National Education Policy-2020

Common Minimum Syllabus for Uttarakhand State Universities and Colleges

SKILL ENHANCEMENT COURSE

Climate Change and Adaptability in Mountains

2025

For Undergraduate Courses

DEPARTMENT OF GEOGRAPHY
SOBAN SINGH JEENA, UNIVERSITY
ALMORA

List of Papers (SEC) with semester wise titles

Semester 1 – CCAM.SEC-01	Introduction to Mountain Ecosystems and Geography
Semester 2 - CCAM.SEC-02	Fundamentals of Climate Change
Semester 3 - CCAM.SEC-03	The Impact of Climate Change on Mountain Regions
Semester 4 - CCAM.SEC-04	Climate Change Mitigation and Adaptation in Mountain Regions
Semester 5 - CCAM.SEC-05	Mountain Conservation and Ecosystem Services
Semester 6 - CCAM.SEC-06	Mountain Research Project and Climate Change Advocacy

COMMITTEE OF BOARD OF STUDY

Sl. No.	Name and address of external experts/member	
1	Prof. R C Joshi, Department of Geography, DSB Campus, Kumaun University, Nainital, Email: hod.geog23dsb@gmail.com Mob. No. 8958811453	Expert
2	Prof. B R Pant, Department of Geography, MBPG College, Haldwani Email: brpant123@rediffmail.com Mob. No.9512958119	Expert
3	Dr. Deepak, Department Of Geography, Soban Singh Jeena, University Almora Email: deepakk5226@yahoo.in Mob.9837558203	Member
4.	Prof. Jyoti Joshi, Department Of Geography, Soban Singh Jeena, University Almora Email: hod.geography@ssju.ac.in Mob.7409404508	Head and convener

PROGRAMME PREREQUISITES

Any student in B.A./B.Sc./B.Com programme (undergraduate level) can opt for Skill Enhancement Course as per university rules.

Program Outcome (POs):

1. Understand Climate Change Impacts: Analyze the causes and effects of climate change on mountain ecosystems, including glaciers, biodiversity, and water resources.
2. Apply Scientific Tools: Utilize remote sensing, GIS, and climate data models to assess and monitor environmental changes in mountainous regions.
3. Develop Adaptation Strategies: Propose sustainable adaptation and mitigation measures for mountain communities affected by climate-induced hazards.
4. Engage in Policy and Community Action: Contribute to climate policies and community-based initiatives for resilience and disaster risk reduction in mountain environments.

Program Specific Outcomes (PSO):

PSO 1: **Gain Expertise in Mountain Climate Studies:** Develop specialized knowledge of climate variability, glacial changes, and ecological responses in high-altitude regions.
PSO 2: **Enhance Research and Analytical Skills:** Acquire hands-on experience with fieldwork, data analysis, and geospatial technologies to study climate change in mountains.
PSO 3: Address Climate Risks and Adaptation: Formulate practical solutions to reduce the vulnerability of mountain communities to climate-related hazards.
PSO 4: **Promote Sustainable Development:** Integrate environmental, social, and policy perspectives to support climate resilience and sustainable development in mountainous regions.

DEPARTMENT OF GEOGRAPHY
B.A./B.Sc./B.Com.
SKILL ENHANCEMENT COURSE (SEC-2) Introduction to Mountain Ecosystems and Geography

Programme: Under Graduate in Arts/Science	**Year: I**	**Semester: I**
Subject: Skill Enhancement	**Course Code:** CCAM.SEC-06	**Course Title: Introduction to Mountain Ecosystems and Geography**

Course Outcomes

1. Understand the fundamental concepts of mountains, their types, and geographical significance.
2. Analyze the climatic characteristics and microclimates of mountain regions.
3. Examine mountain ecosystems, biodiversity, and ecological importance.
4. Assess human settlements, indigenous communities, and socioeconomic activities in mountain regions.

Theory- (Credit-1)	**Distribution of marks according the University rule**.	
Total No. of Lectures – Tutorials – Practical (in hours per week): 1-0-1	**15 hrs for 1 credit theory**	
Unit	Course Content	Lectures
Unit – I	Introduction to Mountains, Types of Mountains, Major Mountain Ranges and their Geographic Importance	07
Unit – II	Mountain Climate; Flora, Fauna and Biodiversity Hotspots.	08
Practical (Credit - 1)	Comparison of rainfall and temperature data across different mountains focusing on variations with altitude. Comparison of flora and fauna based on mountain ranges and altitudes.	30

