SYLLABUS
and
Rules and Regulations

for
Advanced One-Year Diploma in

Remote Sensing
And
Geographic Information System (G.I.S.)

Under

The U.G.C. INNOVATIVE PROGRAMMES
(Teaching and Research in Interdisciplinary and Emerging Areas)

In

Department of Geography
Himachal Pradesh University
Summer Hill, Shimla – 171005.
Nomenclature of the Course:

As per the approval of the U.G.C. (vide letter No. 14-76/2007(Inno/ASIST), dated: 30th May, 2007), the present diploma course will be called as Advanced One-Year Diploma in Remote Sensing and Geographic Information System (G.I.S.).

Venue, Coordination and Teaching:

This diploma course (Advanced One-Year Diploma in Remote Sensing and Geographic Information System (G.I.S.)) will be run by the Department of Geography of the H.P. University. The course would be taught in the department of Geography where the infrastructural facilities like the remote sensing and GIS laboratory and lecture halls will be located.

For the purpose of coordinating the teaching of this course there would be appointed a Programme Coordinator and a Deputy Programme Coordinator drawn from the Department of Geography. The Programme Coordinator and Deputy Programme Coordinator will be paid an honorarium as per the rates being paid in other vocational courses of HPU in addition to the remuneration for classes taught by them as per the HPU rules.

The teachers drawn from geography and other departments of the H.P. University invited to teach classes in this course will be paid a remuneration on per lecture basis as per rates being paid in other vocational courses of the H.P. University in addition to the TA / DA as admissible. The guest faculty invited from outside of the H.P. University will be paid remuneration and TA / DA as admissible under the H.P. University rules.

Time Frame:

This course will be of one year duration and will be run on semester basis. The course will comprise two semesters with three papers in each semester. Before the teaching of the courses is started
(in the Academic Session 2008-2009), one-year period will be utilized for the purpose of preparation. During this period the required infrastructural facilities (like a well equipped remote sensing and GIS laboratory) will be created in the Department and the teaching staff would be trained in the relevant fields. Visits will be arranged to some institutions where similar courses are already being taught (e.g. Indian Institute of Remote Sensing (IIRS), Panjab University, Jamia Millia Islamia, Aligarh Muslim University etc.) to ascertain the financial and laboratory requirements. After the completion of the preparatory phase, teaching of this course will be started in the next academic session (i.e. 2008-2009).

**Course Intake and Fee Structure:**

Intake in this course will be 10 students. In addition to the normal fees as per the HPU norms, a laboratory fee of Rs. 5,000/- (Rupees five thousand only) per semester will be charged from each student. The laboratory fees so realized will be credited to a separate account to be maintained by the Department and operated by the Course Coordinator. The money so generated will be utilized for day-to-day functioning and maintenance of the facilities in related laboratories and for conducting field work etc. related to teaching.

In addition to the above, there will be three supernumerary seats for industry- and government-sponsored candidates applying through proper channel. Fees for sponsored candidates will be Rs. 50,000/- (rupees fifty thousand only) for the whole course in addition to the normal university fees for each semester.

**Eligibility for Admission:**

The following will be the eligibility conditions for admission to this course
(1) Masters degree (M.A. or M.Sc.) in the subject of Geography with at least 50 % marks

OR

(2) Bachelors degree in Engineering with at least 50 % marks plus two years working experience.

Same eligibility conditions will also apply to the sponsored candidates. All those admitted will be expected to have a working knowledge of computers, Disk Operating System (DOS), Windows operating system, and Microsoft-Office suite.

Criteria for Admission:

The admission to this course will be on the basis of marks obtained at Master’s (or Bachelor’s in engineering) degree level, an entrance test conducted by the department / University, and a personal interview of the candidate. The entrance test will consist of 60 objective-type and multiple choice questions on the basic concepts related to geography, remote sensing and spatial data carrying one mark each. Weightage given to marks obtained at M.A. / M.Sc. / B.E. degree level, entrance test, and personal interview will be as follows:

(A) M.A. / M.Sc. / B.E.: 20% of the per cent marks obtained.
(B) Entrance Test: Marks Obtained (out of maximum of 60).
(C) Personal Interview: Marks Obtained (out of maximum of 20).

Total Maximum Marks: 100.

Combined merit so formed will be the basis of admission.

Note: Statutory reservations for scheduled caste (SC) and scheduled tribe (ST) candidates will be available as in case of other courses run by the H.P. University. However, such reservation will not be available for the supernumerary (sponsored) seats.
Syllabus:

The following course structure and syllabi are suggested:

**Semester – I**

<table>
<thead>
<tr>
<th>Paper I</th>
<th>(a) Basic Principles of Remote Sensing and Aerial Photo Interpretation (b) Practical Component</th>
<th>100 Marks</th>
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</thead>
<tbody>
<tr>
<td>Paper II</td>
<td>(a) Satellite based remote sensing and Digital Image Processing and Interpretation (b) Practical Component</td>
<td>100 Marks</td>
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<tr>
<td>Paper III</td>
<td>(a) Introduction to the Geographical Information Systems (GIS) (b) Practical Component</td>
<td>100 Marks</td>
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**Total Marks of Semester – I** 300 Marks

