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**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.**

**Course:**  
the U.G.C. (*vide* letter No. 14-

76/2007(Inno/ASIST), dated: 30<sup>th</sup> 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 infra-structural 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

08-2009), one-year period will be utilized on. During this period the required infra-structural 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

ee (M.A. or M.Sc.) in the subject of  
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**

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

**Semester - II**

Paper ó IV	(a) Advanced Topics in Geographical Information Systems (GIS) (b) Practical Component	100 Marks
Paper ó V	(a) Software Training in Digital Image Processing and GIS (b) Practical Component	100 Marks
Paper ó VI	Project Report	100 Marks
<b>Total marks of Semester – II</b>		<b>300 Marks</b>
<b>Total Marks (all papers of both semesters)</b>		<b>600 Marks</b>

(c) Paper 6 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

- Agarwal, C.S. and Garg, P.K. 2000. *Textbook of Remote Sensing in Natural Resources Monitoring and Management*. New Delhi: Wheeler Publishing.
- Avery, T.E. 1985. *Interpretation of aerial Photographs*. Minneapolis, Minnesota: Burgess Publishing Company.
- Bakker, Wim H., et al. 2001. *Principles of Remote Sensing – An Introductory Textbook*. Enschede, The Netherlands: ITC.
- Banerjee, R.K. and Banerjee, B. 2000. *Remote Sensing for Regional Development*. New Delhi: Concept Publishing Company.
- Campbell, James B. 1996. *Introduction to Remote Sensing (Second Edition)*. London: Taylor & Francis.
- Colwell, Robert N. (ed.) 1983. *Manual of Remote Sensing, Second Edition, Volume 1 and 2*. Falls Church, Virginia: American Society of Photogrammetry.
- Gibson, Paul J. (2000). *Introductory Remote Sensing – Principles and Concepts*. Routledge.
- \*Jensen, John R. 2000. *Remote Sensing of the Environment – An Earth Resource Perspective*. Pearson Education (First Indian Edition, 2003).
- Hord, R. Michael. 1986. *Remote Sensing – Methods and Applications*. (A Wiley-Interscience Publication). New York: John Wiley & Sons.
- \*Lillesand, T.M., Kiefer, R.W., and Chipman, J.W. 2004. *Remote Sensing and Image Interpretation (5<sup>th</sup> Ed.)*. Wiley. (Wiley Student Edition).
- Miller, V.C. 1961. *Photogeology*. New York: McGraw-Hill, Book Company, Inc.
- Paine, D.P. 1981. *Aerial Photography and Image Interpretation for Resource Management*. John Wiley & Sons.
- \*Panda, B.C. 2005. *Remote Sensing – Principles and Applications*. New Delhi: Viva Books Private Limited.

Rashid, S.M. (Ed.) 1993. *Remote Sensing in Geography*. Delhi: Manak Publications, Pvt. Ltd.

Reddy, M.A. 2006. *Textbook of Remote Sensing and geographical Information Systems*. Hyderabad: B.S. Publications.

## Paper 6 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 6 Digital image histogram, Line banding correction, Line dropout correction, Geometric correction, Atmospheric correction, Solar illumination correction; Image enhancement 6 Contrast stretching, Thresholding and density slicing, Spatial filtering, Band ratioing.

Unit 4. Image Classification: Supervised classification 6 Ground truthing and Training stage, classification stage, classification algorithms (minimum-distance-to-means classifier, parallelepiped classifier, maximum-likelihood classifier); Unsupervised classification; Classification accuracy Assessment.

ent: The students will have to make a  
ing 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