Suggested Readings

- Barry, R.G. (2008) Mountain Weather and Climate, Cambridge University Press.
- Beniston, M. (2006) Mountain Environments in Changing Climates, Routledge.
- D.J. Bliss, World Realms George Constantz (2014) Ice, Fire, and Nutcrackers: A Rocky Mountain Ecology, University of Utah Press, 2014
- Ellen Wohl (2021) Something Hidden in the Ranges: The Secret Life of Mountain Ecosystems Oregon State University Press
- Laura L. Scheiber and María N. Zedeño (2015) Engineering Mountain Landscapes: An Anthropology of Social Investment, University of Utah Press
- Roderick Peattie (2017) Mountain Geography: A Critique and Field Study Hardcover, Harvard University Press

DEPARTMENT OF GEOGRAPHY
B.A./B.Sc./B.Com.
SKILL ENHANCEMENT COURSE (SEC-2) Fundamentals of Climate Change

Programme: Under Graduate in Arts/Science	**Year: I**	**Semester: II**
Subject: Skill Enhancement	**Course Code:** CCAM.SEC-02	**Course Title: Fundamentals of Climate Change**

Course Outcomes

1. Develop an understanding of climate change, its natural and anthropogenic causes, and greenhouse gas dynamics.
2. Understand the science behind climate change, carbon cycles, feedback mechanisms, and climate data models.
3. Identification of spatio-temporal climatic data variation.

Theory-(Credit-1)	**Distribution of marks according the University rule**.

Total No. of Lectures – Tutorials – Practical (in hours per week): 1-0-1	**15 hrs for 1 credit theory**

Unit	Course Content	Lectures
Unit – I	**A brief Revision of Semester - I (Introduction to Mountain Ecosystems and Geography)**	2
	Introduction to Climate Change, Natural vs. Anthropogenic Causes, Greenhouse Gases; Role of International agencies: United Nations Framework Convention on Climate Change (UNFCCC) and Intergovernmental Panel on Climate Change (IPCC)	07
Unit – II	Impacts of Climate Change, Global Warming, Extreme Weather, Sea Level Rise, Climate Science, Carbon Cycle	06
Practical (Credit-1)	Data base creation based on literature survey of climate research findings from different parts of the world. Graphical plotting of climatic data and trend analysis.	30

Suggested Readings

- Ronald D. Brunner and Amanda H. Lynch (2010) Adaptive Governance and Climate Change, American Meteorological Society.
- IPCC (2021) Climate Change and the Cryosphere: IPCC Special Report.
- Messerli, B., & Ives, J.D. (1997) Mountains of the World: A Global Priority, The Parthenon Publishing Group.
- DS Lal, Climatology

DEPARTMENT OF GEOGRAPHY
B.A./B.Sc./B.Com.
SKILL ENHANCEMENT COURSE (SEC-2) The Impact of Climate Change on Mountain Regions

Programme: Under Graduate in Arts/Science	**Year: II**	**Semester: III**
Subject: Skill Enhancement	**Course Code:** CCAM.SEC-03	**Course Title: The Impact of Climate Change on Mountain Regions**

Course Outcomes

1. Identify the impacts of climate change on mountain ecosystems.
2. Analyze shifts in alpine flora and fauna, habitat loss, and conservation challenges.
3. Examine mountain hazards, such as landslides, avalanches, and infrastructure vulnerabilities.

Theory-(Credit-1)	**Distribution of marks according the University rule**.
Total No. of Lectures – Tutorials – Practical (in hours per week): 1-0-1	**15 hrs for 1 credit theory**

Unit	Course Content	Lectures
Unit – I	**A brief Revision of Semester -II (Fundamentals of Climate Change)**	3
	Impacts of Climate Change on Mountain: Rising temperature, Melting Glaciers, GLOF, Increased Natural Hazards, Water Insecurity, Shifts in Alpine Flora and Fauna, Impact on Indigenous and Local Communities; Cost of Climate Change Impacts: Economic losses assessment of Climate-related disasters damages annually to infrastructure, agriculture, health, and economies.	12
Practical (Credit -1)	Hazard zone mapping using remote sensing data and GIS techniques, identification of timber line shifts, and preparation of a list of threatened species.	30

Suggested Readings

- Gary D. Libecap and Ariel Dinar (2024) American Agriculture, Water Resources, and Climate Change, University of Chicago Press
- Gregg Garfin, Angela Jardine, Robert Merideth, Mary Black and Sarah LeRoy (Editted) 2013 Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment, Island Press.
- Price, M.F. (2015) Mountain Geography: Physical and Human Dimensions, University of California Press.
- UNEP (2012) Mountains and Climate Change: A Global Concern, United Nations Environment Programme.

