KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY

Resham Nagar, Khanapara, Guwahati-22

GURU PRASAD DAS SCHOOL OF INTERDISCIPLINARY AND VOCATIONAL STUDIES

PROGRAMME GUIDE

FOR

POST GRADUATE CERTIFICATE IN GEOINFORMATICS (PGCG)

CONTENTS

MESSAGE FROM THE PROGRAMME CO-ORDINATOR

Dear Learner,

Greetings from Krishana Kanta Handiqui State Open University (KKHSOU)!

I welcome you to the family of KKHSOU's Post Graduate Certificate Programme in Geoinformatics (PGCG). This is a six-month programme during which you will study topics related to Geoinformatics which is an emerging field concerned with location-based observations and decision-making for different sectors. You will receive support from KKHSOU through one of its Study Centres. This Programme Guide will help you to follow the required steps in successful completion of the programme. This document contains basic information about PGCG programme, instructional system of KKHSOU PGCG programme, syllabus of PGCG programme, details of assessment process, link to assignments along with other important information. The course materials are available in the KKHSOU website. No printed course materials shall be made available. You can download ESLMs and Assignments form the website (www.kkhsou.in). All the assignments are to be submitted with the stipulated last date of submission mentioned against each assignment. Assignment submission is compulsory to be eligible to appear for the Term-end Examination and collect the receipt after submission of assignment.

As a distance learner, you may have several queries. You will find answers to many of them in this guidelines. Kindly read thoroughly and preserve this programme guide until you successfully complete the PGCG programme. Some useful form links are also given at the end of this document. Onetime payment has to be made at the time of admission and kindly confirm the fees with the Study Centre/ Website before you pay.

This Programme Guide contains the information related to the PGCG programme. However, during your studies, if you have any feedback, suggestions and comments to make, please write/email to us immediately. Learners are advised to be in touch with their Study Centre and the website for up-to-date information.

I Wish You All the Best.

Dr. Antara Mahanta Barua
PGCG Programme Coordinator
antarabarua@kkhsou.in

1. BASIC INFORMATION

1.1 Programme Objective

The PGCG programme aims to equip learners with comprehensive knowledge of Geographic Information Systems (GIS), Global Positioning Systems (GPS), and Remote Sensing, and to prepare them for effective application of these geospatial technologies in real-world professional contexts. People from diverse academic and professional backgrounds with an interest in Geoinformatics can enrol in this certificate course.

The main objectives of this programme are-

- To introduce the core concepts of GIS and their integration with Remote Sensing and Global Navigation Satellite Systems (GNSS).
- To develop the analytical and technical skills necessary to apply geospatial tools in real-world problem-solving.
- To enable learners to critically evaluate and implement geospatial solutions in various sectors such as environment, urban planning, disaster management, and agriculture.

1.2 Target Groups

This course is relevant for the students who are professional graduate in earth Sciences (Geography, Geology, Environment, Disaster management) and for the students from other field like B.sc, computer science, engineering, architecture, agriculture, and mining who wish to build their career in geospatial industry and want to be proficient in applying geo-information science in their respective field. This course is also applicable for social science and humanities researchers when geospatial data is a part of their study.

1.3 Duration of the Programme

(Minimum – 6 Months, Maximum - 2 Years)

To fulfil the requirements for acquiring the PGCG, a student may successfully complete all the courses in a minimum of 6 months and a maximum of 2 years.

1.4 Medium of Instruction

The medium of instruction is English. The course material is in English

1.5 Credit System

The University adopts a 'Credit System' for all its academic programmes. Under this system, one credit is equivalent to 30 hours of student learning time comprising all the learning activities. Accordingly, a course carrying 4 credits involves a total of 120 hours of study. This helps the student to understand the academic effort one has to put for successful completion of a course. Successful completion of the programme requires successful completion of both assignments and the Term-End Examination of each course of the programme.

1.6 Programme Structure

The following is the Programme Structure of PGCG:

Course Code	Course Title	Theory/Practical	Credit
GI-01	Fundamentals of GIS	Theory	4
GI-02	Basics of Remote Sensing and Global Positioning System	Theory	4
GI-03	Spatial Analysis and Application in Geoin-formatics	Theory	4
GI-04	Practical Manual on GIS and Remote Sensing	Practical	6

No. of Theory Courses – 3 No. of Practical Courses -1 Total Credits: 18

1.7 Learner Support Services

Learner Support Services (LSS) constitute the most important component of the Open and Distance Learning system. KKHSOU also provides some need based support services, which are as the following:

Face-to-face Counselling: KKHSOU provides face-to-face contact sessions between the learners and counsellors at the study centres to clarify their doubts and answer to their academic quarries related to the programme. This is called 'Academic Counselling', which is normally held on Sundays at the KKKHSOU Study Centres. You can contact your study centre for the schedule of such counselling programme and seek Academic Counselling for your courses. Attending the counselling sessions is not compulsory but it is highly recommended. Participation in Academic Counselling significantly enhances understanding of the concepts and topics covered in the study materials.