- Campbell, James B. 1996. *Introduction to Remote Sensing (Second Edition)*. London: Taylor & Francis.
- Colwell, Robert N. (ed.) 1983. *Manual of Remote Sensing, Second Edition, Volume 1 and 2*. Falls Church, Virginia: American Society of Photogrammetry.
- Gibson, Paul J. and Power, Clare H.(2000). *Introductory Remote Sensing – Digital Image Processing and Applications*. Routledge.
- Girard, Michel-Claude, and Girard, Colette M. 2003. *Processing of Remote Sensing Data*. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
- Hord, R. Michael. 1986. *Remote Sensing – Methods and Applications*. (A Wiley-Interscience Publication). New York: John Wiley & Sons.
- \*Jensen, John R. 1996. *Introductory Digital Image Processing – A Remote Sensing Perspective (Second Edition)*. Prentice Hall.
- \*Jensen, John R. 2000. *Remote Sensing of the Environment – An Earth Resource Perspective*. Pearson Education (First Indian Edition, 2003).
- \*Lillesand, T.M., Kiefer, R.W., and Chipman, J.W. 2004. *Remote Sensing and Image Interpretation (5<sup>th</sup> Ed.)*. Wiley. (Wiley Student Edition).
- \*Nag, Prithvish, and Kudrat, M. 1998. *Digital Remote Sensing*. New Delhi: Concept Publishing Company.

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**

Adriaans, P., and D. Zantinge. 1996. *Data Mining*. New York: Addison-Wesley.

Bernhardsen, Tor. 1999. *Geographic Information Systems: An Introduction*. Toronto: John Wiley & Sons, Inc.

Bishop, Michael P. and Shroder, John F. (Eds.) 2004. *Geographic Information Science and Mountain Geomorphology*. Chichester, U.K.: Praxis Publishing (Springer).

Christopher. 1990. *Information Technology in GIS (Including Principles of GIS)*. London & New York. Routledge.

\*Burrough, Peter A. and McDonnell, Rachael A. 1998. *Principles of Geographical Information Systems – Spatial Information Systems and Geostatistics*. Oxford University Press.

Buttenfield, B.P. and R.P. McMaster 1991. *Map Generalization: Making Rules for Knowledge Presentation*. New York: Wiley.

\*Chang, Kang-tsung. 2002. *Introduction to Geographic Information Systems*. New Delhi: Tata McGraw-Hill Publishing Company Limited.

Chrisman, N. 1998. "Academic Origins of GIS," In T. Foresman (Ed): *The History of Geographic Information Systems*. Upper Saddle River, NJ: Prentice Hall, pp. 33-43.

Chrisman, N. 1997. *Exploring Geographic Information Systems*. New York: John Wiley & Sons, Inc.

Clarke, Keith C. 2001. *Getting Started with Geographic Information Systems (3<sup>rd</sup> Ed.)* (Prentice Hall Series in Geographic Information Science). Upper Saddle River, New Jersey: Prentice Hall.

Curry, M. 1997. "The Digital Individual and the Private Realm." *Annals of the Association of American Geographers*, vol. 87, no. 4, pp. 681-699.

\*DeMers, Michael N. 2000. *Fundamentals of Geographic Information Systems (2<sup>nd</sup> Ed.)* (Wiley Student Edition). New York: John Wiley & Sons, Inc.

Foresman, T. (Ed.) 1998. *The History of Geographic Information Systems – Perspectives from the Pioneers*. Upper Saddle River, NJ: Prentice Hall.

Gregory, D. 1978. *Ideology, Science and Human Geography*. New York: St. Martin's Press.

\*Heywood, Ian; Cornelius, Sarah; and Carver, Steve. 2000. *An Introduction to Geographical Information Systems* (Pearson Education Asia Low Priced Edition). Longman.

ng, Ferjan. 2004. *Cartography – Spatial Data (2<sup>nd</sup> Ed.)* (Pearson Education Low Price Edition). Pearson Education.

Kwan, M. 2002a. "Is GIS for Women? Reflections on the Critical Discourse in the 1990s." *Gender, Place and Culture*. vol. 9, no. 3, pp. 271-279.

Kwan, M. 2002b. "Other GISs in Other Worlds: Feminist Visualization and Reenvisioning GIS." *Annals of the Association of American Geographers*. vol. 92, no. 4, pp. 645-661.

\*Lo, C.P. and Yeung, Albert K.W. 2002. *Concepts and Techniques of Geographic Information Systems (Eastern Economy Edition)*. New Delhi: Prentice-Hall of India, Private Limited.

Longley, P.A., M.F. Goodchild, D.J. Maguire, and D.W. Rhind (eds.). 2001. *Geographical Information Systems and Science*. New York: John Wiley & Sons, Inc.

Monmonier, M. 1996. *How to lie with Maps?* Chicago: University of Chicago Press.