DEPARTMENT OF GEOGRAPHY
B.A./B.Sc./B.Com.
SKILL ENHANCEMENT COURSE (SEC-2) Climate Change Mitigation and Adaptation in Mountain Regions

Programme: Under Graduate in Arts/Science	**Year: II**	**Semester: IV**
Subject: Skill Enhancement	**Course Code:** CCAM.SEC-04	**Course Title: Climate Change Mitigation and Adaptation in Mountain Regions**

Course Outcomes

1. Understand mitigation strategies, including greenhouse gas reduction and sustainable tourism.
2. Explore afforestation, carbon sequestration, and eco-friendly infrastructure in mountain regions.
3. Learn about adaptation strategies, disaster risk reduction, and climate-resilient planning.
4. Analyze water resource management, trans boundary issues, and policy frameworks for mountain regions.

Theory- (Credit-1)	**Distribution of marks according the University rule**.
Total No. of Lectures – Tutorials – Practical (in hours per week): 1-0-1	**15 hrs for 1 credit theory**

Unit	Course Content	Lectures
Unit – I	**A brief Revision of Semester -III (The Impact of Climate Change on Mountain Regions)**	03
	Climate Change Mitigation Strategies: Reducing Greenhouse Gases, Carbon Sequestration, Afforestation, Sustainable Tourism	05
Unit – II	Climate Change Adaptation Strategies: Climate Resilient Planning with special reference to Eco-friendly Infrastructure, Disaster Risk Reduction, Water Resource Management, Tran boundary and Water Issues. Limitation associated with adaptation and mitigation.	07
Practical (Credit -1)	Identification of land use changes using remote sensing techniques/Case study of climate change adaption strategies at local level and Analysis of carbon sequestration.	30

Suggested Readings

• UNESCO (2018) Climate Change and Mountain Ecosystems.
• WWF (2020) Adapting to Climate Change in Mountain Regions.

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SKILL ENHANCEMENT COURSE (SEC-2) Mountain Conservation and Ecosystem Services

Programme: Under Graduate in Arts/Science	**Year: III**	**Semester: V**
Subject: Skill Enhancement	**Course Code:** CCAM.SEC-05	**Course Title: Mountain Conservation and Ecosystem Services**

Course Outcomes

1. Identify conservation challenges, including deforestation, overgrazing, and biodiversity threats.
2. Understand techniques for protecting endemic and threatened species in mountain environments.
3. Explore the role of mountains in regulating water cycles, and ecosystem services.
4. Analyze the importance of protected areas, national parks, and community-based conservation initiatives.

Theory- (Credit-1)	**Distribution of marks according the University rule**.
Total No. of Lectures – Tutorials – Practical (in hours per week): 1-0-1	**15 hrs for 1 credit theory**

Unit	Course Content	Lectures
Unit – I	**A brief Revision of Semester -IV (Climate Change Mitigation and Adaptation in Mountain Regions)**	03
	Conservation: Concept and Challenges, Land, Water and Forest Resources.	06
Unit – II	Ecosystem Services : Regulating services, Provisioning services, Cultural services and Supporting services	06
Practical (Credit-1)	Village survey-based identification and Mapping of Land/ Water/ Forest Resources. Creation of environmental awareness in the village through community participation.	30

Suggested Readings

• IUCN (2019) Mountain Conservation and Biodiversity Protection.

• FAO (2017) Sustainable Mountain Development.

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SKILL ENHANCEMENT COURSE (SEC-2) Mountain Research Project and Climate Change Advocacy

Programme: Under Graduate in Arts/Science	**Year: III**	**Semester: VI**
Subject: Skill Enhancement	**Course Code:** CCAM.SEC-06	**Course Title: Research Project based on Climate change in Mountain region**

Course Outcomes

1. Develop research methodologies for mountain studies, including field techniques and data analysis.
2. Understand ethical considerations in research and strategies for climate change advocacy.
3. Assess the roles of NGOs and government bodies in climate awareness and public engagement.
4. Conduct a final research project on climate change issues, including report writing and presentation.

Theory- (Credit-1)	**Distribution of marks according the University rule**.
Total No. of Lectures – Tutorials – Practical (in hours per week): 1-0-1	**15 hrs for 1 credit theory**

Unit	Course Content	Lectures
Unit – I	Preparation of Project outline: Introduction, Statement of Problem, objectives, Literature review, data source, methodology, Hypothesis, Research Design, Research Ethics, chapterisation schemes and references.	15
Practical (Credit -1)	**Capstone Project**: Field survey-based project dissertation preparation using GIS (Independent or Group Project) on a relevant topic on climate change issues, Urban, Environmental, Disaster, etc. Students are required to prepare 20–25-pages dissertation and must be submitted it in hard copy in the Department one week before the commencement of the Theory Examinations. The evaluation and viva – voce examination will be conducted by the department as per the university guidelines.)	30

Note: In 6th semester the fresh entry (those who have not opted at least two previous semesters of this course) is not allowed.

Suggested Readings

• Global Mountain Partnership (2021) Climate Action in Mountain Regions.
• Esri (2020) GIS for Climate Change and Environmental Research.