



*Faculty of Natural Resources
Department of Climatology*

MA/MSc Program in Environmental Climatology	
Course Type	Credits
General	-
Basic	12
Main	12
Compulsory	-
Optional	-
Thesis	6
Total	30


Program Title: Basic Lessons of MSc in Environmental Climatology

Course Title: Advanced theories and research methods in climatology	Credit Number: 2	Type: Theoretical	Prerequisites/Co-requisites: have not
Instructor: Climatologist	Hours: 32	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input checked="" type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Acquaint students to research methods in Climatology

Syllabus:

- Philosophical and scientific theories in the field of Climatology
- Methodology and Analysis (Model-Based Analysis, Inductive Analysis, Visual Analysis, System Analysis, Comparative Analysis, Interpretive Analysis, paraphrase Analysis, Human and Civil Analysis)
- Types of natural environmental research, descriptive, regional, modeling, problem solving
- Research question and hypothesis
- Methodology and research in Climatology
- Identify data sources, collect and extraction
- Cognition and utilizing data matching and screening methods
- Utilizing software program and hardware's
- Conclusion, compilation and research presentation
- Writing and arranging articles and thesis
- Prepare a research plan

References:

- Basil Gomez and John Paul Jones. (2010). Research Methods in Geography, John Wiley & Sons, Ltd., Publication
- Eva Lövbrand, Björn-Ola Linner and Madelene Ostwald. (2009). Climate Science and Policy Research Conceptual and Methodological Challenges.
- Moghimi, Ibrahim, (2004), Research methods in natural geography, Ghomes Publication
- Tony, Parsons and Peter, G. Knight, 2005. How To Do Your Dissertation in Geography and Related Disciplines


Program Title: Basic Lessons of MSc in Environmental Climatology

Course Title: Spatial analysis of climate data using GIS	Credit Number: 2	Type: Theoretical/Practical	Prerequisites/Co-requisites: have not
Instructor: Climatologist or GIS specialist	Hours: 48	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Acquaintance of students with climatic data analysis methods in GIS

Syllabus:

- An overview of the geographic information system concepts
- Data structure in a geographic information system
- Fundamentals of prepare Climatic Maps Using Geographic Information System
- A variety of interpolation methods
- Establish a spatial database using geographic information system
- Spatial analysis of Climatic data using geographic information system
- Geographical regression models for climatic data analysis
- Practical work and programming with geographic information system software

References:

- Hartwig Dobesch, Pierre Dumolard and Izabela Dyras, 2007. Spatial Interpolation for Climate Data: the Use of GIS in Climatology and Meteorology, Chippenham, Wiltshire.
- Farajzadeh, Manoocher, 2010, Basic of Geography Information System, Entekhab Publication
- Mowahadi Saeid, Soltaniyan Mahmood, 2011, Geography Information System and Climatology, Kankash Publication.


Program Title: Basic Lessons of MSc in Environmental Climatology

Course Title: Advanced statistical methods in climatology	Credit Number: 2	Type: Theoretical/Practical	Prerequisites/Co-requisites: have not
Instructor: Climatologist	Hours: 48	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	
Course Objectives: Acquaintance of students with advanced statistical methods with applicability in climatic data analysis			
Syllabus: <ul style="list-style-type: none"> - Probability theory - Application of matrix in statistics - Statistical distributions - Parametric and non-parametric statistical tests - Regression - Analysis of variance and analysis of spatial variance using variogram and its features - Solidarity, delayed correlation and spatial correlation itself - Multivariate statistical methods - Time series and their preliminary analysis - Definitive, random (Markov chain) and turbulence prediction models - Preparation Models of cognition spatial-climatic - Application of programming in climatic statistical analysis - Practical work and programming with statistical analysis software 			
References: <ul style="list-style-type: none"> - Hossein, Asakareh, 2011, Fundamentals of Statistical Climatology, Zanjan University Publication - Manucher, Farajzadeh, 2007, Climatology Techniques, Samt Publication. - Storch, H, V; F, W. Zwirs, 2003, Statistical analysis in climate research. Cambridge University Press, Cambridge 			


Program Title: Basic Lessons of MSc in Environmental Climatology

Course Title: Techniques of Satellite Climatology	Credit Number: 2	Type: Theoretical/Practical	Prerequisites/Co-requisites: have not
Instructor: Climatologist	Hours: 48	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Acquaintance students with a variety of images of meteorological satellites and how to interpret them

