National School Curriculum

INSTRUCTIONAL GUIDE FOR GEOGRAPHY

CLASSES XI & XII

Department of Curriculum and Professional Development
Ministry of Education, Royal Government of Bhutan

“Your parents, relatives, and friends would be very proud of what you have achieved. At your age, to have completed your studies is your personal accomplishment. Your knowledge and capabilities are a great asset for the nation. I congratulate you for your achievements. Finally, your capabilities and predisposition towards hard work will invariably shape the future of Bhutan. You must work with integrity, you must keep learning, keep working hard, and you must have the audacity to dream big.”

- His Majesty Jigme Khesar Namgyel Wangchuck

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In our endeavour in the development of Education in Emergency curriculum material during the COVID19 pandemic, collaboration and financial support were forthcoming from diverse national and international development partners. In particular, technical and financial support of GPE through Save the Children Bhutan and UNICEF helped us to deliver the curriculum materials on time.

We would like to sincerely acknowledge the retrieval and use of ideas and pictures from various sources. We reaffirm that this book is purely for educational purposes.

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Foreword

The erstwhile Royal Education Council (REC) developed an Adapted and Prioritized curricula for schools so that students can continue learning during the disruptions caused by the COVID 19 pandemic since March 2020. With the commencement of the 2021 academic session, the new normal curriculum, later renamed as the National School Curriculum (NSC), was embraced as a paradigm shift of education from the conventional knowledge-based learning to competency based, open source and experiential learning leveraged on digital technologies. In order to facilitate the effective implementation of the curriculum change, Instructional Guides were developed in all subjects, and the teachers were oriented through virtual and short contact modes as per the prevailing pandemic situations. The curricula were aimed at minimizing the learning loss for learners as it was designed for implementation in different situations - during school closure or during regular contact instructional hours.

While these measures served as a solution to problems brought about by the pandemic and the global changing trend in education, a resilient and more dynamic curricula and instructions remain the current priority of the Government. In cognizance of some the shortfalls in the provisional edition of Instructional Guides (IG), the Department of Curriculum and Professional Development reviewed and revised the existing Instructional Guides across all subjects with the aim of enforcing the competency-based learning, and making teaching-learning happen 'anytime anywhere' commensurate to an inclusive education, so that all learners are provided the opportunity to learn at their pace and situation.

The revised Instructional Guides have drawn ideas and inspiration from various educational philosophies and principles, particularly the Delors Report, Learning: The Treasure Within (1996). The report prioritizes the development of the whole person and not just academic knowledge through the four pillars: "learning to know", "learning to do", "learning to be", and "learning to live together". Therefore, the New Curriculum and the Instructional Guide is an attempt to transform education from the teaching of "what" to learning of "how" and "why" towards empowering learners with the transversal competencies and the 21st century skills, and preparing them to be lifelong learners.

It must be noted that the New Curriculum and the Instructional Guide are not just a response to the pandemic, but a culmination of the curriculum reform work for the last four years by the Royal Education Council. The school curricula are to be perceived as integrated, and based on themes and problems that inspire learners to learn and to live in peace with our common humanity and our common planet. This has the potential in the development of a strong base of knowledge about one's self and about the world, find purpose of learning, and be better able to participate in social and political milieu. Thus, this initiative is envisaged to orient our educational process towards nurturing 'nationally rooted and globally competent' citizens.

Wish all our learners and teachers a life enriching experiential teaching and learning.

Tashi Namgyal
Director

Contents

Introduction

This guide has been developed for teachers teaching Geography in schools across the country for the implementation of the Geography curriculum. As all the schools follow the same curriculum aimed at equipping the students with the same set of competencies, it is crucial for all the teachers to have the same understanding about the intent of the curriculum so that they would be able to implement it as desired.

The Geography curriculum consists of four strands, according to the language competencies to be taught; they are Time and Space, Physical Environment, People and the Environment, and, Essential Skills, and Geographical competencies to be acquired and demonstrated by the learners at each stage of learning are outlined as Standards, Competencies and Objectives. While guiding teachers on what to teach, these standards, competencies and objectives will also inform the stakeholders about the levels of knowledge and skills expected from the learners at various stages of education.

The sample activities given in the guide are suggestive in nature. Teachers can negotiate to adapt and design their own teaching learning activities or experiences that best suit their learners and their environment. What is non-negotiable is the teaching of the competencies that the learners must acquire at each class before they move on to the next class.

The curriculum has a wide range of knowledge, concepts and skills that the students need to master. There are those which the learners can explore, acquire and practice to master on their own, and there are also more complex ones which need to be taught explicitly and practised consistently to gain a satisfactory level of mastery. Classroom teaching and instructional time should focus on teaching those concepts and skills that the students cannot learn on their own, while encouraging learners to explore some areas to learn and practice on their own.

A major shift in the curriculum is the teaching and development of skills by the learners. Therefore, the curriculum contents should be used as vehicles to move towards the acquisition of competencies. The competencies for each class are further broken down as objectives that should serve as signposts for teachers to decide what to teach.

Since, competencies are at the heart of curriculum and its implementation, teachers should make conscious choice of the most suitable teaching-learning approaches. And, because the teaching focusses on acquiring skills/competencies, assessment will also be on the acquisition and demonstration of the skills - skills in terms of Geospatial concepts, social, behavioural and affective domains that are demonstrable and measurable. Various assessment approaches, tools and rubrics have been devised and suggested in the Instructional Guide. Teachers are enquired to be consistent to meaningfully assess students and report to stakeholders at various levels. Further, the focus of assessment should be for learning rather than assessment of learning which would happen periodically.

Purpose of Instructional Guide

Among the many definitions of 'curriculum' this Instructional Guide underscores the meaning of curriculum as a standard and competency-based sequence of planned learning experiences where learners practice and achieve the proficiency in applying the learning experiences in real life scenarios. These proficiencies, in the curriculum framework, have been stated as competencies and objectives for each class. In keeping with the principle, 'less is more' as stated the National School Curriculum, the contents of the curriculum have been reduced so that learners can be engaged more in activities/learning experiences that can lead to the acquisition of geographic knowledge and skills rather than having them cover the syllabus. This Instructional Guide believes that the classroom teachers, as professional individuals, can make the most authentic and reliable judgment about each learner's learning needs and the learning experiences to be provided to propel the learners in the learning continuum. With these beliefs and principles as the background, the following are the purposes of this document:

i. Facilitate learners acquire language skills and competencies using literature as a medium.

ii. Strengthen blended learning, including flipped classroom with multimedia, digital pedagogies and ICT devices and websites as tools to share the responsibility of learning amongst the learners, teachers, the parents and other stakeholders.

iii. Facilitate the use of Continuous Formative Assessment for learning using diverse appropriate assessment techniques and tools commensurate with individual differences in learning, and gather evidence to guide planning of educational programmes and activities for learners.

iv. Promote inclusive learning through the blended learning which facilitates learning anywhere, any time with the learner being responsible for the learning.

v. Provide suggestive means of teaching language skills by building interrelationship among, and through, the integration of the four strands of the curriculum.

vi. Help teachers assume the roles of facilitator, guide, motivator and evaluator.

vii. Guide teachers, parents and other stakeholders in helping learners achieve their potential.

viii. Empower teachers to design their own 'course of study' or 'class curriculum' for their students in line with the National School Curriculum Framework.

ix. Enhance sharing the burden responsibility and accountability for learning amongst the stakeholders, including the learners themselves.

In this age of advanced communication and information technology, contents are widely available from a number of sources, therefore, the contents of the curriculum have been kept flexible enough for teachers to select, structure and sequence them to best suit the learners need while maintaining coherence and consistency. In other words, while the contents of the curriculum are negotiable, the competencies and objectives are not. While, teachers may have access to number of materials, it should be kept in mind that the teaching and learning should be focused on achieving the competencies rather than 'covering of the syllabus. The teaching learning materials should be used as means to create a learning environment that is competency-based where the learners need to master the skills presented to them. While designing lesson plans and teaching learning activities, teachers need to ensure that the materials are relevant and appropriate for the given task.

The assessment should be competency-based wherein the teachers should assess the learners' mastery of the skills stated as competencies and objectives for each class. Teachers should use appropriate assessment tools and techniques depending on the nature of the learning experiences. The learners should be clearly informed about the success criteria, the areas of assessment and the tools to be used so that they know exactly what tasks are to be performed or expected of them. In the process of the performance, the teacher should continuously provide feedback and, if necessary, modify instructions. Efforts have to be made to ensure that every learner has mastered the skills.

National School Curriculum

INSTRUCTIONAL GUIDE FOR GEOGRAPHY

Class XI

Strand 1: Time and Space

Theme 1: The Origin and Evolution of the Universe

The Universe originated around 13.7 billion years ago. It is the whole of space that has matter and energy in it. Scientific and spiritual perspectives help to clarify the origin of the Universe. Several scientific theories like the Big Bang and Solar Nebula have attempted to explain the origin of the Universe more appropriately than others. The Milky Way is one of the billions of galaxies in the observable universe. The Sun is one among hundreds of billions of stars in the Milky Way galaxy, and most of those stars have their own planets that revolve around them.

1.1 Competency

Assess the origin of the universe to understand the religious and hypothetical description of astronomy.

1. 2 Learning Objectives

i. Explain the origin of the universe from a Buddhist perspective.
ii. Examine the significance of the moon for the Earth.
iii. Relate Buddhist perspective of origin of Universe with scientific explanation.

1.3 Learning Experiences

Suggestive strategies are Guest Speaker, Simulation, Interconnectedness, Debate, Q & A session, Group Discussion and other relevant strategies

a. Visit a nearby Dzong or monastery and request or invite religious personnel to share about the origin of Universe from Buddhist perspective.

   Watch the video https://www.youtube.com/watch?v=HdPzOWlLrbE and explore the origin of the Universe from a scientific perspective. In groups, compare and contrast the origin of the Universe from Buddhist and scientific perspective. Write a report and share your findings to the class.

b. Use the web link or other suitable links: https://www.iop.org/explore-physics/moon/how-does-moon-affect-earth#gref and https://www.youtube.com/watch?v=W9tS67S8Ehc

In groups, explore the significance of the moon for the Earth. Explain the significance of the moon from a scientific perspective. Ask your parents/Dzongkha teacher and draw out the implication of the moon for the Earth from a Buddhist perspective. Relate the significance of the moon for the Earth from a scientific and Buddhist perspective. Present the findings.

Reflective Question

- Relate the origin of the universe from Buddhist perspective to the Scientific theory and find out the similarities.

1.4 Assessment

Assessment tools such as self-assessment, reporting, question-answer, oral presentation, quiz, class task, peer assessment, rubrics and other relevant tools.

1.5 Resources

a. https://www.youtube.com/watch?v=uGuq2QfbZAQ (Big Bang on the Buddha's view on the Universe, 2010)
b. http://www.srilankaguardian.org/2010/01/origin-of-life-in-universe-buddhist.html (Journal By Dr Ruwan M Jayatunge M.D., 2010)
c. https://www.youtube.com/watch?v=qj_i7YqDwJA (Where science and Buddhism meet)
d. https://www.youtube.com/watch?v=h7CEQdmce2c (Tiny Dust, 2017)
e. https://www.youtube.com/watch?v=W9tS67S8Ehc (How important is the moon – 2017)
f. https://www.youtube.com/watch?v=6AviDjR9mmo (The Moon – 2018)
g. https://www.space.com/55-earths-moon-formation-composition-and-orbit.html (Journal- 2017)
h. https://my-moon.org/research/ (Personal feelings on the moon)

Strand 1: Time and Space

Theme 2: Geospatial Technology and Resource Management

Geospatial technologies is a term used to describe the range of modern tools contributing to the geographic mapping and analysis of the Earth and human societies. These technologies have been evolving in some form since the first maps were drawn in prehistoric times. In the 19th century, the long important schools of cartography and mapmaking were joined by aerial photography as early cameras were sent aloft on balloons and pigeons, and then on airplanes during the 20th century.

2.1 Competency

Apply the knowledge and skills of geospatial technologies to analyse national and global issues.

2.2 Learning Objectives

a. Explain Remote Sensing and GIS.
b. Identify global issues related to the environment by using RS and GIS.
c. Examine the significance of Remote Sensing and Geographic Information System.

2.3 Learning Experiences

Visualisation, Experiential learning, Computational Learning, Scaffolding, presentation, group discussion, observation of important dates (World GIS Day) and any other relevant strategies for teaching learning process.

Access the links:

https://www.slideshare.net/preetipatil47/remote-sensing-and-gis-ppt and

https://www.biologydiscussion.com/plant-taxonomy/remote-sensing-history-principles-and-types/30587 and prepare notes on following points:

i. Concept of Remote Sensing and GIS
ii. Application of Remote Sensing and GIS
iii. Pros and Cons of Remote Sensing and GIS

Students in groups do the presentation followed by discussion.

Using Google Earth application, zoom into the area surrounding your school and identify different land use and land cover patterns.

Land Use and Land Cover	**Identify and put a (✓) where LULC patterns are visible**
Water body	
Urban Area	
Snow and Glacier	
Shrub	
Mixed Forest	
Grassland	
Conifer forest	
Broadleaved forest	
Barren Area	
Agriculture	

Access the link

https://www2.geog.soton.ac.uk/users/trevesr/obs/rseo/types_of_platform.html and explore;

i. Types of remote sensing platforms and types of orbits. Present the findings.

Access Google Earth application and zoom into the capital city of Bhutan, Thimphu. Click on, show historical imagery button, a time slider will pop up. Slide the button on the slider into the year 2003 and year 2019.

Note down the observations between 2003 and 2019.

Area/Structures	2003	2019
Changlimithang stadium		
Golf Course Area		
Taba Area		
Babesa Area		

Accessing QGIS application, create a vector based (settlement, population, rivers and buildings) map of Bhutan. Provide a brief analysis of the map.

[Note: Access the Google Site https://sites.google.com/education.gov.bt/gst/home for following the steps and procedure to complete above activities.

Reflective Questions

i. Analyse the pros and cons of geospatial technology over the conventional tools.
ii. Based on the observations, what are some of the environmental concerns that may impact the community?

2.4 Assessment

Assessment tools such as self-assessment, oral presentation, question-answer, quiz, anecdotal record, class task, peer assessment or any other relevant tools to assess student's task.

