



FORMAT FOR COURSE CURRICULUM

Course Title: GIS and Remote Sensing in Snow and Glacier Studies

Credit Units:04

L	T	P/S	SW/FW	No. of PSDA	TOTAL CREDIT UNITS
3	0	2	0		4

Course Level:PG

Course Code: To be decided later

Course Objectives: The objective of the course is to enable the students to study and assess the Cryosphere with special emphasis to snow and glacier resources of Himalaya through Remote Sensing and GIS and to encourage and motivate students for advanced glacier research.

Pre-requisites: Student should have the basic knowledge of geography, geological science, remote sensing and GIS

Course Contents/Syllabus:

	Weightage (%)
Module I Descriptors/Topics Introduction to the Cryosphere, Snow cover, ice, Glaciers. Glacier Formation, Classifications of glaciers, Glacier related terminology, Different Parts of the glaciers, Glacial Landforms. Introduction to the Snow and Glaciers resources of the Himalayas.	25
Module II Descriptors/Topics Physical Properties of Snow and Ice, Electromagnetic Properties of Snow in the Optical, Near-Infrared Regions, Thermal and Microwave regions, Introduction to Supraglacial Covers of Himalayan Glaciers, Spectral Response of various Supraglacial Covers of Himalayan Glaciers	25
Module III Descriptors/Topics Conventional techniques for snow and glacier monitoring, Importance and relevance of Remote Sensing data for Snow and Glacier studies, visual data analysis techniques for glacier inventory, glacier geometry, aerial extent glacier retreat and advancement, mass balance studies, Digital Techniques for supraglacial covers mapping, case studies	25

Module IV	25
Descriptors/Topics Impact of Climate alteration over glacier change, Control of non-climatic factors over glacier change, snowmelt run-off modeling, Introduction glacier related hazard: Avalanche, GLOF, case studies	
Module V	
Descriptors/Topics	

Student Learning Outcomes:

On successful completion of this course, students will be able to:

- Students are acquainted with the fundamentals of snow and glacier science and glacier environment.
- Students become aware about the impact of Climate change and its corollary global warming over snow and glacier environment

Students are familiar to applications of satellite images to monitor change in glaciers and snow cover

Pedagogy for Course Delivery:

The course is designed to be taught through the lecture mode and laboratory exercises. Class room interaction and group discussion on various topic will definitely have to be an integral part of the learning

List of Professional Skill Development Activities (PSDA):

- i. _____
- ii. _____
- iii. _____
- iv. _____

Lab/ Practicals details, if applicable:

List of Experiments:

- Introduction to ERDAS IMAGINE: A software used for Processing Remotely sensed Images
- Import / Export of Image, Image Display, Extracting the Information Using Header File
- Stacking of bands, Display Analysis and interpretation of Multispectral images: black & white TCC and FCCs
- Stacking of different bands and Sub-setting of area of interest from the satellite image
- Geo-reference of the Toposheet and satellite Images
- Mosaicking and Sub-setting Satellite Imageries
- Study of the various contrast enhancement techniques
- Principal Component Analysis
- Unsupervised Classification

- Supervised Classification
- Accuracy Analysis of Digital Classification
- Map composition
- Introduction to Model Maker
- Preparation of Spectral Indices using Model Maker

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment (___ %)					End Term Examination (___ %)
Components (Drop down)	Class Test	Attendance			
Linkage of PSDA with Internal Assessment Component, if any					
Weightage (%)	25	5			70

Lab/ Practical/ Studio Assessment:

Continuous Assessment/Internal Assessment (___ %)					End Term Examination (___ %)		
Components (Drop down)	Class Test (Practical Based)	Attendance	Practical Record		Major Lab Exercise	Viva-voce	Practical Record
Weightage (%)	20	5	5		40	20	10

Text Reading:

- Rees, W.G., Remote Sensing of Snow and Ice, Taylor & Francis, 2006 .
- Kargel, J.S., Leonard, G.J., Bishop, M.P., Kääh, A., Raup, B.H. (Eds.), Global Land Ice Measurements from Space, Springer, 2014

- Masson, R. and Lubin, D., Polar Remote Sensing, Volume II, Ice Sheets, Springer Praxis Publishing Ltd., 2006
- McClung, D. and Schaerer, P., The Avalanche handbook, The Mountaineers, Seattle, 1993
- Grove, J.M., 1988. The little ice age. London, UK: Methuen, 498.
- Paterson, W.S.B., Physics of glaciers, Third Edition, Butterworth-Heinemann Publishing, 1998

References:

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Additional Reading:

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Any other Study Material:

- **Journals:**
 1. Journal of Glaciology
 2. Annals of Glaciology
 3. Journal of Mountain Science
 4. Remote Sensing of Environment
 5. International of Journal of Remote Sensing
 6. Geocarto International