Syllabus:

- Basics of image processing (basic and principal of pattern recognition, types of methods of interpretation and classification of satellite images, advantages and limitations of interpretation and visual and digital classification, methods of preparing thematic maps using visual interpretation of data)
- Suitable sensors for satellite meteorology and related platforms
- Appropriate bands for extracting information and how to use it
- Interaction of the electromagnetic spectrum with atmospheric phenomena
- Determination cloud texture utilizing satellite imagery
- Determining the different fronts using satellite images
- Estimation of cloud features
- Prediction of atmospheric phenomena
- Extraction meteorological parameters from satellite data
- Algorithms and methods of extracting information from meteorological images
- Practical work and programming with image processing software

References:

- Farajzadeh, Manucher and Karimi, Nematolla, 2013, Fundamental of Satellite Meteorology, Samt publication
- Carr, Michael William, 1999, International Marine's Weather Predicting Simplified: How to Read Weather Charts and Satellite Images, International Marine/Ragged Mountain Press; 1 edition.
- Mobasheri Mohamad Reza, 2002. Satellite Meteorology and now casting, WMO. RMTTC
- Caletton Andrew M., 1991, Satellite Remote Sensing in Climatology, London, Belhaven Press


Program Title: Basic Lessons of MSc in Environmental Climatology

Course Title: Methods of Synoptic Climatology	Credit Number: 2	Type: Theoretical	Prerequisites/Co-requisites: have not
Instructor: Climatologist	Hours: 32	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input type="checkbox"/> Laboratory: <input checked="" type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Acquaintance students with the theoretical foundations of synoptic Climatology

Syllabus:

- A review of the synoptic climatology basic concepts
- General principles of preparing and interpreting air maps
- Synoptic processes and systems
- Manual analysis of Circulation Patterns
- Quantitative analysis of circulation patterns
- Relationship between circulation patterns and environmental characteristics
- Patterns and index of teleconnection
- New topics and recent advances in synoptic climatology
- Synoptic analysis of air systems in Iran
- Practical work and programming with synoptic analysis software

References:

- Alijani, Bohlool, 2002, Synoptic climatology, Samt publications
- Omidvar, Kamal, 2010, Synoptic climatology, Yaz university Publications
- Lashkari, Hasan, 2011, Principles of Climate Maps and Chart, Shahid Beheshti University Publications
- Brent, Yarnal, 1993, Synoptic climatology in environmental analysis, Belhaven Press
- Howarat BlueStein, ۲۰۰۸, Synoptic-Dynamic Meteorology in Mid-Latitudes
- Principles of Kinematics and Dynamics, Vol. 1, Volume II: Observations and Theory of Weather Systems, Oxford University Press.


Program Title: Basic Lessons of MSc in Environmental Climatology

Course Title: Hydro-Climate of Iran's Rivers Basins	Credit Number: 2	Type: Theoretical	Prerequisites/Co-requisites: have not
Instructor: Climatologist	Hours: 32	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Cognition the basic subjects in hydro-climate studies of Iranian basins

Syllabus:

- A review of the concepts of hydrology and hydro-geomorphology in Iran
- An overview of Iranian geomorphology
- Water resources in Iran based on geomorphological features
- Divisions of basins in Iran and their coding principles
- Iran's surface water resources
- Investigation of rainfall and runoff in the watershed basins of Iran
- Investigation of groundwater flow in Iranian watersheds
- Water balance of the main watershed basins in the country
- Water resources management and planning strategies in the country
- Practical work and programming with hydrological analysis software

References:

- Alizadeh, Amin, 2013, Principles of Applied Hydrology, Astan Ghods Razavi Publications
- Sedaghat, Mahmood, 2011, Iran's water resources and issues, PayamNoor university publication
- Shafiee, Masood, 2012, Water resource in the world and the middle east with an emphasis on the situation of Iran, Strategic Research Institute publication
- Moghimi, Ibrahim, 2012, Geomorphology Of Iran, Tehran university publication


Program Title: Main Lessons of MSc in Environmental Climatology

Course Title: Agricultural Climatology	Credit Number: 2	Type: Theoretical	Prerequisites/Co-requisites: have not
Instructor: Climatologist	Hours: 32	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Acquaintance students with the principles, methods and applications of agricultural climatology