2.5 Resources

1. URL links:

Remote sensing - YouTubeWhat is Remote Sensing? - YouTube

https://www.youtube.com/watch?v=xIsUP1Ds5Pg (What is Remote Sensing)

https://www.youtube.com/watch?v=NZkqeBR9MFs (What is GIS)

https://www.academia.edu/6042218/Lecture_Delivered_on_Applications_of_GIS_and_Remote_Sensing (Application of GIS and Remote Sensing slide)

https://www.biologydiscussion.com/plant-taxonomy/remote-sensing-history-principles-and-types/30587 (Remote sensing)

2. ISC Geography Textbook for Class XI by D.R. Khullar

Strand 1: Time and Space

Theme 3: Map Reading and Interpretation

Map is a scaled representation of a part of the earth or whole of the earth's surface on a flat surface such as sheet of paper, wall, piece of wood or plastic etc. OR, It is a drawing which represents physical features.

Map interpretation is the process of examining a given topographical map of an area represented for the purpose of identifying the geographical information of an area. It has two basic process; map reading and map analysis. Map reading is the process of examining the given topographical map, conventional symbols and signs. Map analysis is the process of relating the identified information on the map with other geographical information which are not directly shown on the map.

3.1. Competency

Demonstrate cartographic skills to analyse geographical information.

3.2. Objectives

a. Discuss various map projections
b. Demonstrate the skills of constructing map projection using different methods.
c. Explain the concept of scales.
d. Convert representative fraction into statement scale and vice versa.
e. Demonstrate the skills of interpreting topographic maps.
f. Represent natural and human-made features on a map.

3.3 Learning Experiences

Reinforcement of prior knowledge, visualisation, group discussion, demonstration, interpretation, exploration and other relevant strategies.

a. Accessing QGIS application, show the Coordinate Reference System (CRS) or projection of the world using Mercator and Cylindrical Equal Area Projection. Discuss the differences between these projections. Students make comparison and try with other projections as well.

(Note: Access the Google Site https://sites.google.com/education.gov.bt/gst/home for following the steps and procedure to complete activity.

b. Using the link or any other relevant resources

https://www.bing.com/videos/search?q=map+projections&&view=detail&mid=29063D9E4314392BF24229063D9E4314392BF242&&FORM=VRDGAR

c. Explain the concept of Map Projections. Teacher demonstrates the process of constructing map projection (Cylindrical Equal Area Projection, Conical

Projection with One Standard Parallel and Polar Zenithal Equidistant Projection) referring to any other resources.

Students carry out map projection as a practical task.

d. Check prior knowledge of the students on concepts and types of scale. Students, in pairs, explain three types of scale using relevant examples. Present the findings to the class.

Check prior knowledge of the students on map interpretation. Teacher demonstrates interpreting topographic maps. Students in groups, referring to any topographical map interpret and identify various features.

e. Using the link

http://studymaterial.unipune.ac.in:8080/jspui/bitstream/123456789/3524/1/conversion%20of%20scale.pdf

Students examine and explicate the process of conversion of scale. Teacher provides questions on conversion of Representative Fraction into Statement Scale and vice versa. Students solve the questions.

Reflective Question

- How does map reading and interpretation skills help in planning and decision making?

3.4 Assessment

Appropriate tools such as rubrics, checklist, class task, rating scale, anecdotal record, peer assessment, self-assessment or any other relevant assessment tools may be implemented.

3.5. Resources

a. https://www.rei.com/learn/expert-advice/topo-maps-how-to-use.html (How to read a topographic map)
b. https://study.com/academy/lesson/what-is-a-topographic-map-definition-features.html (What is a topographic map?)
c. https://www.youtube.com/watch?v=z1JHqVhsCB0 (Scale in Geographic analysis)
d. https://www.bing.com/videos/search?q=map+projections&&view=detail&mid=29063D9E4314392BF24229063D9E4314392BF242&&FORM=VRDGAR (Narrative video)
e. https://ncert.nic.in/textbook/pdf/kegy304.pdf
f. https://www.geographyrealm.com/types-map-projections/

Strand 2: Physical Environment

Theme 4: Climate Change and Global Warming

Global warming and climate change are two of the most pressing issues of the world today. Global warming refers to the heating up of the planet due to holes created on the ozone layer. The ozone layer protects our planet from harmful Ultra Voilet rays that the sun emits. This phenomenon causes our planet to heat up, and this concept is called global warming which leads to climate change. There are many human-made ways in which the holes in the ozone layer are created, which are harmful to us and our entire planet.

4.1. Competency

- Explore climatological elements and human activities to understand climate dynamics.

4.2. Objectives

a. Discuss temperature and pressure.
b. Explain the causes and consequences of shifts in world pressure and wind belts.
c. Explain different climatic zones of the world.
d. Analyse the relationship between global warming and climate change.
e. Discuss the evidence for climate change.
f. Analyse the consequences of climate change and suggest measures to minimise the impact.

4.3 Learning Experiences

Suggestive strategies: Research, Content analysis, Group Discussion, Q & A session, Simulation, Geo-Inquiry, Field work, K-W-L method, Worksheet, PowerPoint presentation and other relevant strategies.

Use the links or any other relevant links:

- https://www.nationalgeographic.org/encyclopedia/atmospheric-pressure/print/
- https://www.nationalgeographic.org/encyclopedia/temperature/#:~:text=Temperature%20is%20the%20degree%20of%20hotness%20or%20coldness%20of%20an%20object.&text=The%20temperature%20of

a. In groups, discuss the difference between temperature and pressure and share their findings. OR write the differences between temperature and pressure in the worksheets and present the findings.

b. Watch the video https://www.youtube.com/watch?v=FicN1PCGFp0 and explore the causes and consequences of shifting of pressure belt (chart or notebook) and present the findings to the class.

c. Use the link or any other relevant resources.

https://www.britannica.com/video/143199/distribution-climates-surface-sunlight-Earth

Students examine the different climatic regions of the world. List and write the characteristics of different climatic regions.

d. Use K-W-L method:

Check students' prior knowledge on climate change (causes, evidence and consequences).

Watch the video https://www.youtube.com/watch?v=We2nYvdjpKk OR https://www.youtube.com/watch?v=-D_Np-3dVBQ

In groups, students explore and prepare a report on the relationship between global warming and climate change. State evidences and consequences of climate change. Suggest measures to mitigate climate change. Present the report to the class.

4.4 Assessment

Assessment tools such as self-assessment, reporting, anecdotal record, question-answer, oral presentation, rating scale, quiz, PowerPoint presentation, class task, peer assessment, rubrics and other relevant tools.

4.5. Resources

a. https://www.bing.com/videos/search?q=temperature&&view=detail&mid=1A2D8E1C56C0C2ADE4121A2D8E1C56C0C2ADE412&&FORM=VRDGAR (a simple understanding on Temperature)
b. https://www.bing.com/videos/search?q=Relationship+Between+Temperature+and+Pressure&&view=detail&mid=47F1F5991734843C8F9647F1F5991734843C8F96&&FORM=VRDGAR (the relationship between temperature and pressure)
c. https://www.youtube.com/watch?v=BsOL9Fafo2w (Koeppen's Climate Classification)
d. https://courses.lumenlearning.com/geophysical/chapter/climate-zones-and-biomes/ (Climatic zones and biomes)
e. https://www.nasa.gov/feature/goddard/2021/the-climate-events-of-2020-show-how-excess-heat-is-expressed-on-earth (The climate events of 2020)
f. https://news.un.org/en/story/2020/12/1080882 (Planet warming trend continues)
g. https://www.youtube.com/watch?v=atkur6XI6OI (News)
h. https://www.youtube.com/watch?v=We2nYvdjpKk (Animation, 2020)
i. https://www.youtube.com/watch?v=-D_Np-3dVBQ
j. https://www.youtube.com/watch?v=wbR-5mHI6bo
k. ISC Geography Textbook of class XI by D.R. Khullar

Strand 2: Physical Environment

Theme 5: Land Formation Processes

The geomorphic processes of weathering, erosion and deposition create a large variety of landscapes and landforms. The processes that form different landscapes and create their unique landforms are largely determined by climate and geology. In the future climate change could influence the geomorphic processes forming and transforming landscapes by changing river flow, melting glaciers and increasing extreme weather events. An understanding of the geomorphic processes that shape landscapes and landform help us to visualise how places looked in the past and predict how they may look in the future.

5.1 Competency

Analyse the geomorphological processes to deduce the significance of land features.

5.2. Objectives

i. Explain the internal structure of the earth with illustrations.
ii. Discuss the causes and impacts of volcanism and earthquakes.
iii. Suggest measures to reduce the risk of earthquake.

5.3 Learning Experiences

Suggestive strategies: Model, Peer learning, Demonstration, Simulation, Analysis, Debate, Q & A session and other relevant strategies.

Accessing the internet, ISC Geography textbook (Class XI) or any other relevant resources, students in groups make models of the internal structure of the Earth. Display the model along with explanation of the structure of the Earth.

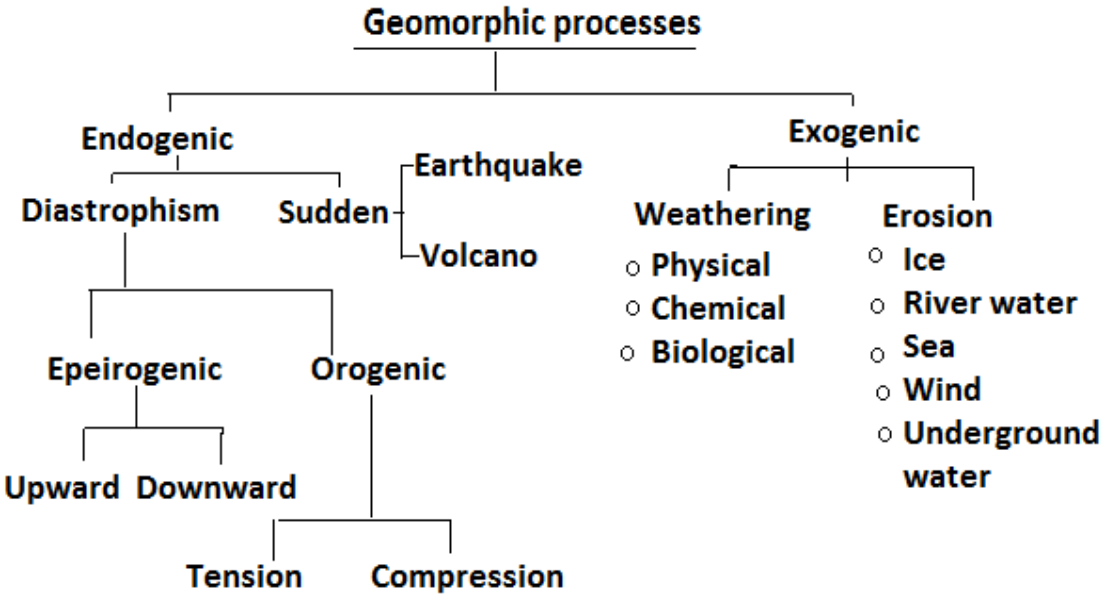
a. Assign project work in groups on earthquake and volcano (definition, causes, impacts and risks).
b. Using the link https://hub.arcgis.com/datasets/c8af9c5411814584b460cc87cb7c3780 Students assess the real time data of earthquakes around the World. In groups, explain the benefits of using this application.

c. Watching the video https://www.youtube.com/watch?v=gPhRiPVYqIc Students propose and explain the measures to reduce the risk of earthquakes. Prepare MS PowerPoint presentation and present to the class.

d. Referring to one of the past earthquakes in Bhutan, identify earthquake hazards and disaster experienced in that area. Prepare a list of risk reduction measures that could increase the chances of survival during an earthquake. Use any

applications to illustrate it in a digital form (Paint, MS Word, MS Publisher, Photoshop, Illustrator, Picsart, etc).

e. Using the flow chart on geomorphic processes, students discuss the endogenic and exogenic factors. Prepare PPT.



Reflective Question

- Analyse the significance of landforms on the life of the community or the society.

5.4 Assessment

Assessment tools such as self-assessment, reporting, question-answer, oral presentation, quiz, class task, peer assessment, rubrics and other relevant tools.

5.5 Resources

f. https://slideplayer.com/slide/4149356/ (internal structure of earth)
g. https://pubs.usgs.gov/gip/interior/ (internal structure of the earth
h. https://www.youtube.com/watch?v=eXiVGEEPQ6c (Structure of The Earth).
i. https://www.youtube.com/watch?v=C2rIrj6yUQU (Causes of Volcano)
j. https://www.youtube.com/watch?v=AArne-wh_Uc (Causes of Earthquake)
k. https://www.youtube.com/watch?v=JtNgk9PtLYE (Effects of Earthquake on people and Environment)
l. https://www.youtube.com/watch?v=OQAY2SEMtPg (Negative impacts of Volcano)
m. https://www.youtube.com/watch?v=FowixCmKNKs (Effects of Earthquake)
n. https://www.youtube.com/watch?v=8Z1EGfwU9qo (Mitigation plan for Earthquake

Strand 2: Physical Environment

Theme 5: **Land Formation Processes (Soil properties)**

Soil is comprised of minerals, soil organic matter, water, and air. The composition and proportion of these components greatly influence soil physical properties, including texture, structure, and porosity, the fraction of pore space in a soil. In turn, these properties affect air and water movement in the soil, and thus the soil's ability to function.

6.1 Competency

Apply the knowledge of soil science to explain the biological, physical and chemical properties.

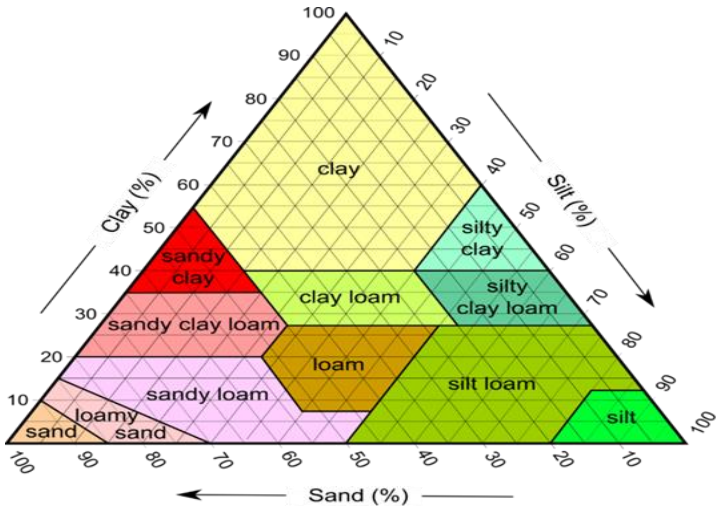
6.2 Objectives

a. Describe the properties of soil.
b. Distinguish soils for various uses.

