  **Text Book:** Kasenow, M. 2001. Applied Ground-water Hydrology and Well Hydraulics. Water Resources Publication, LCC, USA.  **Recommended References:** Anderson, M., Woessner, W., Hunt, R. 2015. Applied Groundwater Modeling: Simulation of Flow and Advective Transport. 2nd Edition. Academic Press, USA. | **3(3-0)** |
| **504009734** | **Design of hydraulic structures**  Storage structures; dams, reservoirs, embankments, ponds, and tanks. Conveyance structures; canals, flumes, weirs, spillways, and culverts. Flow measurements structures; orifices, weirs, and venture flumes. Sediment control structures; sedimentation tanks, silt traps, and screens. Collection structures; in take structures and discharge wells.  **Text Book:** Novak, P., A.I.B Moffat, C. Nalluri, R. Narayanan. 2007. Hydraulic Structures. 4th Edition. Taylor & Francis, USA.  **Recommended References:** Chen, Sheng-Hong. 2015. Hydraulic Structures. Springer-Verlag Berlin Heidelberg. | **3(2-3)** |
| **504009741** | **Advanced soil physics**  Solutions of saturated and unsaturated water flow problems, seepage analysis, gaseous diffusion in soil, mathematical equations, solutions of heat and vapor flow through the soil, advective diffusive solute transport and equation, and miscible displacement.  **Text Book:** Marshall, T.J., J. W. Holmes, C. W. Rose. 1996. Soil Physics. Cambridge University Press, UK.  **Recommended References:** Hillel, D. 2003. Introduction to Environmental Soil Physics. Academic Press, USA. | **3(3-0)** |
| **504009742** | **Irrigation science theory**  Basic plant-soil-water relationship, crop water requirements, and estimation. Irrigation system characteristics, types, and performance. Data requirements and procedures for data measurement in consumptive use and soil parameter estimation. Project planning and application of different models for irrigation scheduling and evapotranspiration  **Text Book:** A.M. Michael. 2009. Irrigation Theory and Practice, 2nd Edition, Vikas Publishing House Pvt Limited.  **Recommended References:**  - Crop Evapotranspiration (guidelines for computing crop water requirements), FAO Irrigation and Drainage Paper, No. 56.  - Stewart, B.A., D. R. Nielsen. 2007. Irrigation of Agricultural Crops, 2nd Edition. American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, USA. | **3(3-0)** |
| **504009744** | **Soil and water conservation**  Conservation of soil and water, soil erosion and sedimentation, wind erosion and deposition, soil survey as a basis for land use planning, soil conservation practices and erosion control, tillage practices for erosion control, water conservation, agriculture land drainage, irrigation and soil reclamation, economics of soil and water conservation.  **Text Book:** Blanco-Canqui, H. and Lal, R. 2008. Principles of Soil Conservation and Management. Springer, USA.  **Recommended References:**  <https://www.researchgate.net/publication/320729156_Soil_and_Water_Conservation/link/5a7a93110f7e9b41dbd6245f/download> | **3(3-0)** |
| **504009746** | **Environmental soil chemistry**  Electrochemistry of the double layer, principles and applications to the soil, kinetics of soil reactions, surface complexation models in the soil and its applications, oxidation reduction reactions in the soil, transport of adsorbed chemicals in the soil, reclamation of saline and sodic soils and its reactions.  **Text Book:** Evangelou, V.P. 1998. ENVIRONMENTAL SOIL AND WATER CHEMISTRY: Principles and Applications. 1st Edition. John Wiley & Sons, Inc., USA.  **Recommended References:** Essington, M. 2015. Soil and Water Chemistry: An Integrative Approach, 2nd Edition. CRC Press, USA. | **3(2-3)** |
| **50404841** | **Advanced biostatistics**  Estimation of sample size. Measurement of central tendency. Measurement of dispersion variation. Graphics. Probability. Testing of hypothesis. Type I and error. Statistical tests (t and f test, chi-square). Experimental designs. Analysis of variance, mean separation, Covariance, Linear and multiple regression. Using computer-based programs in data analyses. | **3(3-0)** |
| **50404844** | **Advanced environmental biotechnology**  Use of living organisms to biodegrade waste. Converting wastes to usable substances. Prevention of biodeterioration of valuable materials such as minerals, metals, celluloses, aromatics, and hydrocarbons. Waste water treatment. Recent applications in environmental biotechnology. | **3(3-0)** |