Syllabus:

- Definition and principles of agricultural climatology and climatic elements affecting agriculture
- Climate, and crop calendar
- Extremes of climate required for agricultural and livestock production
- Climate, and plant and flowers fosterage
- Climate, beekeeping and ostrich breeding
- Climate, pests and parasites of crop
- Climate and protection of agricultural products after harvest
- Climate, transportation and maintenance of crops, orchards and livestock
- Changes and adjustments arising from agriculture on a farm scale
- Climatic forecasting methods for various agricultural operations
- Product prediction models based on climatic elements
- Agro-climatic zoning concepts, indicators and methods
- Product growth models and their application areas
- Climatic phenomena that harmful to agriculture
- The potentials and limitations of Iran's agricultural climate

References:

- Mavi, Harpal singh, 1935, Introduction to agro-meteorology, Oxford & IBH. Publication
- Applied Agrometeorology", 2010, Editors: Stigter, Kees (Ed.). Springer
- Singh, S, N (Ed.), 2009, Climate Change and Crops, Springer-Verlag
- Sivakumar, M, Motha, R. 2007, Managing Weather and Climate Risks in Agriculture, Springer


Program Title: Main Lessons of MSc in Environmental Climatology

Course Title: Boundary Layer Climate	Credit Number: 2	Type: Theoretical	Prerequisites/Co-requisites: have not
Instructor: Climatologist	Hours: 32	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Familiarity with the principles and aspects of boundary layer climatology

Syllabus:

- Conceptual frameworks of microclimate studies and its difference with other climatic studies on a larger scale
- Physical foundations of boundary layer, mixed, roughness, inertia, etc. in microclimate
- Concepts and rules of radiation, energy transfer methods and highlighting the conduction method in the microclimate
- Physical and thermal properties of all types of surfaces and materials and their interaction with radiation
- Radiation balance, energy balance, air temperature and tangible temperature transfer
- Heat flow and soil temperature and humidity in the adjacent layer of the earth's surface
- Fundamentals of turbulence and turbulence theories in vertical temperature distribution
- Humidity, wind and gases concentrated in the boundary layer
- Microclimate of barren lands
- Microclimate of snow and ice surfaces
- Microclimate of vegetation and forest microclimate
- Microclimate of urban green spaces (thermal island and flow, urban air pollution)
- Investigating the effects of microclimate factors in humans, animals and vegetation

References:

- 1- Arya, S. Pal (2001), Introduction to microclimatology, Academic Press: International Geophysics, Vol. 79.
- 2- Garratt, J. R (1992), The atmospheric boundary layer, Cambridge Univ. Press.
- 3- Oke, T. R (1981), Boundary Layer climates, Methuen and Co Ltd.


Program Title: Main Lessons of MSc in Environmental Climatology

Course Title: Health Climatology	Credit Number: 2	Type: Theoretical	Prerequisites/Co-requisites: have not
Instructor: Climatologist	Hours: 32	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Acquaintance students with the concepts and applications of medical climatology

Syllabus:

- Basic concepts of medical climatology
- Medical climatology of important diseases
- Climate and mortality
- Environmental factors and disease development
- Climatology of air pollution and the development of various diseases
- The effect of dust storms on disease
- Effects of temperature changes on insect reproduction and disease transmission
- Seasonal analysis and classification of diseases
- Diseases arising from heat (increase in temperature) and cold (decrease in temperature) and others (humidity, sultry, etc.)
- The role of climate based environmental parameters on the occurrence of chronic and seasonal allergies
- Diseases caused by urban climate
- Climate of mental health and the effect of climate on suicide
- Probable effects of climate change on mutations and pathogens
- Climatology and location analysis of hospitals and medical centers
- Climatotherapy and the capabilities of different climatic regions for climatotherapy

References:

- Mohammadi, Hossein, 2015, Medical Climatology, Tehran university publication
- Thomas, Pat, 1959, Under the weather : how the weather and climate affect our health,
- World Health Organization, 2003, Climate change and human health: Risks and responses, World Health Organization
- Sari Kovats, 2003, Methods of Assessing Human Health Vulnerability and public health adaptation to climate change, World Health Organization