6.3 Learning Experiences

Suggestive strategies: Model, Field trip, Q & A session, Simulation, Research, Geo-Inquiry, Group Discussion and other relevant strategies.

a. Using the link https://www.nrcs.usda.gov/wps/portal/nrcs/detail/nj/home/?cid=nrcs141p2_018993, students explore and explain the physical and chemical properties of soil and in pairs, prepare MS PowerPoint presentations. Present to the class.
b. Identify areas with different structure of soil in your locality and conduct soil test using soil testing kit or Pantry pH test and share your findings.
c. In teams, study the soil textural triangle diagram and fill in the missing information in the table.



Sl.no	% Sand	% Silt	% Clay	Soil Texture
Example	75	10	15	Sandy loam
1	42		37	
2		52	21	
3		35	50	
4	64	30		
5	50		40	

d. Using internet, library or any other relevant resources, fill in the table with relevant information. Present the findings to the class.

Sl. No	Types of soil	Properties	Uses
1.	Clay soil		
2.	Sandy soil		
3.	Loamy soil		
4.	Red soil		
5.	Black soil		
6.	Mountain soil		
7.	Alluvial soil		

6.4 Assessment

Assessment tools such as self-assessment, reporting, question-answer, oral presentation, quiz, class task, peer assessment, rubrics and other relevant tools may be used.

6.5 Resources

a. https://www.youtube.com/watch?v=voWgADFhht8 (How soils are formed from rocks?)
b. https://www.britannica.com/video/143210/Soil-forms-weathering-rock-action-matter-organisms

Strand 3: People and the Environment

Theme 6: Energy Resources and Industries

Energy resources are all forms of fuels used in the modern world, either for heating, generation of electrical energy, or for other forms of energy conversion processes. Energy resources can be roughly classified in three categories: renewable, fossil, and nuclear.

7.1 Competency

Assess the significance of natural resources to conserve the ecosystem for sustainable use.

7.2 Objectives

a. Discuss energy sources.
b. Differentiate between conventional and non-conventional energy sources.
c. Discuss geothermal energy.
d. Explain the importance and approaches of resource management.
e. Discuss sustainable development.
f. Examine the dichotomy between resource utilisation and sustainable development.
g. Discuss the concept of biomes.

7.3 Learning Experiences

Prior-Knowledge activation, Analysis, Adaptive Learning, Peer Coaching, Literature review, inquiry-based learning, inductive and deductive are suggestive teaching learning experiences.

a. Use the link https://byjus.com/physics/conventional-and-nonconventional-sources-of-energy/ to identify the difference between conventional and non-conventional energy. Ask diverse questions on energy sources. Distribute worksheets to categorise energy sources into conventional and non-conventional energy.
b. Watch the video: https://www.youtube.com/watch?v=eyOXmqu4PS8, and in groups, write and share the insights about geothermal energy. Teacher validates their points and provides feedback.
c. Students brainstorm on the importance of resource management. List the points and ideas in the notebook and share. Use the link https://www.youtube.com/watch?v=Q38pL8KewOY to discuss and draw the approaches to resource management (Maximum Sustainable Yield Approach, Natural Resource Scarcity Approach and Ecological Approach).
d. Ask questions to check the prior knowledge of students on sustainable development. Using the link https://www.youtube.com/watch?v=7V8oFI4GYMY students in groups explore more information on sustainable development. As an extended

activity, students work in pairs to examine and write the dichotomy between resource utilisation and sustainable development.

e. On an outline map of the world, identify major types of biomes. Shade the types of biomes with different colours and label them accordingly. Compare and contrast the unique characteristics of the major biomes.

Reflective Question

- How do you reconcile the dilemma between resource utilisation and sustainable development?

7.4 Assessment

Assessment tools such as rubrics, peer assessment, self-assessment, oral presentation, question-answer, rating scale, quiz, class task, anecdotal record or any other relevant tools to assess students' task.

7.5 Resources

Use suggestive websites/You-tube videos or any relevant materials to explore and learn more about the topic.

a. https://www.youtube.com/watch?v=AOhQ4gj4Ng8 (Energy Sources)

b. https://www.youtube.com/watch?v=CvQP7hI9UvM (What are biomes?)

c. https://www.youtube.com/watch?v=PLBK1ux5b7U (Renewable and non-renewable resources)

d. https://www.wri.org/events/2017/12/conflict-and-natural-resource-management (Conflict and Resource management)

e. https://www.power-technology.com/features/what-is-geothermal-energy/ (Geo-thermal Energy)

f. ISC Geography Textbook for Class XI by D.R. Khullar

Strand 3: People and the Environment

Theme 6: Energy Resources and Industries (Agriculture and industries)

Industrial development unleashes or opens up dynamic and competitive economic performance which generates income and employment, facilitates international trade and increases resource efficiency, therefore is a major driver of poverty alleviation and shared prosperity.

Although industrialization contributes to the universal objective of economic growth, its impact differs depending on the country's stage of development. In developed economies, industrial growth is reflected in achieving higher productivity, embracing new technologies, intelligent production processes and reducing the effects of industrial production on the environment and climate.

8.1 Competency

Assess different sources of information and data to plan for socio-economic development.

8.2 Objectives

a. Trace the development of agriculture in Bhutan.
b. Explain features of agriculture.
c. Examine the scope of agriculture in Bhutan.
d. Discuss the history of industrial development.
e. Explain types of manufacturing industries.
f. Discuss the development of the tourism industry in Bhutan.
g. Explain the factors affecting tourism.

8.3 Learning Experiences

Suggestive strategies: Critical thinking, Problem-solving, Case Study, Inquiry, Cooperative Learning, Project-based, Task based learning, Field trip and any other relevant strategies.

a. Refer the link or any other relevant resources https://www.researchgate.net/publication/324012576_Agricultural_Transformation_in_Bhutan_From_Peasants_to_Entrepreneurial_Farm

   Students in pairs, suggest and explain the development of Agriculture in Bhutan. Visit a nearby village and ask the farmers regarding agricultural practices in the past and present. Prepare a chart presentation and present to the class.

b. Use the link or other relevant resources http://drukjournal.bt/agricultural-sustainability-in-bhutan-a-perspective/

Students in groups, examine the challenges, limitations and scopes of agriculture in Bhutan. Prepare a MS power point presentation and present to the class.

c. Using the link or other relevant resources
https://www.britannica.com/event/Industrial-Revolution

Students evaluate the history of Industrial Development. In pairs, explain the history of industrial development. Referring to internet or other relevant resources, explain the history of industrial development in Bhutan. Present your findings to the class.

d. List the types of manufacturing industries (such as cottage based industries, mineral based industries, forest based industries, pharmaceutical industry, agro-based industries, metallurgical based industries, automobile based industries and technological based industries). In groups, students discuss and explain the types of manufacturing industries.

e. Using the link or any other relevant resources
https://www.worlddata.info/asia/bhutan/tourism.php

In pairs, students discuss and write the reasons for the increasing number of tourists in Bhutan from 1995-2019. Referring to the reasons, students analyse and explain the development of the tourism industry in Bhutan.

f. In groups, discuss tourism industry in Bhutan. Within each group, students contribute their thoughts and ideas. Explain the factors affecting tourism (such as technology, historical or cultural importance, economy, environment, research and religious importance) using relevant resources.

8.4 Assessment

Assessment tools such as self-assessment, anecdotal record, oral presentation, question answer, rating scale, quiz, PowerPoint presentation, class task, peer assessment, rubrics, or any other relevant tools to assess students' task may be used.

8.5 Resources

a. https://www.youtube.com/watch?v=rVAfXiksBKU (2020)

b. https://www.youtube.com/watch?v=NCp93xbSwWM

c. https://www.youtube.com/watch?v=5lctRvTpb_Y

d. https://www.britannica.com/event/Industrial-Revolution

e. https://www.youtube.com/watch?v=Zzd8cMmoAdQ

f. https://bizfluent.com/about-5643539-types-manufacturing-industries.html (notes)

g. https://ncert.nic.in/textbook/pdf/legy208.pdf (pdf notes)

h. https://www.youtube.com/watch?v=a2uMKG7ETyQ

i.https://www.researchgate.net/publication/342150793_Development_of_the_Sustainable_Tourism_in_Bhutan_A_Sectoral_Study_Based_on_Pros-and-cons_Analysis – Dec 2019

j. https://www.thlib.org/static/reprints/jbs/JBS_03_01_03.pdf

k. https://www.tandfonline.com/doi/pdf/10.1080/15693430701365420 – by Chhewang Rinzin , Walter J. V. Vermeulen & Pieter Glasbergen

l. https://www.tourism.gov.bt/about-us/tourism-policy

Strand 3: People and the Environment

Theme 7: Population and Spatial Diversity

Population growth has proceeded at an unprecedented rate, with the world's population currently totaling seven billion people. The public health impact of this growth has been tremendous, and the implications for the future are equally daunting. Trends in fertility and mortality rates offer insight into the health and development challenges posed by population growth, and the possible demographic scenarios of the future.

9.1 Competency

Explore the similarities and differences between places and regions to understand spatial diversity.

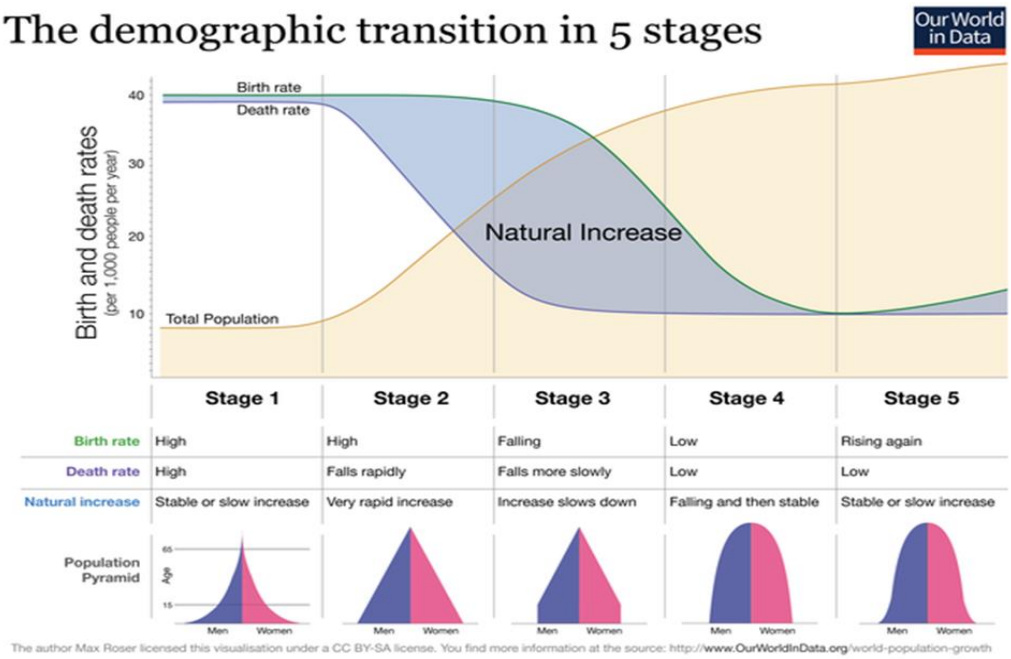
9.2. Objectives

i. Analyse the significance of conducting population census.
ii. Explore sources of population data.
iii. Examine the spatial distribution of population.
iv. Discuss population dynamics.
v. Explain the trends of population.
vi. Draw a population pyramid using a given population data and interpret it.

9.3 Learning Experiences

Experiential learning, Team based learning, Task Based learning, Geo-inquiry process, Statistical Learning, Library research, Brainstorming are suggestive pedagogical approaches and may use any relevant pedagogy in teaching learning processes.

a. In groups, explore the significance of conducting population census and prepare a PowerPoint presentation. Share the findings to the class.
b. Explore the challenges in carrying out population and housing census in a country. You may like to focus on PHCB. Share your findings.
c. Refer Population and Housing Census of Bhutan 2017 and prepare a choropleth map manually or using QGIS based on the total population of each dzongkhag to show the spatial distribution of population in the county.
d. Refer the data in PHCB 2017 on total population, female and male for 20 dzongkhags. Using QGIS, prepare a population distribution map and overlay bar graph layer to show female and male population in each dzongkhag.
e. Use the link https://www.bbc.co.uk/bitesize/guides/zpgjk2p/revision/2 or any other relevant resources, explain the demographic transition model. Prepare PowerPoint presentations and share the findings to the class.



e. Conduct a survey on the number of students and staff in your school and draw a population pyramid. Using the pyramid, explain its trends and spatial distribution.

f. Accessing the link https://www.jkgeography.com/population-pyramids.html, discuss expansive, constrictive and stationary population pyramids. Prepare notes.

9.4 Assessment

Assessment tools such as rubrics, peer assessment, checklist, oral presentation, rating scale, anecdotal record, quiz, question-answer, muddiest point, classwork/homework or any other relevant tools may be used to assess students' tasks.

9.5 Resources

a. https://www.youtube.com/watch?v=XFpM5e_6rtM (Population dynamics)
b. https://www.youtube.com/watch?v=c8Z8aWCkFsk (Census)
c. https://www.youtube.com/watch?v=Cx7KFyasW6A (Population pyramid)
d. https://www.youtube.com/watch?v=RLmKfXwWQtE (Population pyramid)
e. https://www.un.org/development/desa/pd/themes/population-trends
(Population Trends, data and facts, publications, events

Strand 3: People and the Environment

Theme 7: Population and Spatial Diversity (Urbanisation)

In 2009 the United Nation reported that half of the world's human population lived in cities and was expected to grow to 66% by 2050. The movement of people from dispersed living to concentration in urban environments is a large change both for human civilization and for the environment.

