Course Description for Ph.D. Degree in Range Sciences

3716802 **Ecological topics** 2 Cr.

Ecology and other sciences, different majors in ecology, an overview of different ecosystems (i.e. humid, semi-arid, arid and desert ecosystems), effects of abiotic factors (i.e. light, climate, wind) on growth and regeneration of range plant species, importance of water for vegetation, plant water resistance, modeling and drought prediction in rangeland ecosystems, climate change and sustainable rangeland management, human interface and vegetation, plant life forms in arid and desert areas, classification of plant species based on soil properties, ecological requirement of main range plant species (autecology).

3716804 **Biological erosion control** 2 Cr.

An overview of Iranian ecological zones; water and wind erosion mechanisms; basics, goals and methods of biological approaches to control wind and water erosion; Landslide, rill and Gully control, kinds of live wind break, wind break calculation.

3716800 **Quantitative plant ecology** 2 Cr.

Applications of quantitative, analytical techniques used to describe and assess range plant communities, vegetation description (Abundance, Frequency, Cover,…),sampling methods (Random, Systematic, Stratified,…), vegetation distribution patterns (spatial pattern, normal and negative distributions), species association (X^2 test), vegetation analysis (Qualitative methods, Community classification, Braun- Blanquet method, gradient analysis, ordination methods (Polar ordination, PCA, DCA, CCA)
Practical remarks: Case studies

3716807 **Range animal nutrition** 2 Cr.

The balance between forage and livestock feeding requirements, forage quality (concept, measuring methods and index), determining livestock daily nutrition requirements, based on environmental characteristics, forage quality and livestock physiological condition, feeding behavior of livestock, and utilization of rangeland.
Experimental section: Experimentation in measurement of nutrient requirements and analysis of the range animal nutritional aspects.

3716540 **Modeling in rangeland ecosystems** 2 Cr.

Principles of modeling; definition and functions of models; modeling approaches; application of Decision Support Systems (DSS) in rangeland ecosystems; model components; advantage and disadvantages of models; model feedback; modeling calibrations; model evaluations; sensitivity analysis approaches; ecological models; habitat models; data models; statistical models (parametric and non parametric approaches); Bayesian belief network modeling; practical work: case studies

3716806 **Living organisms and rangeland ecosystems** 2 Cr.

Diversity, distribution and the role of living organisms (human, plant, free-ranging mammals, birds, livestock,….) in rangeland ecosystems, immigration in plant and animal species, adaptation and distinction in plant and animal species and related classifications, fundamental of bio-geo chemical cycling in rangeland ecosystems, individual, species and population in rangeland ecosystems, population energy flow, interaction between species, living organism as an open system, theoretical and practical conservation, estimation of animal population size.

3716806 **The Economics of rangelands** 2 Cr.

The economical aspects and preferences of the rangelands in Iran, comparison of the objectives of the herders in Iran and other countries, concepts of carrying out capacity and production functions, full-cost pricing and externality costs, logistic growth curves and their applications, productivity indicators and indices, technical and economical efficiency in pastoral management, planning for sustainable pastoral management.

3716803 **Sustainable development and natural Resources** 2 Cr.

History, concepts, economical systems and their relation with sustainable development, sustainable and socioeconomic development in developed and developing countries, traditional systems, economical principles, resourcedistribution, poverty and sustainable development, needed information to design a sustainable system, evaluating criteria, integrated plans, and future strategies

3716808 **New theories in range science** 2 Cr.

Challenges to rangeland science, including trends in ecology and evolution of rangeland management; range ecosystem functions; uncertainty and sustainability in the management of rangelands, rangeland dynamics and different paradigms; limitations of using scientific tools in rangeland ecosystems and introducing adaptive management and participatory approaches; holistic approach to range ecosystem management.

3716809 **Seminar** 2 Cr.

According to supervisors' guidance, a research project will be performed. It should be approved by the Educational Division Council and the Graduate Office. The results will be announced in the presence of the Educational Division members.

1310088 **Operations Research** 2 Cr.

Definitions and concepts, the application of operations research in natural resources, assignment model, queuing models, linear programming, simplex method, dual simplex method, transportation problems, allocation problems, dynamic programming (deterministic/probabilistic), optimization, sensitivity analysis