GIS – 820 GIS in Agriculture and Natural Resources (3+0=3)

1. **Course Objectives:**
   a. To develop a basic understanding of agriculture and its various branches.
   b. Understand what spatial information is, and how it is collected and analyzed using remote sensing, GIS and GPS technologies in agriculture and natural resources.

2. **Course Outcomes:**
   a. Students will be able to apply the knowledge of GIS in different fields of agriculture and natural resources.

3. **Course Code:**
   a. GIS – 820

4. **Credit Hours:**
   a. Theory   =   03
   b. Practical   =   00
   c. Total =   03

5. **Detailed Contents:**
   a. An educational documentary about the impact of climate change on natural resources
   b. Understanding of agriculture, forestry, geology, and other natural resources
   (1) Highlights of various disciplines of agriculture, forestry, geology
   (2) Agriculture: soil sci., agronomy, etc. water management, weed sci., food sci., and plant pathology.
   (3) Forestry: Forest resources of Pakistan, REDD+ concept, Rangeland management, agroforestry etc.
   (4) Geology: Rocks & minerals, geological structures, and Geology of Pakistan
   c. Remote Sensing of Soils, & mineral and Geomorphology
   (1) Soil Characteristics and Taxonomy
   (2) Soil grain size and texture
   (3) Remote sensing of soils properties
   (4) Remote sensing of rocks and minerals
   (5) Remote sensing of geological structures
   (6) Imaging spectroscopy
   d. Introduction to GPS
   e. Introduction to Geostatistics
   (1) Difference between Classical and Geostatistics
   (2) Spatial Interpolation
   (3) Elements of Spatial Interpolations
   (4) Spatial Interpolation
   (a) Global methods,
   (b) Local methods,
   (c) Exact and Inexact,
   (d) Stochastic and Deterministic
   (e) Kriging, Co-kriging, Semivariogram
   (5) Spatial Autocorrelation
   (a) Moran's I
   (b) Getis Ord-Gi
   f. Remote sensing of vegetation
   (1) Agriculture
   (2) Forest
   (3) Rangeland

(4) Wetland
g. Precision Agriculture using GIS and RS
(1) Variable Rate Technology Spatial Variability of Soils and Crop Parameters
(2) The role of Technology in the Precession Agriculture
(3) Site-Specific Management
(4) Spatial Variability Yield
(5) Spatial Variability Analysis and Mapping
(6) Management Zones
(7) Research Papers in Precision Agriculture Class Discussion
(8) Crop modeling for yield estimation and production (GOSSYM, DSSAT, PC-Yield)
h. Journal published research papers related to Precision Agriculture and GIS & RS application in natural resource management will be discussed in the class
i. Term Project: Each graduate student will be assigned a term project related to GIS & RS application in agriculture, forestry, water resources and geology. The term project will involve data collection, GIS & RS analysis, report writing and final presentation.

6. **Detail of Lab work, workshop practice, if applicable:**

   Labs will be conducted related to GIS & RS applications in agriculture (precision agriculture), water resources, forestry, mineralogy, conservation etc. Data and lab manual will be provided by the lab instructor to carry out each lab.

7. **Textbooks/Reference Books:**
   a. Pierce, F. J and David Clay. GIS Applications in Agriculture. Boca Raton: CRC Press, 2007. Print.
   b. Neale, Christopher M. U and Antonino Maltese. Remote Sensing for Agriculture, Ecosystems, and Hydrology XII. Bellingham, Wash.: SPIE, 2010. Print.
   c. Oliver, Margaret A. Geostatistical Applications for Precision Agriculture. Dordrecht: Springer, 2010. Print.
   d. Brase, Terry A. Precision Agriculture. Clifton Park, NY: Thomson/Delmar Learning, 2006. Print.
   e. Related Journal Papers (Class handouts).