Urbanization is the process of changing from natural habitats to dense grey space made up primarily of buildings, roads, and accessory infrastructure (e.g. street lights, underground sewage pipes, power lines, etc) accompanied by dense human populations.

10.1 Competency

Examine the evolution of settlements to understand the significance of it.

10.2 Objectives

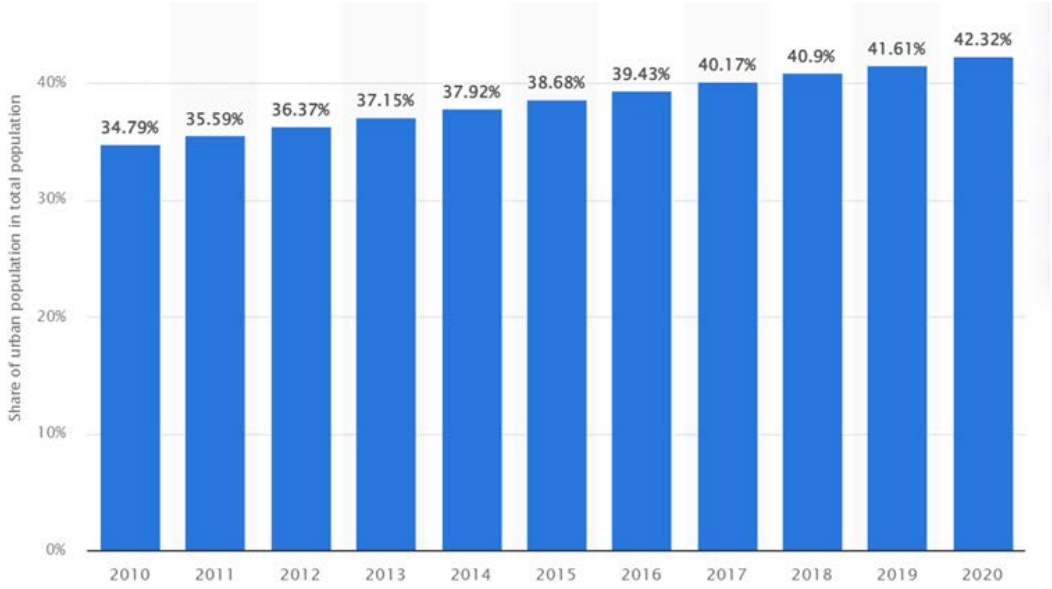
a. Discuss urbanisation.
b. Analyse the causes of urbanisation.
c. Discuss models of urban centres.
d. Classify urban centres.

10.3 Learning Experiences

Suggestive strategies: Critical thinking, Problem-solving, Case Study, Inquiry, Cooperative Learning, Project-based, Task based learning, Field trip and any other relevant strategies.

a. Using the link, https://www.youtube.com/watch?v=TDfHjfzeVYo, list the issues related to urbanisation. Suggest measures to tackle the problems of urbanisation.

b. Students study the figure and participate in debate on – 'The rate of urbanisation has increased in the past ten years in Bhutan. Is this urbanisation trend good or bad for our country?'



Source: World Bank 2020

https://www.owen.k12.ky.us/userfiles/257/Classes/17727/APHGModelsofUrbanStructure.pdf

c. Referring to the link, students discuss models of Urban Centres (Concentric zone theory, Sector model and Multiple Nuclei Model). In teams, develop models using locally available materials. Display the models.

d. Watch the video https://youtube/D9R5xSv7gZY or watch any other related clips from YouTube or internet and discuss the process of formation of urban agglomeration and conurbation.

Types of Urban Area	**Population Size**	**Major Function**
Gyalyong Thromde (National/ Regional City)	More than 10,000	National/Regional economic drivers
Dzongkhag Thromde (Dzongkhag Centres)	5,000 to 9,999	Dzongkhag Administration/Service centre
Yenlag Throm (Medium Towns)	1,500 to 4,999	Service centre for nodes
Geog Throm (Small Towns or Geog Centres)	100 to 1,499	RNR service, market, Geog centre (IGC)

e. Study the table on hierarchy of national urban system of Bhutan and referring the link; http://www.metrovancouver.org/services/regional-planning/livable-urban-centres/types-of-urban-centres/Pages/default.aspx

   Students compare and contrast the hierarchy of national urban system of Bhutan with that of the U.S.A.

10.4 Assessment

Assessment tools such as rubrics, peer assessment, checklist, oral presentation, rating scale, anecdotal record, quiz, question-answer, muddiest point, classwork/homework or any other relevant tools may be used to assess students' tasks.

10.5 Resources

a. https://www.youtube.com/watch?v=8Ge_0eJljrQ (Urban centres)

b. https://www.youtube.com/watch?v=EjMarOuFAps (Video on models of urban centres)

c. https://planningtank.com/settlement-geography/sector-model-hoyt-model (sector model)

d. https://www.aboutcivil.org/concentric-zone-model-theory (Burgess Model)

Instructional Hours and Weighting Based on Competency

Sl No.	Strand	Competencies	Weighting (%)	Instructional time (minutes)	Remarks
1	**Time and Space**	Assess the origin of the universe to understand the religious and hypothetical description of astronomy.	6%	432	
		Apply the knowledge and skills of geospatial technologies to analyse national and global issues.	15%	1080	Practical component
		Demonstrate cartographic skills to analyse geographical information.	15%	1080	Practical component
2.	**Physical Environment**	Explore climatological elements and human activities to understand climate dynamics.	9%	648	
		Apply the knowledge of soil science to explain the biological, physical and chemical properties.	8%	576	
		Analyse the geomorphological processes to deduce the significance of land features.	7%	504	
3.	**People and the Environment**	Assess different sources of information and data to plan for socio-economic development.	9%	648	
		Assess the significance of natural resources to conserve the ecosystem for sustainable use.	10%	720	
		Explore the similarities and differences between places and regions to understand spatial diversity.	11%	792	
		Examine the evolution of settlements to understand the significance of it.	10%	720	
	Total (144 Instructional Days)		100	7200 min (120 hours)	

Rubric for map work

Map / Score	4	3	2	1
Neatness of colour and lines	90 to 100% of the label/features can be read easily	80 to 89% of the labels/features can be read easily	70 to 79% of the labels/features can be read easily	Less than 70% of the labels/features can be read easily
Map Legends/key	Legends are labelled and contains complete set of symbols including compass	Legends contains complete set of symbols including compass	Legends lacks several symbols	It lacks all symbols
Scale	All features on the map are drawn to scale and the scale used is clearly indicated on the map	Most features on the map are drawn to scale and the scale used is clearly indicated on the map	Few features of the map are drawn to scale or the scale used on the map	There is no scale
Title	Title tells the content of the map, it is distinguishable as the title (e.g larger letters, underlines and etc) and it is printed on the top of the map	Title is located on top of the map stating the content or the purpose of the map	Title tells the contents/purpose of the map but it is not located on the top	There is no title

Practical work for CLASS XI

Sl. No	Topics	Number(s) to be conducted	Weighting
1.	Map Projection a. Cylindrical Equal Area Projection	1	3
	b. Conical Projection with One Standard Parallel	1	3
	c. Polar Zenithal Equidistant Projection)	1	3
2.	Drawing of Plain/Graphical Scale Conversion of R.F into S.S and vice versa	1	6
3.	Interpretation of Topographical map a. Representing marginal, natural and human-made features	1	5
4.	GIS and Remote Sensing a. Dzongkhag wise settlement map b. Dzongkhag wise agriculture map	2	10
	Total	**7**	**30%**

Note: Competency 2.1 and 3.1 are practical components.

Questions patterns (Terminal Examinations)

Part I – Compulsory (50 marks)

1. Multiple Choice 15 marks
2. Completion 5 marks
3. Alternative response 5 marks
4. Matching items 5 marks
5. Short answer question 10 marks
6. Map Work (Bhutan) 10 marks

Part II (50 marks)

There will be six questions each carrying 10 marks, candidate must choose only five questions.

Oral Presentation Rubric

CATEGORY	4	3	2	1
Preparedness	Student is thoroughly prepared and has obviously rehearsed.	Student seems pretty prepared but might need a couple more rehearsals.	Student somewhat prepared, but it is clear that rehearsal was lacking.	Student does not seem at all prepared to present.
Speaks clearly	Speaks clearly and distinctly (100-95%) the time, and mispronounces no words.	Speaks clearly and distinctly all (100-95%) the time, but mispronounces one word.	Speaks clearly and distinctly most (94-85%) of the time. Mispronounces more than one word.	Often mumbles or cannot be understood OR mispronounces more than two words.
Content	Shows full understanding of the topic.	Shows a good understanding of the topic.	Shows a good understanding of parts of the topic.	Does not seem to understand the topic very well.
Stays on Topic	Stays on topic all (100%) of the time.	Stays on topic most (99-90%) of the time.	Stays on topic some (89% -75%) of the time.	It was hard to tell what the topic was.
Comprehension	Student is able to accurately answer almost all questions posed by visiting examiner about the topic.	Student is able to accurately answer most of the questions posed by visiting examiner about the topic.	Student is able to accurately answer a few questions posed by visiting examiner about the topic.	Student is unable to accurately answer questions posed by Visiting examiner about the topic.

Research Project Work

CATEGORY	4	3	2	1
Organization	Information is very organized with well-constructed paragraphs and subheadings.	Information is organized with well-constructed paragraphs.	Information is organized, but paragraphs are not well-constructed.	The information appears to be disorganized.
Quality of information	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
Graphic organizer	Graphic organizer or outline has been completed and shows clear, logical relationships between all topics and subtopics.	Graphic organizer or outline has been completed and shows clear, logical relationships between most topics and subtopics.	Graphic organizer or outline has been started and includes some topics and subtopics.	Graphic organizer or outline has not been attempted.
Diagrams & Illustrations	Diagrams and illustrations are neat, accurate and add to the reader\'s understanding of the topic.	Diagrams and illustrations are accurate and add to the reader\'s understanding of the topic.	Diagrams and illustrations are neat and accurate and sometimes add to the reader\'s understanding of the topic.	Diagrams and illustrations are not accurate OR do not add to the reader\'s understanding of the topic.
Sources	All sources (information and graphics) are accurately documented in the desired format.	All sources (information and graphics) are accurately documented, but a few are not in the desired format.	All sources (information and graphics) are accurately documented, but many are not in the desired format.	Some sources are not accurately documented.

National School Curriculum

INSTRUCTIONAL GUIDE FOR GEOGRAPHY

Class XII

Strand 1: Time and Space

Theme 1: The Origin and Evolution of the Universe

The Universe originated around 13.7 billion years ago. It is the whole of space that has matter and energy in it. Scientific and spiritual perspectives help to clarify the origin of the Universe. Several scientific theories like the Big Bang and Solar Nebula have attempted to explain the origin of the Universe more appropriately than others. The Milky Way is one of the billions of galaxies in the observable universe. The Sun is one among hundreds of billions of stars in the Milky Way galaxy, and most of those stars have their own planets that revolve around them.

1.1 Competency

Examine the origin of the universe to understand the scientific account of astronomy.

1.2 Learning Objectives

a. Explain the origin of the universe with reference to gaseous mass hypothesis and electromagnetic theory.

b. Relative these theories with Buddhist perspectives to draw parallels.

1.3 Learning Experiences

Strategies such as Inquiry based learning, Guest Speaker, Simulation, Interconnectedness, Debate, Q & A session, Group Discussion, Peer learning, PowerPoint presentation are suggestive.

a. Using the link or any other relevant resources

   https://prezi.com/m8ml36ztip4y/gaseous-mass-theory-of kant/

   OR

   https://www.shaktiiasacademy.com/blog/gaseous-hypothesis-of-kant

   Recapitulate various theories of the origin of the universe by asking questions. In groups, explore and write a brief summary of Gaseous Mass Hypothesis.

b. Compare and contrast Solar Nebula Theory with Gaseous Mass Hypothesis. Prepare a PowerPoint presentation and present to the class.

c. Watching the video: https://youtu.be/dFjYjbQ86A, students discuss the relation between temperature of the primordial matter and rate of collision.

d. Describe the role of given components in the development of the gaseous mass theory.

a. Primordial Matter	b. The rise in the temperature	c. Motion of the particles	d. Gravity	e. Time period

e. Use the link or any other relevant resources

Watch the video: https://www.youtube.com/watch?v=9FCYGbOWk4w and discuss electromagnetism and prepare notes.

Reflective Question

i. What theory challenges the nebular hypothesis to explain the solar system formation and evolution?

1.4 Assessment

Use assessment tools such as rubrics, checklist, rating scale, anecdotal record, quiz, question- answer, muddiest point, peer assessment, self-assessment, class task or any other relevant tools to assess students' task.

1.5 Resources

a. https://www.scielo.br/pdf/ea/v20n58/en_20.pdf (Origin of the Universe by Joao E Steiner)

b. https://www.youtube.com/watch?v=d_FjYjbQ86A (Gaseous hypothesis of Kant)

c. https://prezi.com/m8ml36ztip4y/gaseous-mass-theory-of kant/(Gaseous Mass Hypothesis)

d. https://www.shaktiiasacademy.com/blog/gaseous-hypothesis-of-kant

e. https://www.youtube.com/watch?v=9FCYGbOWk4w (Electromagnetic Theory)

f. https://www.slideshare.net/ahyes18/theories-explaining-the-origin-of-the-universe (Theories explaining the origin of the universe)

Strand 1: Time and Space

Theme 2: Geospatial Technology and Resource Management

Geospatial technologies is a term used to describe the range of modern tools contributing to the geographic mapping and analysis of the Earth and human societies. These technologies have been evolving in some form since the first maps were drawn in prehistoric times. In the 19th century, the long important schools of cartography and mapmaking were joined by aerial photography as early cameras were sent aloft on balloons and pigeons, and then on airplanes during the 20th century.

2.1 Competency

Apply the knowledge and skills of geospatial technologies to analyse the global issues.

2.2 Learning Objectives

a. Describe Global Positioning System (GPS) and its importance.
b. Discuss Remote Sensing and its application.
c. Discuss Geographic Information System (GIS) and its application.
d. Demonstrate the use of GIS software for spatial and non-spatial data.