Pickles, J. 1997. "Tool or Science? GIS, Technoscience, and Theoretical Turn." *Annals of the Association of American Geographers*, vol. 87, pp. 363-372.

Schuurman, Nadine. 2000. "Trouble in the Heartland: GIS and its Critics in the 1990s." *Progress in Human Geography*, vol. 24, no. 4, pp. 569-590.

Schuurman, Nadine and G. Pratt. 2002. "Care of the Subject: Feminism and Critiques of GIS." *Gender, Place and Culture*, vol. 9, no. 3, pp. 291-299.

\*Schuurman, Nadine. 2004. *GIS – A Short Introduction*. Blackwell Publishing.

## Paper 4 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

direction) and different types of map  
formal, azimuthal, and equidistant.

Unit 2. Data Models: Vector data model; Raster data model; Vector data ó Objects and topology, Vector data input, editing, attribute data input and management; Raster data ó Types of raster data, Raster data structure, Data conversion; Integration of raster and vector data.

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

Unit 4. Terrain Mapping and Spatial Interpolation: Terrain mapping and analysis ó DEM, TIN, Operations in terrain mapping; Spatial Interpolation ó 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**

Bishop, Michael P. and Shroder, John F. (Eds.) 2004. *Geographic Information Science and Mountain Geomorphology*. Chichester, U.K.: Praxis Publishing (Springer).

Burrough, Peter A. and McDonnell, Rachael A. 1998. *Principles of Geographical Information Systems – Spatial Information Systems and Geostatistics*. Oxford University Press.

Chang, Kang-tsung. 2002. *Introduction to Geographic Information Systems*. New Delhi: Tata McGraw-Hill Publishing Company Limited.

*Getting Started with Geographic Information Systems (3<sup>rd</sup> Ed.)* (Prentice Hall Series in Geographic Information Science). Upper Saddle River, New Jersey: Prentice Hall.

\*DeMers, Michael N. 2000. *Fundamentals of Geographic Information Systems (2<sup>nd</sup> Ed.)* (Wiley Student Edition). New York: John Wiley & Sons, Inc.

\*Heywood, Ian; Cornelius, Sarah; and Carver, Steve. 2000. *An Introduction to Geographical Information Systems* (Pearson Education Asia Low Priced Edition). Longman.

Kraak, Menno-Jan and Ormeling, Ferjan. 2004. *Cartography – Visualization of Geospatial Data (2<sup>nd</sup> Ed.)* (Pearson Education Low Price Edition). Pearson Education.

\*Lo, C.P. and Yeung, Albert K.W. 2002. *Concepts and Techniques of Geographic Information Systems (Eastern Economy Edition)*. New Delhi: Prentice-Hall of India, Private Limited.

Price, Martin F. and Heywood, D. Ian. (Eds.) 1994. *Mountain Environments and Geographic Information Systems*. Taylor & Francis.

\*Schuurman, Nadine. 2004. *GIS – A Short Introduction*. Blackwell Publishing.

#### Paper ó 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**

ifferent softwares will be the recommended

### Paper ó 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**

- Anderson, Janathan; Durston, Berry H; and Poole, Millicent. 1970 (or latest). *Thesis and Assignment Writing*. New Delhi: Wiley Eastern Limited.
- Day, Robert A. 1995. *How to Write and Publish a Scientific Paper* (4<sup>th</sup> Ed.) (Cambridge Low Price Edition). Cambridge University Press.
- Gibaldi, Joseph. 2000. *MLA Handbook for Writers of Research Papers* (5<sup>th</sup> Ed.). New Delhi: Affiliated East-West Press Pvt. Ltd.
- Panneerselvam, R. 2006. *Research Methodology*. (Eastern Economy Edition). New Delhi: Prentice-Hall of India, Private Limited.
- University of Chicago Press. 1996. *The Chicago Manual of Style* (14<sup>th</sup> Ed.). New Delhi: Prentice-Hall of India, Private Limited.

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:**

		<b>100</b>
	<b>(A) Internal / Continuous Assessment</b>	<b>40</b>
	(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>(B) Semester-End Written and Viva-voce Examination</b>	<b>60</b>
	(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:**

<b>Total Marks</b>	<b>100</b>
<b>(a) Report Evaluation</b>	<b>75 (Average of Internal and External)</b>



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25

**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).**