Program Title: Main Lessons of MSc in Environmental Climatology

Course Title: Urban climatology and transportation	Credit Number: 2	Type: Theoretical	Prerequisites/Co-requisites: have not
Instructor: Urban Climatologist	Hours: 32	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Acquaintance of students with the climatology of biological complexes, especially cities

Syllabus:

- Definitions and generalities of biological complexes climatology
- Climatological considerations in the design and location analysis of the city
- Human activities and Climate of the city, climatology and urban land uses
- Climatic phenomena specific of cities: air pollution, photochemical fog, acid rain
- The relationship between the morphology of the city and the climate of the city, the effects of urban climate on health and hygiene
- Thermal island and moisture island and the interaction of green space and climatology in cities
- Assessing the Capabilities and Constraints climatology development of Cities, Healthy and Sustainable Cities
- Climate changes and Cities
- The main concepts of transportation climatology
- Types of climate variables affecting on transportation systems
- Climate and road transport, climate and Air transport, climate and maritime transport
- Effects of climate change on transportation systems
- City climatological Design

References:

- Mohammadi, Hossein, 2011, Urban Climatology, Tehran University publications
- Giselle Scrooge, ۱۹۹۸, climate and urban: urban environment, translated by Khaledi, Shahryar, Tabiaat Publication
- Habibi Nowkhandan, Majid and Gholam Ali, Kmali, 2007, Climate and road safety, Transportation Research Institute Publications
- Baklanov, A (ed), 2009. 4 Meteorological and Air Quality Models for Urban Areas, Springer-Verlag
- Gartland, L, 2008, Heat islands: understanding and mitigating heat in urban areas, Earthscan
- Daniel Sperling and James S. Canon, 2010, Climate and Transportation solution, UCdavis Press
- Andreas Schafer and John B. Heywood, 2009, Transportation in a climate constrained world. MIT Press.


Program Title: Main Lessons of MSc in Environmental Climatology

Course Title: Climate and Energy Management	Credit Number: 2	Type: Theoretical	Prerequisites/Co-requisites: have not
Instructor: Urban Climatologist	Hours: 32	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Familiarity with the concepts and applications of architectural climate and energy management

Syllabus:

- The concept of thermal comfort
- The efficiency of the body in measuring environmental factors
- Bioclimatic diagram
- Building bioclimatic diagram
- Bioclimatic indicators
- Climatic design methods
- Microclimate and protection of cultural heritage
- Climate change and architecture
- Climate change and energy
- Environmental-climatic capabilities of Iran (wind and solar energy)
- Power and gas energy management in climatic crisis (cold and heat waves)
- Fundamental climate energies, biological complexes and sustainable development
- Climate and energy economy

References:

- Sen, Zakai, 2008, Solar Energy Fundamentals and Modeling Techniques: Atmosphere Environment, Climate Change and Renewable Energy, Springer.
- IEA, 2007, Energy Security and Climate Policy- Assessing Interactions, OECD publishing.
- Pielou, E, C, 2001, The Energy of Nature, The University of Chicago Press.


Program Title: Main Lessons of MSc in Environmental Climatology

Course Title: Climate and environmental design	Credit Number: 2	Type: Theoretical	Prerequisites/Co-requisites: have not
Instructor: Urban Climatologist	Hours: 32	Supplementary Training: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Scientific Trip: <input type="checkbox"/> Workshop: <input checked="" type="checkbox"/> Laboratory: <input type="checkbox"/> Seminar <input type="checkbox"/> Presentation: <input type="checkbox"/>	

Course Objectives:

Familiarize students with the status and application of climate in the design of natural environments and human spaces

Syllabus:

- Climate and environmental design
- Environmental phenomena and climatic scale
- Regional Climate Phenomena
- Climatic factors of soil
- Climate, vegetation and soil
- Compatibility of urban green spaces with climate
- Topo-Climatology of urban places
- sunlight at surface of the earth
- Air flow and human spaces
- Urban climate scales
- The hypothetical model of urban climate
- Wind and environmental design
- Temperature and environmental design
- Rain, humidity and environmental design

References:

- Peter, J; D, Hartog, 2003, Designing Indoor Climate, Delft University Press
- Brown, R; T, Gillespie, 1995, Microclimate Landscape Design: Creating Thermal Comfort and Energy Efficiency, Wiley