2.3 Learning Experiences

Desktop based Map generation, Web based map generation, Data interpretation, Observation of important dates (World GIS Day) Exploration, Demonstration, Simulations are suggestive learning experiences.

a. Using the links
https://ethw.org/Global_Positioning_System?gclid=EAIaIQobChMIxYrtuMKj7wIV7sEWBR33jA8AEAAYASAAEgI_F_D_BwE

OR

https://www.gps.gov/systems/gps/

Students explore and discuss the Global Positioning System (GPS). In pairs, students explain the three segments of GPS (space segment, user segment and control segment).

Students explain the importance of Global Positioning Systems (such as land navigation, sea navigation, air navigation, communication system and automatic vehicle location).

Download *GPS Location application and Google map* using smartphone, find the location of team X using coordinates sent by the team Y.

b. Using the web link or any other relevant resources

https://www.planetek.it/eng/training_courses/online_manuals/on_line_course_of_remote_sensing/2_the_history_of_remote_sensing students in groups frame timeline on the history of remote sensing. Share the findings to the class.

c. Using the link or any other relevant resources

https://tudip.com/blog-post/what-is-remote-sensing-and-its-applications/#:~:text=Remote%20sensing%20technology%20is%20used,keep%20track%20of%20the%20drought

Students comprehend types of remote sensing (active and passive sensor). In groups, list and explain the different applications of remote sensing.

d. Access the link https://earthengine.google.com/timelapse/ and complete the activity.

Steps:

i. Click on the link and type 'Jomolhari, Bhutan' in the search button.

ii. Let the timelapse play completely and gather a general idea of the changes that occurred each year.

iii. Click on the pause button for 1991, 2005 and 2020.

1. What are the environmental changes that are observed in 1990, 2005 and 2020?
2. Discuss the reasons for these changes.

e. Accessing the link or any other relevant resources

https://www.esri.com/en-us/what-is-gis/history-of-gis OR

https://www.bcs.org/content-hub/the-history-of-geographic-information-systems-gis/ OR

https://volaya.github.io/gis-book/en/History.html

Students frame a timeline on the history of the Geographic Information System. Develop poster and display.

f. Using the link or any other relevant resources

https://grindgis.com/blog/components-of-gis OR

https://gis.usc.edu/blog/gis-applications/ OR

https://www.slideshare.net/pramodgpramod/applications-of-gis-76693631

Students discuss and write different components of GIS. In groups, students list and explain different applications of GIS.

g. Referring the link or any other relevant resources

https://www.slideshare.net/SumantDiwakar/spatial-vs-non-spatial

Students deduce the differences between spatial and non-spatial data. In pairs, explain the differences.

h. Using the link https://www.g2.com/categories/gis, download online GIS software or accessing ArcGIS/QGIS/Maptitude software, teacher demonstrates how to use remote sensing data for map interpretation. Provide students with various raster and vector data to generate maps. https://www.youtube.com/watch?v=NHolzMgaqwE (QGIS tutorial)

Teacher uses the link to access QGIS software for teaching and learning purposes.

i. Using the data on percentage of Rural-Urban Migrants, develop a QGIS map following the instructions. Make sure to save Dzongkhag shapefile in the computer.

i. Double click on Dzongkhag layer

ii. Right click and open attribute table

iii. Click on Toggle Editing Mode (Ctrl+E)

iv. Click on New Field (Ctrl+W) and fill Name as 'Migrant', Type as 'Decimal number (real)', Length '5', Precision '1' and Click OK

v. Add data for 20 Dzongkhags

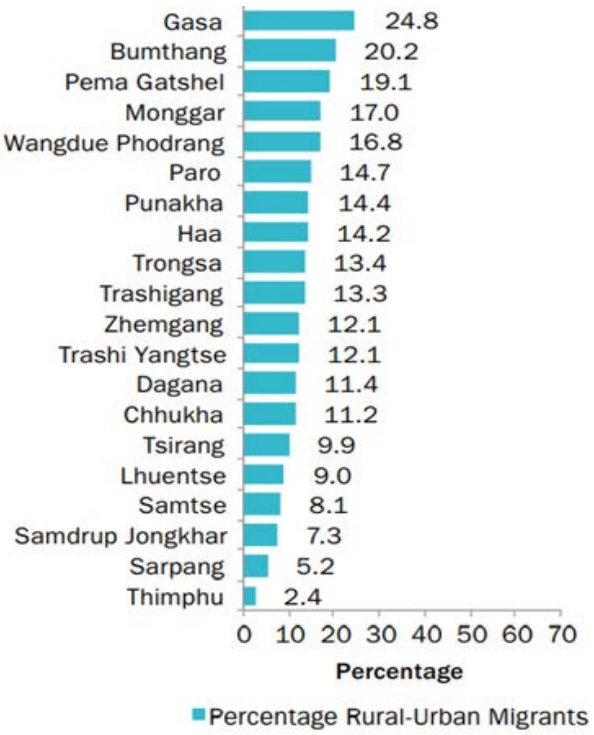
vi. Click on Save edits (Ctrl+S) and Click on Toggle Editing Mode to stop editing

vii. Click on Classify

viii. Click OK

ix. Double click Dzongkhag layer

x. Click on Symbology



xi. Change to Graduated

xii. Change value to Migrants

xiii. Change colour ramp (as you wish but DO NOT choose Random Colour)

xiv. Make classes into 3

xv. Click on Classify

xvi. Click OK

Reflective questions

i. Which are the leading problems for the invention of GIS and remote sensing?

ii. Explain, how GIS is used in remote sensing?

2.4 Assessment

Assessment tools such as oral presentation, test, practical work, powerpoint presentation, question-answer, rating scale, quiz, self-assessment, anecdotal record, class task, peer assessment, rubrics or any other relevant tools.

2.5 Resources

- https://www.nh.gov/nhdfl/documents/introduction-to-global-positioning-system.pdf (Theoretical Notes)
- https://www.nateko.lu.se/sites/nateko.lu.se.sv/files/remote_sensing_and_gis_20111212.pdf (Theoretical Notes)
- https://www.youtube.com/watch?v=bjwTjVQnAfo (What is GIS)
- https://www.youtube.com/watch?v=wCcARVbL_Dk (How GPS works today)
- https://www.youtube.com/watch?v=pM6XwiueIUw (What is remote sensing and how it is used)
- https://www.youtube.com/watch?v=mFMpkJ9prLw (GPS, Remote Sensing, GIS)
- https://www.safe.com/what-is/spatial-data/ (What is spatial data?)
- https://www.slideshare.net/SumantDiwakar/spatial-vs-non-spatial (Spatial vs Non-spatial)
- https://www.quora.com/What-are-the-differences-between-spatial-and-non-spatial-data (Differences between spatial and nonspatial data)
- https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/gps/howitworks/(GPS notes)
- https://www.youtube.com/watch?v=U3eX6QKS9kY (GPS video)
- https://www.geospatialworld.net/article/role-of-gps-in-navigation-fleet-management-and-other-location-based-services/ (Uses of GPS)

Strand 1: Time and Space

Theme 3: Map Reading and Interpretation

A map is a portion or part of the features of the earth's surface drawn to scale on a plane surface such as paper, card, plastic, cloth or some other material. Or a map is a representation on any plane surface of the features of part or portion of the earth's surface drawn to scale.

3.1 Competency

Apply surveying techniques with available equipment and technology to plan the development of a place.

3.2 Learning Objectives

a. Explain cartography and its uses.
b. Discuss surveying.
c. Describe instruments for plane table survey.
d. Explain precautions for conducting plane table survey.
e. Conduct plane table survey.
f. Discuss the use of Total Station.

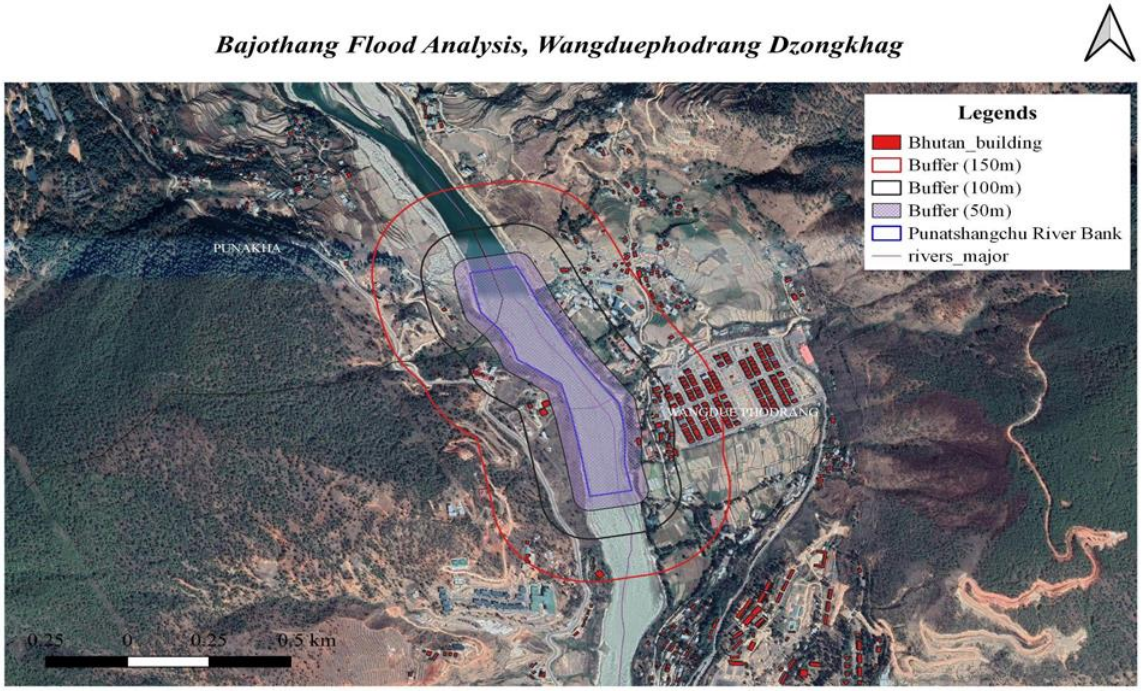
3.3 Learning Experiences

Suggestive strategies: Independent work, Self-Regulation, Field trip, Demonstration, Q & A session, experiential learning are suggestive strategies and may use any other relevant teaching learning strategies.

a. Use the links or other relevant resources:
    - http://www.ngi.gov.za/index.php/technical information/catography/what-is-cartography
    - https://www.youtube.com/watch?v=pBAtrN0vOm0
    - https://unearthlabs.com/blog/modern-cartography/#:~:text=A%20confluence%20between%20practice%2C%20science,behind%20maps%20and%20map%20making.&text=Cartography%20helps%20us%20understand%20our,effect%20on%20our%20daily%20lives.

    Students in pairs, infer the concept of cartography. Probe questions on various map projections (Cylindrical Equal Area Projection, Conical Projection with One Standard Parallel and Polar Zenithal Equidistant Projection). In groups,

students analyse and write the uses of traditional cartography and modern cartography.



b. Interpret Google Earth map using essential skills of cartography.

1. In teams, students analyse the image on the basis of Land Use Land Cover including vegetation, farming and water bodies. Prepare notes and present them to the class.

2. Discuss and prepare flood mitigation plans for floods measuring 50m and 150m.

c. Use the link or other relevant resources
https://www.britannica.com/technology/surveying

In pairs, students discuss and explain the concept, types and history of surveying.

Accessing the link or any other relevant resources

https://theconstructor.org/surveying/plane-table-survey-equipments/6474/

Students describe various instruments for plane table survey.

f. Referring the link or any other relevant resources

http://oer.nios.ac.in/wiki/index.php/How_to_use_the_Plane_table

http://surveyingestimating.blogspot.com/2018/09/errors-and-precautions-for-plane-table.html

Students learn the process, error and precautions in conducting plane table survey. Teacher demonstrates in conducting plane table survey using radiation and intersection method. Students carry out the survey.

g. Use the link https://www.alleninstruments.com/what-is-a-total-station/

In groups, students evaluate and describe the uses of total stations. Students explain the differences in conducting plane table survey with total station. Teacher provides necessary feedback.

Reflective Questions

1. Analyse the pros and cons of conducting survey using traditional instruments.
2. What are the opportunities and challenges of using modern survey instruments?

3.4 Assessment

Assessment tools such as oral presentation, test, practical work, PowerPoint presentation, question-answer, rating scale, quiz, self-assessment, anecdotal record, class task, peer assessment, rubrics or any other relevant tools.

3.5 Resources

a. https://www.shutterstock.com/search/WHAT+IS+CARTOGRAPHY (Only images)
b. https://study.com/academy/lesson/what-is-cartography-definition-history.html (overall view of Cartography)
c. https://www.esri.com/videos/watch?videoid=wsidXGshNgA (What is cartography?)
d. https://www.youtube.com/watch?v=HE6Q5Q6wYX4 (Cartographer)
e. https://www.etsu.edu/cbat/applieddesign/surveying.php (Survey and mapping)
f. https://www.google.com/search?q=surveying+instruments&tbm=isch&source=lnms&sa=X&ved=0ahUKEwijjp3Vr5PvAhXkIbcAHaHABSAQ_AUICygB&biw=1440&bih=850&dpr=1.5 (Surveying instruments)
g. https://civilseek.com/plane-table-surveying/ (Plane Table Surveying)
h. https://www.youtube.com/watch?v=5wLPX7HhrXg (Intro to Total Station)

Strand 2: Physical Environment

Theme 4: Land Formation Processes

Rocks are generally divided into three major types based on the process of their formation. These are; igneous rocks, sedimentary rocks and metamorphic rocks. Igneous rocks are formed by the solidification and cooling of magma in volcanic areas, while sedimentary rocks are formed by low temperature accumulation of sediments in tectonic basins and topographical sinks. Metamorphic rocks on the other hand are formed by application of temperature and pressure on pre-existing rocks.

