General course information:

Course title:	**Management of Extreme Hydrological Phenomena**	**Course code:**	ΥΔ0610
Credits:	6	**Work load (hours):**	172
Course level:	Undergraduate ☑	Graduate ☐	
Course type:	Mandatory ☐	Selective ☑	
Course category:	Basic ☐	Orientation ☑	
Semester:	9th	**Hours per week:**	4

Course objectives (capabilities pursued and learning results):

Scope of the course is the introduction to hydrology of floods and droughts and natural and human-induced causes of floods and droughts, methods and models of flood and drought analysis and flood and drought management. The outline of the course includes: Introduction to droughts (Definitions, types, characteristics). Climatological and human-induced causes and predictability. Types of droughts (meteorological, hydrological (low flow river and groundwater drought), agricultural and water resources drought). Methods and models of analysis. Drought Indices. Drought modeling using meteorological, agrohydrological and hydrological models. Stochastic modeling of droughts. Probabilistic modeling of droughts. Introduction on hydrology of floods (flood types, characteristics and causes of flooding). Statistical Frequency Analysis of Hydrologic Data. Regional Frequency analysis. Flood Mapping and Flood Zoning. Flash Floods. Urban Floods. Climate Change and Floods. Drought and flood management (adaptation and mitigation, preparedness plans).

This course strengthens students' technical and intellectual competency, preparing them for engineering employment or advanced study. The course exposes students to computational techniques of flood risk estimation and drought identification, modelling, monitoring and assessment used in modern professional and engineering practice. Upon completion of the course, students should be able to demonstrate:

- Understanding of drought types and their characteristics
- Understanding drought causes and impacts of drought
- Understanding the benefits and limitations of different approaches used in drought modelling (statistical, stochastic-probabilistic methods etc.)
- To employ various drought techniques (meteorological and hydrological) for drought modelling and monitoring
- Understanding of the natural processes of flood generation
- Understanding and practical familiarity with current modelling and statistical approaches to flood risk estimation and modelling
- Understanding the range of different approaches used in flood modelling
  Ability to estimate the design flood of a watershed with statistical analysis of flow data or application of empirical methods and hydrological models
- Ability to apply current methods for flood risk estimation in basic cases

Prerequisites:
Hydrology Hydrological Modeling and Forecasting Probability - Statistics

Instructor's data:

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Level:	
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Other tutors:	

Specific course information:

Week No.	**Course contents**	**Hours**	
		Course attendance	**Preparation**
1	**Introduction to droughts (Definitions, types, characteristics). Climatological and human-induced causes and predictability.**	**4**	**2**
2	**Types of droughts (meteorological, hydrological (low flow river and groundwater drought), agricultural and water resources drought.**	**4**	**4**
3	**Methods and models of analysis. Meteorological and agricultural drought. Drought Indices.**	**4**	**4**
4	**Methods and models of analysis. Hydrological (low flow river and groundwater drought) and water resources drought. Drought Indices.**	**4**	**4**
5	**Drought modeling using meteorological, agrohydrological and hydrological models.**	**4**	**4**
6	**Stochastic and probabilistic modeling of droughts.**	**4**	**4**

7	**Introduction on hydrology of floods (flood types, characteristics and causes of flooding).**	**4**	**2**
8	**Statistical Frequency Analysis of Hydrologic Data.**	**4**	**4**
9	**Regional Frequency analysis.**	**4**	**4**
10	**Hydrological models and Simulation (Rainfall-runoff modeling, Continuous hydrologic modelling, Snowmelt-runoff modeling).**	**4**	**4**
11	**Flood routing (Hydrologic and Hydraulic methods of flood routing, Channel and Reservoir-Lake Routing).** **Flood Mapping and Flood Zoning.**	**4**	**4**
12	**Flash Floods.** **Climate Change and Floods.**	**4**	**4**
13	**Flood Management.**	**4**	**4**
14	**Management of hydrological hazards (adaptation and mitigation, preparedness plans).**	**4**	**4**

Suggested Literature:

Bibliography in English:

Anderson M.G., and J.J. McDonnell (eds.) (2005). Encyclopedia of Hydrological Sciences, Wiley Publications.