**Semester - II**

<table>
<thead>
<tr>
<th>Paper IV</th>
<th>(a) Advanced Topics in Geographical Information Systems (GIS) (b) Practical Component</th>
<th>100 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper V</td>
<td>(a) Software Training in Digital Image Processing and GIS (b) Practical Component</td>
<td>100 Marks</td>
</tr>
<tr>
<td>Paper VI</td>
<td>Project Report</td>
<td>100 Marks</td>
</tr>
</tbody>
</table>

**Total marks of Semester – II** 300 Marks

**Total Marks (all papers of both semesters)** 600 Marks
(c) Paper I: **Basic Principles of Remote Sensing and Aerial Photo Interpretation**

Unit 1. **Concepts and Foundations of Remote Sensing:**
Remote sensing; an ideal remote sensing system; a real remote sensing system; Remote sensing terminology; History and recent developments in remote sensing.

Unit 2. **Electromagnetic Radiation:** Energy sources and radiation principles; Sources and types of electromagnetic energy used in remote sensing; Energy interactions in the atmosphere; Energy interactions with earth surface features; Human eye and the camera.

Unit 3. **Elements of Photographic Systems:** The basic negative-to-positive photographic sequence; Photographic films: Black and White (Panchromatic) film, colour film, colour infrared film; Aerial cameras; Aerial photographs; Taking vertical aerial photographs; Scale and ground coverage of vertical aerial photographs; Photographic resolution.

Unit 4. **Photogrammetry and Airphoto Interpretation:**
Geometric elements of vertical photographs; Relief displacement of vertical features; Image parallax; Parallax measurement; Stereoscopy; Stereoscopic instruments (pocket stereoscope, mirror stereoscope); Making stereograms; Fundamentals of Airphoto Interpretation: Basic Photo interpretation equipment; Elements of visual airphoto interpretation.

**Practical Component:** The students will have to make a practical record book comprising exercises from the contents of the paper. The record book will be evaluated by the external examiner and the paper teacher at the end of the semester.
List of Recommended Readings


Paper II: **Satellite based remote sensing and Digital Image Processing and Interpretation**

Unit 1. **Earth Resource Satellites:** Early history of space imaging; Geostationary satellites; Polar Sun-synchronous satellites; LANDSAT satellite program overview; SPOT satellite program overview; IRS satellite program overview; Meteorological satellites; Ocean Monitoring satellites.

Unit 2. **Remote Sensing Data:** Digital data; Analog image digitization: Optical mechanical scanning, Video digitization, Linear and area-array charge-coupled-device (CCD) digitization; Remotely sensed data already in digital format: Multispectral data through discrete detectors and scanning mirrors, linear and area array sensor systems; Digital Image data Formats: Band Sequential (BSQ) format, Band Interleaved by Line (BIL) format, Band Interleaved by Pixel (BIP) format, Run-length Encoding format.

Unit 3. **Digital Image Processing:** Pre-processing of digital data – Digital image histogram, Line banding correction, Line dropout correction, Geometric correction, Atmospheric correction, Solar illumination correction; Image enhancement – Contrast stretching, Thresholding and density slicing, Spatial filtering, Band ratioing.

Unit 4. **Image Classification:** Supervised classification – Ground truthing and Training stage, classification stage, classification algorithms (minimum-distance-to-means classifier, parallelepiped classifier, maximum-likelihood classifier); Unsupervised classification; Classification accuracy Assessment.
Practical Component: The students will have to make a practical record book comprising exercises from the contents of the course. The record book will be evaluated by the external examiner and the paper teacher at the end of the semester.

List of Recommended Readings


Unit 1. Geographical Information Systems (GIS):
Introductory concepts; Definition and scope; Significance; History of GIS; Data for GIS; GIS and Human Geography: Philosophical issues (Epistemology and Ontology in GIS); Precepts from Human Geography to understand GIS; Generalisation in GIS.

Unit 2. Data: Issues of Spatial and non-spatial data collection, representation and standardization; Data collection; Data organization (location, attributes, consistency, scale); Meta data; Data Interoperability; Data standardization; Data Classification.

Unit 3. GIS for Analysis and Modeling of Spatial Phenomena: Overlay analysis; Set theory; and Map Algebra; Environmental modeling; Multi-criteria Evaluation; Visualisation and New Cartography.

Unit 4. Issues of GIS Training and Research: People and Research versus Software training; Ontology and Epistemology revisited; Feminism (Gender) and GIS.

Practical Component: The students will have to make a practical record book comprising exercises from the contents of the course. The record book will be evaluated by the external examiner and the paper teacher at the end of the semester.

List of Recommended Readings


Paper IV: *Advanced Topics in Geographical Information Systems (GIS)*

Unit 1. *Geographical Information System (GIS):* Spatial Data; Attribute Data; GIS concepts; GIS Operations; Geographic grid; Coordinate systems in GIS; Map Projections: Properties of the spherical
Unit 2. **Data Models**: Vector data model; Raster data model; Vector data – Objects and topology, Vector data input, editing, attribute data input and management; Raster data – Types of raster data, Raster data structure, Data conversion; Integration of raster and vector data.