Each of these three rock types are further classified in terms of; chemistry, the form and environment of formation. The distributions of these major rock types are critical in regional mapping of natural resources. Igneous is coined from word "ignis" meaning fire and therefore these rocks are good indicators of volcanism and are therefore associated with geothermal resources and hydrothermal deposits like porphyry copper, and gold etc. Sedimentary rocks especially the organic sediments on the other hand are good source of rocks and are associated with resources like coal and oil. Sediments are also good proxies for environmental reconstruction, since fossils can be well preserved in these deposits. Metamorphic environments are associated with Gemstones and alteration minerals which form good index minerals as geobarometers and geothermometry.

4.1 Competency

Apply geological knowledge on physical characteristics of rocks to understand its formation.

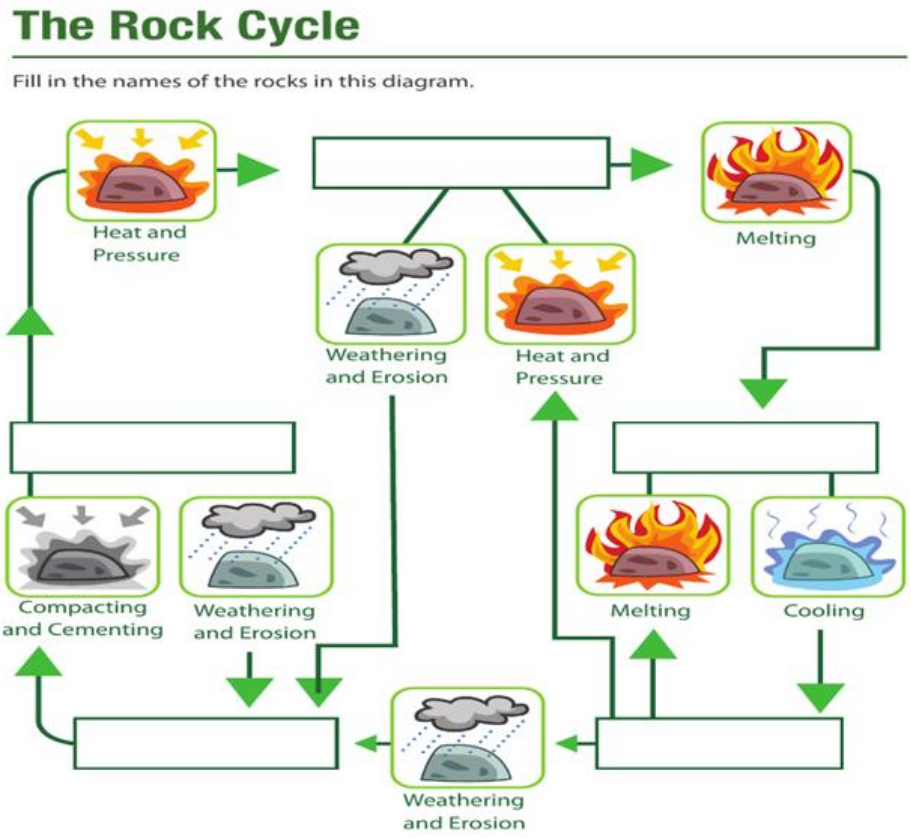
4.2 Learning Objectives

a. Explain rock cycle.
b. Classify rocks.
c. Discuss the scope of studying rocks.

4.3 Learning Experiences

Field trip, Observation, Sampling, Simulation, Geo-inquiry process, Q & A session, interviewing process, resource based learning or relevant strategies for teaching learning process.

a. Probe questions on types of rocks (Igneous, Sedimentary and Metamorphic rocks). In groups, students discuss and write characteristics, mode of formation, importance and examples of types of rocks on chart paper. Students display their work and do the presentation.
b. Students refer to relevant textbook or internet sources and complete the worksheet. In pairs, explain and write the different processes of the rock cycle. Teacher supplements and provides necessary feedback.



c. Students collect a few rock samples that are available in their locality. Using rock and mineral identifier apps, classify the rock sample into different types and list the characteristics. Share the findings to the class.
d. Browse relevant video source/article/write up and compare the different rock classifications. Prepare a PowerPoint presentation and present to the class.
    a. Plutonic and hypabyssal
    b. Arenaceous and argillaceous
    c. Calcareous and carbonaceous
    d. Dynamic and thermal metamorphism
    e. Regional and contact metamorphism

Reflective Questions

i. What occurs when wind or moving water causes to rocks and soil to be relocated?
ii. How do humans affect the rock cycle?

4.4 Assessment

Assessment tools such as oral presentation, rubrics, test, peer assessment, anecdotal record, quiz, class task, PowerPoint presentation, question- answer or any other relevant tools for assessing students' task.

4.5 Resources

a. https://www.createwebquest.com/types-rocks-rock-cycle (Types of rock cycle)
b. https://www.youtube.com/watch?v=Df23YAZna60 (Classification of rocks)
c. https://ocw.nagoya-u.jp/files/526/humblet_L5.pdf (why study rocks)
d. Why Study Rocks – Teacher Noteshttp://www.wasp.edu.au › mod resource › content (Why study rocks - teacher notes)

Strand 2: Physical Environment

Theme 4: Land Formation Processes (Soil Properties and Soil Conservation)

Soil is a mixture of minerals, organic matter, liquids, gases, small organisms that altogether support life. It is the upper layer of the earth's surface composed of a mixture of organic remains, clay, and rock materials on which plants grow. It supports plant life and growth. It continually undergoes development by numerous physical, chemical, and biological processes, which include weathering and erosion.

Soil conservation is the process of prevention of loss of the topmost layer of the soil from erosion or prevention of reduced fertility caused by over usage, acidification, salinization, or other chemical soil contamination. By conserving soil. we can preserve the fertility of the soil.

5.1 Competency

Apply the knowledge of properties of soil to understand the biological, physical and chemical composition.

5.2 Learning Objectives

a. Discuss the major classification of soil in the world.
b. Explore the importance of soil.
c. Discuss causes of soil degradation.
d. Suggest measures of soil conservation.

5.3 Learning Experiences

Scaffolding, Peer learning, Simulation, Resource based learning, Q & A session, Field trip, Brainstorming, Critique session, Integrated projects, Use of Google Earth (Categorising soil types) or other relevant strategies for teaching learning process.

a. Study the link https://www.youtube.com/watch?v=BArbrfmsxeQ Check prior knowledge of the students by asking questions on soil. In groups, classify soils based on chemical and physical properties. Prepare a presentation using charts and present it to the class.

b. https://www.falmouthme.org/environmental-initiatives/pages/the-importance-of-soil#:~:text=Healthy%20soils%20are%20essential%20for,of%20the%20world's%20forests%20combined. Refer to the link or other relevant resources to understand the importance of soil. Students in teams examine the acidity and alkalinity of the soil in the school compound using the soil testing kit. Students share their findings with the class.

c. Use the link https://blog.agrivi.com/post/soil-degradation or other relevant resources to explain the causes of soil degradation.

d. Refer the link https://eos.com/blog/soil-conservation/ or other relevant resources to discuss the measures of soil conservation.

5.4 Assessment

Assessment tools such as rubrics, test, anecdotal record, quiz, question- answer or any other relevant tools for assessing students' task.

5.5 Resources

a. https://www.youtube.com/watch?v=2KooBOLMUqU (How to identify soil types)
b. https://www.youtube.com/watch?v=Ng7kza18K48 (Soil classification system)
c. https://www.youtube.com/results?search_query=importance+of+soil (Why is soil important)
d. https://www.youtube.com/watch?v=hc-3J0MmMbg (Soil Degradation)
e. https://www.youtube.com/watch?v=UchhAA9mCa0 (Human causes and effects of land degradation)
f. https://www.youtube.com/watch?v=y2BXkl5vDi8 (Methods of soil conservation)

Strand 2: Physical Environment

Theme 4: Land Formation Processes

The geomorphic processes of weathering, erosion and deposition create a large variety of landscapes and landforms. The processes that form different landscapes and create their unique landforms are largely determined by climate and geology. In the future climate change could influence the geomorphic processes forming and transforming landscapes by changing river flow, melting glaciers and increasing extreme weather events. An understanding of the geomorphic processes that shape landscapes and landform help us to visualise how places looked in the past and predict how they may look in the future.

6.1. Competency

Analyse the geomorphic processes to extrapolate the significance of land features.

6.2 Learning Objectives

a. Classify glaciers.
b. Discuss glaciers as agents of gradation.
c. Explain the third pole in the context of glaciers and global warming.
d. Discuss fluvial processes and associated landforms.
e. Discuss cycle of erosion.

6.3 Learning Experiences

Cooperative Learning, PowerPoint presentation and lecture method, resource-based learning, Mini-library research, Brainstorming exercise, Google Earth Engine (Time Lapse), Peer learning, Inquiry based learning, Questioning, KWL chart, Learning by doing, Games or relevant strategies for teaching learning process.

a. Use the link https://openpress.usask.ca/physicalgeology/chapter/17-1-types-of-glaciers/ or other relevant resources to explain the types of glaciers.

b. Using the link or any other relevant resources https://www.youtube.com/watch?v=jwPnAJHAVOA Students explain how glaciers act as an agent of gradation. Browsing internet, textbook and other relevant resources, students in groups, discuss and explain:
   i. Glacier erosion and related features (scraping and plucking)
   ii. Glacier deposition and related features (glacial drift, till, glacial fluvial sediments, snout, terminal moraine, recessional moraine, ground moraine and drumlins)
   iii. Alpine glaciers and related landforms (cirque, cirque glacier, valley glacier, lateral moraine and medial moraine)

iv. Alpine glacier and erosional landforms (tarns, horn, glacial trough, hanging valleys and fjords)

c. Bhutan has more than 2600 high altitude glacial lakes, out of which some lakes pose a risk of Glacial Lake Outburst Floods (GLOFs). Using google earth, students explore major high risk glacial lakes and suggest mitigation measures down streams.

d. Using the link https://www.thethirdpole.net/en/about/

Students explore the reasons why Hindu Kush Himalayan region and Tibetan plateau is referred to as the Third Pole of the World. Students brainstorm and write how the Third Pole contributes to the development of economy and livelihood in Bhutan, India, Pakistan, Nepal, Bangladesh and China.

e. Referring the article from the web link

https://www.theguardian.com/environment/2019/sep/15/tibetan-plateau-glacier-melt-ipcc-report-third-pole

Students explore the consequences of global warming on the Third Pole. In groups, students discuss and suggest relevant measures to protect the Third Pole from global warming.

f. Using Google Earth application, students identify a river basin from Bhutan and India showing three fluvial processes (erosion, transportation and deposition). In pairs, deliberate and write the landforms created by rivers in Bhutan and India. Explain each landform of two different countries categorising into erosion, transportation and depositional landforms.

g. Refer the link

http://studymaterial.unipune.ac.in:8080/jspui/bitstream/123456789/4495/1/Gg.111%20davis%20theory.pdf and https://www.slideshare.net/pramodgpramod/davis-cycle-of-erosion

Students in the group differentiate Davisian cycle of erosion from Penck's cycle of erosion. Prepare a PowerPoint presentation including views, characteristics, positive aspects and drawbacks on cycle of erosion by William M Davis and Walther Penck.

Reflective question

i. Elaborate the three stages of Davis cycle of erosion.
ii. Critique Davis cycle of erosion.

6.4 Assessment

Assessment tools such as rubrics, test, anecdotal record, quiz, question- answer or any other relevant tools for assessing students' tasks.

6.5 Resources

a. https://www.nationalgeographic.org/encyclopedia/glacier/ (Theoretical Notes)

b. https://www.youtube.com/watch?v=jwPnAJHAVOA (2012)

c. https://public.wmo.int/en/resources/bulletin/third-pole-climate-warming-and-cryosphere-system-changes (Third Pole)

d. https://www.youtube.com/watch?v=ynq5h5x3Odo (Panel Discussion)

e. https://www.nrdc.org/stories/global-warming-101 (Notes)

f. https://www.iasj.net/iasj/download/1309ece36042e463 (Davis and Penck Cycle of erosion)

Strand 3: Physical Environment

Theme 5: Climate Classification

Climate classification is the formalisation of systems that recognise, clarify, and simplify climatic similarities and differences between geographic areas in order to enhance the scientific understanding of climates. Such classification schemes rely on efforts that sort and group vast amounts of environmental data to uncover patterns between interacting climatic processes. All such classifications are limited since no two areas are subject to the same physical or biological forces in exactly the same way. The creation of an individual climate scheme follows either a genetic or an empirical approach.

7.1 Competency

Explore the climatological elements and human actions to understand climate dynamics.

7.2 Learning Objectives

i. Explain humidity and air temperature.
ii. Calculate relative humidity.
iii. Describe different forms of condensation.
iv. Discuss types of precipitation.
v. Discuss Koppen's classification of climate.

7.3 Learning Experiences

Suggestive strategies: PowerPoint Presentation and lecture method, Mini-library research, Inquiry based learning, Observation, Geo-inquiry are some suggestive teaching learning experiences.

a. Using the links or any other relevant resources

   https://www.youtube.com/watch?v=y1biskUhXIQ OR

   https://www.fondriest.com/news/airtemperature.htm#:~:text=Air%20temperature%20is%20a%20measure,more%20quickly%2C%20air%20temperature%20increases. OR

   https://sciencing.com/relationship-between-moisture-temperature-4007.html

   Students describe the differences between humidity and air temperature. In pairs, find out how humidity and air temperature are related. Share the findings.

b. Using the link

https://www.youtube.com/watch?v=PNsF5PzNVJo OR

https://www.youtube.com/watch?v=Uz3CGQKm4AY

Teacher demonstrates how to calculate relative humidity. Students calculate relative humidity using different data

c. Students in groups discuss different forms of condensation (such as dew, white frost, fog, mist, haze, smog and clouds). Using the link https://www.pmfias.com/condensation-forms-of-condensation-types-of-clouds/#:~:text=After%20condensation%20the%20water%20vapour,higher%20than%20the%20freezing%20point Students identify and arrange the clouds into low, middle and high clouds. Students explain the different types of clouds using the internet or relevant resources.

d. Using the link https://www.youtube.com/watch?v=YAhS1aUuWLY Students identify and write different forms of precipitation. In pairs, explain different types of precipitation.

e. Using the links https://www.youtube.com/watch?v=4by3NMycz7s OR https://www.youtube.com/watch?v=GBuQc1OL1xE

In groups, students discuss and explain Koppen's classification of climate (A-Tropical, B - Dry, C-Temperate, D - Continental and E - Polar). Using Atlas, Google Earth or any relevant resources, locate countries from different continents under Koppen's Climate Classification.