Beven K.J. (2012). Rainfall-Runoff Modelling: The Primer, 2nd Edition, Wiley-Blackwell.

Ghosh, S.N., (2014). Flood Control and Drainage Engineering, 4th Edition, CRC Press.

Iglesias A., L. Garrote, A. Cancelliere, F. Cubillo, D.A. Wilhite, (Eds.) (2009). Coping with Drought Risk in Agriculture and Water Supply Systems: Drought Management and Policy Development in the Mediterranean. Advances in Natural and Technological Hazards Research, Vol. 26, Springer Publications.

Karamouz, M., Nazif, S., Falahi, M., (2013). Hydrology and Hydroclimatology: Principles and Applications. CRC Press.

Maidment D.R. (ed.) (1993). Handbook of Hydrology. McGraw-Hill.

Mays, L.W., (2010). Water Resources Engineering, 2nd Edition, John Wiley & Sons.

Mimikou, M., Baltas, E. and Tsihrintzis, V., 2016. Hydrology and Water Resources System Analysis, July 2016, Textbook – 448 Pages – 208 B/W Illustrations, ISBN 9781466581302, CRC Press, Taylor and Francis Group.

Nagarajan R., (2010). Drought Assessment. Springer Publications.

Ramachandra Rao A., K.H. Hamed, (2000). Flood frequency analysis, CRC Press.

Rossi G., T. Vega, and B. Bonaccorso, (eds.) (2003). Tools for Drought Mitigation in Mediterranean Regions. Water Science and Technology Library, Vol. 44, Kluwer Academic Publishers, The Netherlands.

Rossi G., T. Vega, and B. Bonaccorso, (eds.) (2007). Methods and Tools for Drought Analysis and Managment. Water Science and Technology Library, Vol. 62, Springer Publications.

Sene, K. (2008). Flood Warning, Forecasting and Emergency Response, Springer Publications.

Tallaksen L.M., and H.A.J. van Lanen, (eds.) (2004). Hydrological Drought - Processes and Estimation Methods for Streamflow and Groundwater, Developments in Water Sciences 48, Elsevier B.V., The Netherlands.

Vogt J.V., and F. Somma, (eds.) (2000). Drought and Drought Mitigation in Europe. Advances in Natural and Technological Hazards Research, Vol. 14, Kluwer Academic Publishers, Dordrecht, the Netherlands.

Wardlow B.D., M. C. Anderson, and J.P. Verdin. (eds.) (2012). Remote Sensing of Drought: Innovative Monitoring Approaches. Drought and water crises series, CRC Press.

Watt, W.E. et al. (1989). Hydrology of Floods in Canada: A Guide to Planning and Design. NRCC

Wilhite, D.A. (ed.) (2000). Drought: A Global Assessment. Natural Hazards and Disasters Series. Routledge Publishers, London.

Wilhite, D.A. (ed.) (2005). Drought and Water Crises: Science, Technology, and Management Issues. CRC Press.

World Meteorological Organization, (WMO) (2008). Manual on Low-flow Estimation and Prediction. WMO- No. 1029, Operational Hydrology report No. 50, 136p.

Teaching method *(select and describe if necessary* - **weight***):*		
Teaching	☑	40%
Seminars	☐	…….%
Demonstrations	☐	…….%
Laboratory	☑	40%
Exercises	☐	20%
Visits at facilities	☐	…….%
Other *(describe):* …….	☐	…….%
Total		100%

Evaluation method *(select)*- **weight:**				
	written	*%*	*Oral*	*%*
Homework	☐		☐	
Class project	☑	100%	☑	20%
Interim examination	☐		☐	
Final examinations	☐		☐	
Other *(describe):* ……	☐		☐	