Unit 3. **Spatial Data Analysis**: Vector data analysis – Buffering, Map overlay, Distance measurement, Map manipulation; Raster data analysis – Analysis environment, Local operations, Neighborhood operations, Zonal operations, Distance measure operations, Spatial autocorrelation.

Unit 4. **Terrain Mapping and Spatial Interpolation**: Terrain mapping and analysis – DEM, TIN, Operations in terrain mapping; Spatial Interpolation – Control points, Global methods (Trend surface Analysis, Regression Models), Local Methods (Theissen polygons, Density estimation, Inverse distance weighted interpolation, Thin-plate splines, krigging).

**Practical Component**: The students will have to make a practical record book comprising exercises from the contents of the course. The record book will be evaluated by the external examiner and the paper teacher at the end of the semester.

**List of Recommended Readings**


**Paper V: Software Training in Digital Image Processing (DIP) and Geographical Information Systems (GIS)**

In this paper the students will be given training in different GIS software (e.g. PopMap, GeoMedia, ArcView, Idrisi, ErdasImagine, GeoMatica, ArcGIS, ILWIS etc.). They will be provided exposure to basic GIS operations.

**Practical Component:** The students will have to make a practical record book comprising exercises from the contents of the course. The record book will be evaluated by the external examiner and the paper teacher at the end of the semester.

**List of Recommended Readings**

Note: In addition to the books recommended for the different parent papers in digital image processing (DIP) and GIS, the Operation or
Paper VI: Project Report

In this paper the students will be expected to produce a project report using one or more of the different remote sensing and GIS techniques learnt through the course and using one or more of the software (e.g. PopMap, GeoMedia, ArcView, Idrisi, ErdasImagine, GeoMatica, ArcInfo, ArcGIS etc.) in which they have been trained through this course. They will choose a study area and theme and will collect data for it. Report will be submitted in typed form (with text typed in double line spacing in font size 12 on A4 size paper with one inch margin on all sides) in not less than 70 pages and will have the following components:

I Introduction.
II Data and Methodology.
III Data Representation and Analysis.
IV Discussion.
V Summary and Conclusions.

List of Recommended Readings


and the supervisor will be assigned to each student sometime in the middle of the first semester. Student will work under the guidance of the supervisor and submit the project report in triplicate in the Department Office by the end of the second semester.

**Examination and Evaluation:**

There will be 40% internal / continuous assessment which will be on the basis of continuous evaluation of the student throughout the period of the course. Student will be evaluated through classroom attendance, quizzes, seminars, and homework assignments. The remaining 60% of the course grade will be on the basis of comprehensive semester-end written and viva-voce examinations. The question paper for the written examination will comprise the following sections:

**Section A:** Two long-answer (not more than 200 words) type questions each carrying ten marks.

**Section B:** Ten short-answer (not more than 50 words) type questions each carrying one mark.

**Section C:** Forty objective-type (True / False, Multiple Choice, Matching) questions each carrying half mark.

This examination will be on the basis of a question paper as detailed above covering the whole syllabus set by an external examiner in coordination with the internal examiner (who will be the teacher who has taught the paper). The external examiner will be chosen out of a panel of four submitted to the Vice-Chancellor by the Programme coordinator / Deputy Programme Coordinator. The answer books will be evaluated jointly by the external and internal examiners. The viva-voce will be conducted by the external examiner and the internal examiner. The total marks of each paper (except project report) will be distributed as follows:
(A) Internal / Continuous Assessment 40
(i) Classroom Attendance 10
(ii) Quizzes and Seminars (at least two in each semester) 10
(iii) Homework Assignments (at least two in each semester) 20
(B) Semester-End Written and Viva-voce Examination 60
(i) Written Examination 50
(ii) Viva-voce Examination 10

The project Report will be submitted in the Department in triplicate. This will be evaluated separately by an internal examiner (who will be a teacher of the Department other than the supervisor of the candidate) and an external examiner (to be appointed by the Vice-Chancellor out of a panel of four to be submitted by the Programme Coordinator / Deputy Programme Coordinator) and each will assign marks out of a maximum of 75 marks. A written report will also be submitted by both the internal and external examiners in which they will clearly mention whether they recommend the Project Report for the award of diploma and the conduct of viva-voce or not. If recommended by both, a viva-voce examination will be conducted by a committee comprising:

1. Internal examiner,
2. External examiner,
3. Programme Coordinator and / or Deputy Programme Coordinator, and
4. Department Chairman.

The viva-voce examination will carry a maximum of 25 marks.

The distribution of marks in the project Report, thus, will be as below:

Total Marks 100
(a) Report Evaluation 75 (Average of Internal and External)
The candidate will be declared pass if he/she has scored at least 50% marks separately in all different papers of the course. For the determination of division, the norms of the HPU will be followed (i.e. Second division for 50 to 59.9% marks, and First division for 60% and above marks).