Koppen's Climate Classification	**Continent**	**Countries**
A-Tropical		
B-Dry		
C-Temperate		
D-Continental		
E-Polar		

7.4 Assessment

Assessment tools such as rubrics, test, anecdotal record, quiz, question- answer or any other relevant tools for assessing student's task.

7.5 Resources

a. https://www.youtube.com/watch?v=y1biskUhXIQ (Simple definition)

b. https://www.youtube.com/watch?v=PNsF5PzNVJo (Relative humidity)

c. https://www.youtube.com/watch?v=Uz3CGQKm4AY(Calculating relative humidity)

d. https://www.youtube.com/watch?v=5tSKzhbLl9o (Types of condensation)

e. https://www.youtube.com/watch?v=YAhS1aUuWLY (Types of Precipitation)

Strand 3: People and the Environment

Theme 6: Energy Resources and Industries

Energy resources are all forms of fuels used in the modern world, either for heating, generation of electrical energy, or for other forms of energy conversion processes. Energy resources can be roughly classified in three categories: renewable, fossil, and nuclear.

8.1 Competency

Assess the significance of natural resources to understand the measures to conserve the ecosystem.

8.2 Learning Objectives

i. Discuss the development of the hydropower sector in Bhutan.
ii. Discuss the factors influencing the development of Hydro Power
iii. Assess the impacts of hydro power development in Bhutan
iv. Analyse the sustainability of hydropower in Bhutan
v. Explore the scope of alternative sources of energy

8.3 Learning Experiences

Pedagogies such as, Problem solving, Cooperative Learning, Kagan Structure, Field trip, Project based learning, Inquiry based learning, Fishbowl, 5Es Learning Model, Observation, Exploration, Peer learning, Games are suggestive or use any other relevant or better pedagogies in teaching learning process.

a. Use the link or any other relevant sources;

   https://kuenselonline.com/hydropower-and-the-bhutanese-economy/

   https://www.thethirdpole.net/en/energy/the-future-of-bhutans-hydropower/

   Use Fishbowl strategy:

   Students in groups (Inner circle/Outer circle) discuss the development of the hydropower sector (objectives, establishments, challenges and scope) in Bhutan. The groups listen and ask questions to the group.

b. Refer the link https://www.yourarticlelibrary.com/essay/factors-affecting-the-development-and-generation-of-hydro-electric-power/25578 or any other relevant sources. Students in teams, discuss the factors influencing the development of hydro power. Make notes of the factors and make comparison with the factors that influence the development of hydropower in Bhutan.

c. Using QGIS, prepare a map to show commissioned hydropower plants of Bhutan.

Power Plant	**Installed Capacity (MW)**	**2019 Annual generation (MUs)**	**2020 Annual generation (MUs)**
Chukha HEP	336	1,689	1,858
Kurichhu HEP	60	395	391
Basochhu HEP	64	306	384
Tala HEP	1020	4,536	5,031
Dagachhu HEP	126	399	518
Mangdechhu HEP	720	1,320	3,218

d. Students use the information in the table to draw a suitable bar graph using Microsoft excel. Interpret the graph and present the findings to the class.

e. Read the extract and answer the question:

"The 1,020MW Tala hydroelectric plant has been completely shut down since 6pm of July 19 with a daily revenue loss of around Nu 55 million (M). Large chunks of debris due to continuous rainfall during the past few days clogged the gates of the intake tunnels. At this time of the year, the Tala power plant with the monsoon rains would be generating the rated capacity of 1,020MW and an additional 10 percent overloading capacity, altogether amounting to 1,122 MW, according to the Druk Green Power Corporation (DGPC). This is equivalent to a daily generation of about 26 million units" (Bhutan's Daily Newspaper, 2021a).

Identify the challenges and discuss measures to address it. Prepare a PowerPoint presentation and present it to the class.

f. Referring to the article http://drukjournal.bt/sustainable-energy-is-hydropower-the-answer/ students discuss the sustainability of hydropower in Bhutan.

g. Students share their prior knowledge about alternative energy sources to the class.

Using the link https://www.youtube.com/watch?v=XjtCugcxsBo

In groups, discuss alternative sources of energy. Write their findings and do a Gallery Walk.

h. Read the extract and answer the question.

'Unlike other renewable energy sources, biomass can be converted directly into liquid fuels, called "biofuels," to help meet transportation fuel needs. The two most common types of biofuels in use today are ethanol and biodiesel, both of which represent the first generation of biofuel technology.' (Biofuel Basics, n.d.)

Referring to internet sources, students explore the production process and uses of ethanol and biodiesel.

i. Watch the video in the link https://youtu.be/AMXxXoHtM-o and discuss the process of producing nuclear power. Prepare powerpoint presentation and present it to the class.

8.4 Assessment

Use assessment tools such as self-assessment, rubrics, quiz, rating scale, anecdotal record, question- answer, peer assessment, class task, muddiest point or any other relevant tools.

8.5 Resources

a. https://sandrp.in/2020/01/28/bhutan-drp-overview-2019/ (Map showing Power Houses in Bhutan)
b. https://www.youtube.com/watch?v=AcxRQJKD0LE (Bhutan banks on 'white gold' hydropower)
c. https://www.universetoday.com/74599/what-is-alternative-energy/ (Alternative energy)
d. https://en.reset.org/knowledge/renewable-energy-environmentally-friendly-and-low-cost-energy-inexhaustible-sources (Notes on Renewable Energy)
e. https://www.youtube.com/watch?v=q8HmRLCgDAI (Animation on how HEP works)
f. https://www.adb.org/features/bhutan-s-hydropower-sector-12-things-know (Bhutan's hydropower sector)
g. https://www.youtube.com/watch?v=xu1Emt-3BSo (Bhutan: Electricity from sustainable hydropower to an entire nation)
h. https://www.yourarticlelibrary.com/essay/factors-affecting-the-development-and-generation-of-hydro-electric-power/25578 (Factors influencing the development of Hydro Power)

Strand 3: People and the Environment

Theme 6: Energy Resources and Industries (Creative Industries)

Creative Industries uses an individual's creativity, skill and talent for job and wealth creation through the generation and exploitation of intellectual property. International Trade Centre's (ITC) assistance in Creative Industries targets the sectors of artisanal products, visual arts and music in developing and transition economies by adding the entrepreneurial dimension and providing technical assistance to promote trade opportunities and develop producers' export capabilities.

9.1 Competency

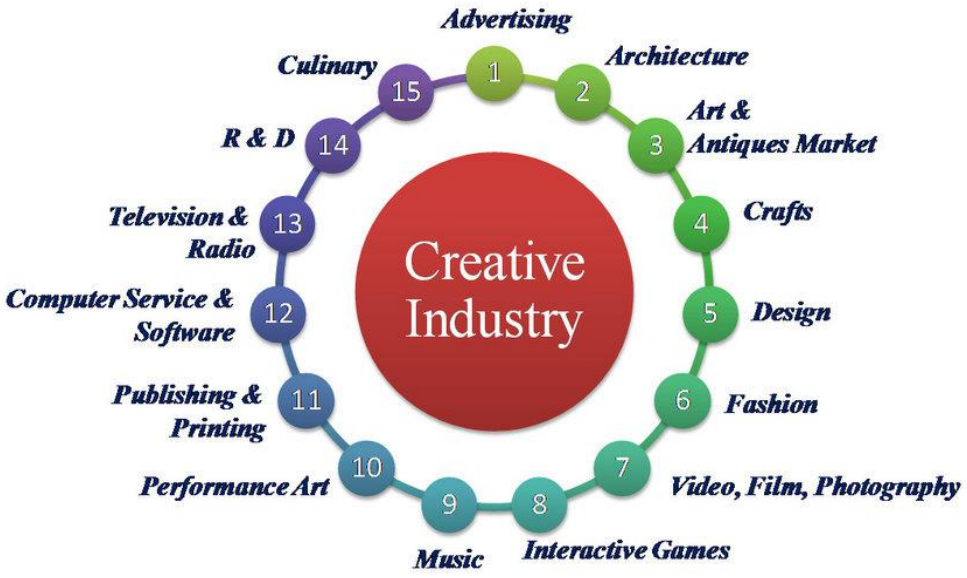
Examine the function of economic activities to promote socio-economic development of a place.

9.2 Learning Objectives

a. Discuss the concept of creative industries.
b. Explain sub-sectors of creative industries.
c. Identify and explain the challenges of creative industries.

9.3 Learning Experiences

Suggestive strategies: Content Analysis, Library research, Theoretic Learning, simulation, Project Based, Presentation, Audio Visual, KWL chart are suggestive pedagogical approaches and may use any relevant pedagogy.



a. Use the image and discuss the concept of creative industries.
b. Use the links: https://connectamericas.com/content/orange-economy-infinite-opportunity and https://www.unep.org/regions/asia-and-pacific/regional-initiatives/supporting-resource-efficiency/ to discuss the concept of "Orange Economy" and "Green Economy". In teams, categorise the different creative industries into Orange Economy and Green Economy. Share the findings to the class.
c. Referring to relevant resources, students explore and discuss the sub-sectors of creative industries (Arts and Crafts, Film and Entertainment, Advertising and Marketing, Publishing and Media, Software and Apps, Gaming). Prepare a PowerPoint presentation and share it to the class.
d. Watch the video in the link https://youtu.be/pbRzyfg0FgU and students discuss how the gamer in the video established herself as the only professional gamer from Bhutan.
e. https://www.hwca.com/accountants-newcastle/opinion/three-big-challenges-faced-by-the-creative-industries-in-2020/

   Refer to the link and discuss the challenges of creative industries. Prepare notes and share the findings with the class.

Reflective Questions:

i. Analyse the pros and cons of creative industries.
ii. How do creative industries help in solving unemployment problem in a country? Suggest probable creative industries for Bhutan.

9.4 Assessment

Assessment tools such as self-assessment, checklist, rubrics, rating scale, quiz, peer assessment, class task, or any other relevant tools to assess students' task.

9.5 Resources

a. https://discovercreative.careers/students-and-parents/what-are-the-creative-industries/ (What are Creative Industries?)
b. https://www.intracen.org/itc/sectors/creative-industries/ (a write up on creative industry)
c. https://www.davidparrish.com/creative-industries-definitions/ (13 sub sectors of creative industry- by David Parrish)

d. https://www.hwca.com/accountants-newcastle/opinion/three-big-challenges-faced-by-the-creative-industries-in-2020/ (3 big challenges faced by Creative Industries in 2020)
e. https://unctad.org/system/files/official-document/ditc20082cer_en.pdf (Creative Economy)
f. https://www.culturalstudiesinbusiness.org/post/creative-economy-and-the-idea-of-the-creative-society (Creative Economy and the idea of creative society)

Strand 3: People and the Environment

Theme 7: Emerging Risks and Hazards

Changes in technologies and workplace demographics are inevitable or essential, but with them come new workplace risks that need to be understood, assessed and managed. Such changes not only have the potential to impact on employees' health, safety and wellbeing, they can also present new risks to property, reputation and legal liabilities.

Risk management strategies must therefore be developed, established and continuously reviewed. It's critical to take a structured and planned approach to identifying and managing risks, both those that have been known and understood for some time and also potential new risks.

10.1 Competency

Apply indigenous knowledge and modern technology to support in managing and addressing disasters.

10.2 Learning Objectives

a. Discuss emerging risks and hazards.
b. Analyse the impact of emerging risks and hazards globally.
c. Suggest measures to mitigate emerging risks and hazards.

10.3 Learning Experiences

Oral presentation, Quiz Class task, Peer assessment, Embodied Learning, Adaptive Learning, Reciprocal Learning, Debate, Group discussion are suggestive approaches.

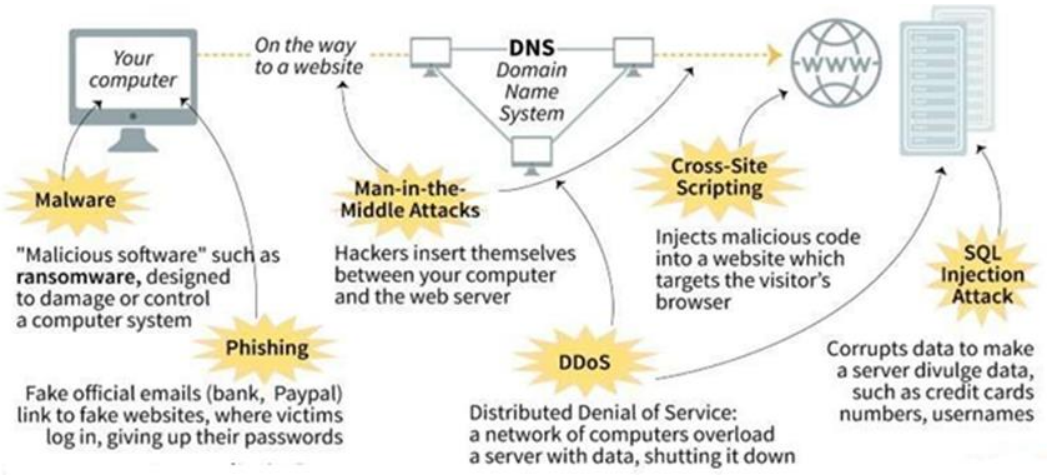
a. Access internet sources and explain the emerging risks and hazards.

b. *The Glacial Lake Outburst Flood (GLOF) comes as a reminder of our vulnerability. As climate changes, GLOF are becoming more common. It is proven that global temperatures are rising and glaciers are melting, creating lakes that can burst violently, devastating communities and properties downstream.* Source: Kuensel, Feb 10th, 2021

Locate any place near the river bank with abundant settlement on Google Earth application. Export the map into QGIS and show the river buffer zone to advocate people about the risk.

c. Refer the link https://www.nafcu.org/nafcuservicesnafcu-services-blog/5-emerging-risks-and-how-mitigate-them or any other relevant resources and explore the concept of Internet of Things (IoT), Bitcoin and Blockchain. Students discuss the measures to minimise its impact on human users. Share the findings.

d. Elon Musk said, "Unless we learn how to prepare for, and avoid, the potential risks, AI could be the worst event in the history of our civilization." Students brainstorm on the AI apocalypse and share the perceptions.



e. "Many countries are affected by cybercrimes and Bhutan is not an exception." Different cyber-attacks are represented in the picture. Exploring various sources, students in teams recommend measures to prevent such crimes. Share the findings to the class.

f. Accessing various internet sources, students suggest measures to mitigate emerging risks and hazards. (Climate change hazards, Industrial hazard, Artificial Intelligence hazard and Bioterrorism). Prepare a PowerPoint presentation and present it to the class.

Reflective Questions

i. What is cyber terrorism? What would terrorists want to do in cyberspace?
ii. How do you identify bioterrorism? Explain citing examples.

10.4 Assessment

Assessment tools such as self-assessment, checklist, rubrics, rating scale, quiz, peer assessment, class task, or any other relevant tools to assess students' task.

10.5 Resources

a. https://www.youtube.com/watch?v=3YeQWXdvRqI (how to identify emerging risks)
b. https://www.airmic.com/news/guest-stories/emerging-risks-how-move-reactive-proactive-management (Emerging risks: how to move from reactive to proactive management)
c. https://www.youtube.com/watch?v=QIMPE2QCKSY (Extreme hazard of AI)
d. https://www.youtube.com/watch?v=1oeoosMrJz4 (Can Artificial Intelligence be Dangerous? Ten risks associated with AI)
e. https://www.youtube.com/watch?v=7bJyMCrddqo (The Threat of Bioterrorism)

Strand 3: People and the Environment

Theme 8: Population and Spatial Diversity

Population growth has proceeded at an unprecedented rate, with the world's population currently totaling seven billion people. The public health impact of this growth has been tremendous, and the implications for the future are equally daunting.

Trends in fertility and mortality rates offer insight into the health and development challenges posed by population growth, and the possible demographic scenarios of the future.

11.1 Competency

Explore the similarities and differences between places and regions to recognise spatial diversity.

11.2 Learning Objectives

i. Explain measures of fertility and mortality.
ii. Analyse the trends of fertility and mortality.
iii. Examine the causes and consequences of migration.
iv. Suggest measures to mitigate migration.
v. Discuss the impact of working population on the economy.
vi. Suggest ways to overcome unemployment problem in Bhutan.

11.3 Learning Experiences

Question and answering, KWL chart, Mini-library research, Group discussion, Inquiry based learning, Cooperative learning, Simulation, Prioritise workload, Games are some suggestive pedagogies or use any relevant methods of teaching learning.

a. Using the link https://iranicaonline.org/articles/fertility-and-mortality Students explore the concept of fertility and mortality. In pairs, explain different measures of fertility (such as Crude Birth Rate, General Fertility Rate, General Marital Fertility Rate, Age Specific Fertility Rate and Total Fertility Rate) and mortality (such as Crude Death Rate, Maternal Mortality Ratio, Childhood Mortality and Age Specific Death Rate).

b. Referring the link or supplementary geography textbook class XII https://www.slideshare.net/kavindyamj16/measures-of-fertility-and-mortality Students calculate different measures of fertility and mortality using relevant data from the 2017 Population and Housing Census of Bhutan or other relevant documents.

c. Using the links https://ourworldindata.org/fertility-rate#:~:text=Globally%2C%20the%20fertility%20rate%20has,below%203%20children%20per%20woman. https://www.un.org/en/development/desa/population/publications/pdf/mortality/WMR2019/WMR2019_Highlights.pdf Students analyse and prepare a brief notes on the trends of fertility and mortality in the World. Teacher supplements and provides feedback.

d. Using the link https://www.gfmag.com/global-data/economic-data/worlds-unemployment-ratescom In pairs, students select at least 10 countries and draw a bar graph using Microsoft excel to show unemployment rate. Analyse and interpret the graph to understand the trend of unemployment. Suggest ways to overcome unemployment problem in Bhutan by referring to the link https://kuenselonline.com/unemployment-a-problem-that-will-never-go-away/ and prepare MS power point.

e. Ask questions to check prior knowledge about migration and its types. Students explain different types of migration using the internet or relevant resources.
    i. Internal Migration - Rural to Urban, Urban to Rural, Rural to Rural and Urban to Urban.
    ii. International Migration - Out-migration and In – migration
    iii. Emigration and Immigration
    iv. Step migration and Sequential migration

f. Students explore push and pull factors that cause migration. In pairs, students explain the different factors using the internet or other relevant resources. Using the link https://www.sem.admin.ch/sem/en/home/internationales/weltweite-migration/migrationsfolgen.html OR https://www.patnauniversity.ac.in/e-content/social_sciences/geography/MAGeog72.pdf

g. Students examine the consequences of migration. In groups, discuss and explain measures to mitigate migration. Present the findings to the class.

Reflective Question

a. What is the general trend of international migration? Support your answer with suitable examples.

11.4 Assessment

Assessment tools such as self-assessment, checklist, rubrics, rating scale, quiz, peer assessment, class task, or any other relevant tools to assess students' task.

11.5 Resources

a. https://kuenselonline.com/unemployment-a-problem-that-will-never-go-away/ (Unemployment: a problem that will never go away)

b. https://thebhutanese.bt/the-unemployment-issue/ (The unemployment issue)

c. https://www.jkgeography.com/migration.html (Migration)

d. https://iranicaonline.org/articles/fertility-and-mortality (Fertility and Mortality)

e. https://www.gfmag.com/global-data/economic-data/worlds-unemployment-ratescom (World unemployment rate)

Strand 3: People and the Environment

Theme 8: Population and Spatial Diversity (Urban Evolution)

In 2009 the United Nation reported that half of the world's human population lived in cities and was expected to grow to 66% by 2050. The movement of people from dispersed living to concentration in urban environments is a large change both for human civilisation and for the environment.

Urbanisation is the process of changing from natural habitats to dense grey space made up primarily of buildings, roads, and accessory infrastructure (e.g. street lights, underground sewage pipes, power lines, etc) accompanied by dense human populations.

12.1 Competency

Assess the significance of settlements to understand the evolution and characteristics of settlements.

12.2 Learning Objectives

b. Discuss models of urban centres.
c. Discuss the importance of urbanisation.
d. Analyse the causes and problems of urbanisation.
e. Suggest measures to overcome problems of urbanisation.

12.3 Learning Experiences

Demonstration, Model, Mini library research, Problem solving, Google Earth Engine (Time Lapse), KWL chart, Geo-inquiry, 5Es model, Field trip are some suggestive pedagogies or use any relevant methods of teaching learning.

a. Using the link or any other relevant resources https://www.owen.k12.ky.us/userfiles/257/Classes/17727/APHGModelsofUrbanStructure.pdf
Students discuss and write notes on different models of urban centres **(**Urban Realm Model, Rank Size Rule and Central Place Theory). Teacher supplements and provides feedback.

b. Check the prior knowledge of students by asking questions on urbanisation. In pairs, students write and share the importance of urbanisation on education, health, transport and communication, tourism and agriculture. Teacher provides necessary feedback.

c. Using textbooks or relevant resources, students write the causes and problems of urbanisation. Using ICT/paint/chart, design posters in groups to explain the causes and problems of urbanisation. Display the chart in the class.

d. Use the link or other relevant resources
https://www.civilserviceindia.com/subject/General-Studies/notes/urbanization-their-problems-and-their-remedies.html
Students examine the measures to overcome the problem of urbanisation. In pairs, list the measures and write a prepare note on overcoming the problems of urbanisation.

Reflective Questions

i. What are the purposes of urban models?
ii. What are the major global urbanisation problems that poses devastating effect on our planet?

12.4 Assessment

Assessment tools such as rubrics, checklist, rating scale, anecdotal record, quiz, question- answer, muddiest point, test or any other relevant tools for assessing students' task.

12.5 Resources

Use suggestive websites/YouTube videos or any relevant materials to explore and learn more about the topic.

a. https://www.economywatch.com/employment/working-population.html (Working Population)
b. https://www.youtube.com/watch?v=DwcW12J1FFA (Urbanisation)
c. https://www.aboutcivil.org/Chrystaller-Central-Place-Theory (Central Place Theory)
d. https://www.slideshare.net/bgeffa/urban-models-23134278 (urban models)
e. https://slideplayer.com/slide/4649707/ (Urban Realm Model)
f. Geography Supplementary Textbook for Class XII

Instructional Hours and Weighting Based on Competency

Sl. No.	Strand	Competencies	Weighting (%)	Instructional time (minutes)	Remarks
1.	Time and Space	Examine the origin of the universe to understand the scientific account of astronomy.	5	360	
		Apply the knowledge and skills of geospatial technology to analyse global issues.	15	1080	Practical component
		Apply surveying techniques with available equipment and technology to plan for the development of a place.	15	1080	Practical component
2.	Physical Environment	Apply geological knowledge on physical characteristics of rocks to understand its formation.	5	360	
		Apply the knowledge and skills of soil to understand biological, physical and chemical composition.	5	360	
		Analyse the geomorphic processes to extrapolate the significance of land features.	9	648	
		Explore the climatological elements and human actions to understand climate dynamics.	7	504	
3.	People and the Environment	Assess the significance of natural resources to understand the measures to conserve the ecosystem.	7	504	
		Examine the function of economic activities to promote socio-economic development of a place.	9	648	
		Apply indigenous knowledge and modern technology to support in managing and addressing disasters.	8	576	
		Examine the similarities and differences between places and regions to recognise spatial diversity	8	576	
		Assess the significance of settlements to understand the evolution and characteristics of settlements.	7	504	
	Total (144 Instructional Days)		**100%**	**7200 min**	**120 Hours**

Practical Work Class XII

Sl. No	Topics	Number(s) to be conducted	Weighting
1.	**Geographic Information System**		3
	a. Population choropleth map of Bhutan with quantile classification method.	1	
	b. Clipped map of any Dzongkhag with settlement/river/population data.	1	3
2.	**Plane Table Survey**	1	2
	a. Radiation method		
	b. Intersection Method	1	2
3.	Presentation a. Remote sensing b. GIS	1	5
4.	Project work	1	5
5.	Presentation, Assignment, model making		5
6.	Viva Voce GIS, Remote Sensing and Plane table survey		5
	Total	**6**	**30%**

Note: Competency 2.1 and 3.1 are practical components.

Oral Presentation Rubric

CATEGORY	4	3	2	1
Preparedness	Student is completely prepared and has obviously rehearsed.	Student seems pretty prepared but might have needed a couple more rehearsals.	The student is somewhat prepared, but it is clear that rehearsal was lacking.	Student does not seem at all prepared to present.
Speaks clearly	Speaks clearly and distinctly all (100-95%) the time, and mispronounces no words.	Speaks clearly and distinctly all (100-95%) the time, but mispronounces one word.	Speaks clearly and distinctly most (94-85%) of the time. Mispronounces no more than one word.	Often mumbles or cannot be understood OR mispronounces more than one word.
Content	Shows a full understanding of the topic.	Shows a good understanding of the topic.	Shows a good understanding of parts of the topic.	Does not seem to understand the topic very well.
Stays on Topic	Stays on topic all (100%) of the time.	Stays on topic most (99-90%) of the time.	Stays on topic some (89%-75%) of the time.	It was hard to tell what the topic was.
Comprehension	Student is able to accurately answer almost all questions posed by visiting examiner about the topic.	Student is able to accurately answer most questions posed by Visiting examiner about the topic.	Student is able to accurately answer a few questions posed by visiting examiner about the topic.	Student is unable to accurately answer questions posed by Visiting examiner about the topic.

Research Project Work

CATEGORY	4	3	2	1
Organization	Information is very organized with well-constructed paragraphs and subheadings.	Information is organized with well-constructed paragraphs.	Information is organized, but paragraphs are not well-constructed.	The information appears to be disorganized.
Quality of information	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
Graphic organizer	Graphic organizer or outline has been completed and shows clear, logical relationships between all topics and subtopics.	Graphic organizer or outline has been completed and shows clear, logical relationships between most topics and subtopics.	Graphic organizer or outline has been started and includes some topics and subtopics.	Graphic organizer or outline has not been attempted.
Diagrams & Illustrations	Diagrams and illustrations are neat, accurate and add to the reader\'s understanding of the topic.	Diagrams and illustrations are accurate and add to the reader\'s understanding of the topic.	Diagrams and illustrations are neat and accurate and sometimes add to the reader\'s understanding of the topic.	Diagrams and illustrations are not accurate OR do not add to the reader\'s understanding of the topic.
Sources	All sources (information and graphics) are accurately documented in the desired format.	All sources (information and graphics) are accurately documented, but a few are not in the desired format.	All sources (information and graphics) are accurately documented, but many are not in the desired format.	Some sources are not accurately documented.
Sources	All sources (information and graphics) are accurately documented in the desired format.	All sources (information and graphics) are accurately documented, but a few are not in the desired format.	All sources (information and graphics) are accurately documented, but many are not in the desired format.	Some sources are not accurately documented.

Practical Rubrics

Map/ Score	4	3	2	1
Neatness of colour and lines	90 to 100% of the label/features can be read easily	80 to 89% of the labels/features can be read easily	70 to 79% of the labels/features can be read easily	Less than 70% of the labels/features can be read easily
Map legends/key	Legends are labelled and contains complete set of symbols including compass	Legends contains complete set of symbols including compass	Legends lacks several symbols	It lacks all symbols
Scale	All features on the map are drawn to scale and the scale used is clearly indicated on the map	Most features on the map are drawn to scale and the scale used is clearly indicated on the map	Few features of the map are drawn to scale or the scale used on the map	There is no scale
Title	Title tells the content of the map, it is distinguishable as the title (e.g larger letters, underlines and etc) and it is printed on the top of the map	Title is located on top of the map stating the content or the purpose of the map	Title tells the contents/purpose of the map but it is not located on the top	There is no title

Questions patterns for terminal Examinations

Part I – Compulsory (50 marks)

1. Multiple Choice 15 marks
2. Completion 5 marks
3. Alternative response 5 marks
4. Matching items 5 marks
5. Short answer question 10 marks
6. Map Work (Bhutan) 10 marks

Part II (50marks)

There will be six questions each carrying 10 marks, candidate need to choose five questions.