Note that Counselling is not lecturing, though a counselling session may include a short lecture to trigger a fruitful discussion. In fact, the counselling session is a group activity session, where you participate in discussions, share your views and do all other sorts of activities to comprehend your units. Therefore, it is important that you regularly come to the counselling sessions thoroughly prepared, after reading the relevant units of the study material. You should contact the Study Centre co-ordinator for the counselling schedule just after your admission. If your problems are not solved and if the counsellors refuse to hold counselling at the centre, you may inform the university Headquarters. You may also contact the Programme Coordinator for further guidance and support.

Online Counselling

Online academic counselling in KKHSOU provides flexible and accessible support for students pursuing distance education. Through virtual platforms, students can connect with faculty members to receive guidance on course content and study planning. This form of academic counselling helps to reach learners at remote study centers and enables them in receiving the support needed to succeed in their studies.

In these counselling sessions, you must try to resolve your subject-based difficulties and any other related problems.

1.8 Career Prospects:

Geoinformatics has a lot of potential in the job market because of the current and unexplored opportunities. The Geoinformatics field is expanding rapidly as more industries are employing spatial data to manage their activities. In recent years, government initiatives have increasingly focused on the development of smart cities. In this context, geospatial technologies are expected to play a vital role by supporting planning, infrastructure development, resource management, and service delivery. The application of geospatial data extends across a wide range of sectors, including urban administration, unmanned aerial vehicle (UAV) technology, defence and missile systems, e-governance, advertising, and marketing. As a result, the demand for skilled professionals in this domain continues to rise.

There are various professional positions of GIS at different levels. Some of them are GIS Mapping Technician, GIS Data Specialist, GIS Application Specialist, GIS Business Analyst, GIS Operator, GIS Consultant, Geospatial Software Engineer, GIS Programmer, GIS Technical Assistant etc. The private sector also offers a considerable number of opportunities, particularly for software developers with expertise in GIS and Remote Sensing technologies. For those interested in research and academia, Geoinformatics can be pursued up to the doctoral (Ph.D.) level, providing access to positions in esteemed research organizations at the national and international levels.

This field is especially beneficial for graduates from disciplines such as Geography, Geology, Climatology, Meteorology, Urban Planning, Natural Resource Management, Environmental Science, and Water Resource Management. A background in these subjects provides a strong foundation for applying theoretical knowledge to practical, real-world challenges through Geoinformatics.

1.9 Contacting the PGCG Programme Co-ordinator

Students may contact the PGCG Programme Coordinator by sending a communication through post PGCG Programme Coordinator, GPDSoIVS, Krishna Kanta Handiqui State Open University, NH- 37, Resham Nagar, Near Bodoland Guest House, Khanapara, Guwahati-781022 or can send an email to - gpds@kkhsou.in

2. Instructional System

2.1 Self-Learning Material

Self-Learning Materials are the primary form of learning materials. This self-Learning Material is made available in printed form or in electronic form through KKHSOU ESLM webpage. Students are advised to study reference books without fail. Studying the self-instructional material alone may not be sufficient to write assignments and prepare for the Term-end Examinations. In the case of PGCG, no printed course material shall be made available. The study materials are available for download. Ensure that you download all four materials, which include three theory course ESLMs and one practical manual, for effective learning.

2.2 Counselling Sessions:

The details of the theory and practical counselling sessions are given in the following sections.

Theory Sessions: In distance education, face-to-face interaction between learners and academic counsellors is limited. Theory sessions are intended to address your questions and clarify any doubts related to the topics covered in your programme's syllabus. Academic counsellors at the Study Centre are available to offer guidance and support in the courses you have enrolled in. The duration for one theory counselling session is of 1 hours. It is important to note that these sessions are not the same as traditional classroom teaching, but are focused on supporting your independent learning.

Practical Sessions: The practical sessions for PGCG programme will be held in the computer labs of the Study Centre. In these computer labs, the learners will have the facility to use the computer and software packages relevant to the syllabus. The practical sessions for PGCG programme will be conducted using open-source software such as QGIS and duration for one practical counselling session is of 3 hours. Learners must submit their practical notebooks containing the experiments performed during the practical sessions at the time of the practical examination.

2.3 Web Based Support

Website: The University has developed a full-fledged official website (https://www.kkhsou.in) for learners and the general public. The website has a dedicated Learners' Corner that contains exhaustive information and links to useful resources which is accessible to the vast learner population. You can download assignments, old question papers, circulars, etc. from the website. The Programme Guide is also available at the website. Furthermore, the Website links to social-networking sites like Facebook where learners, faculty members, and stakeholders can interact. And most of the audio-visual programmes are accessible online through YouTube videos.

3. PGCG Syllabus

COURSE 1
Course Name: Fundamentals of GIS
Course Code: GI-01

Credits - 4 **Marks-100**

UNIT 1: Basics of Geoinformatics

Concept of Geoinformatics; Major Fields of Geoinformatics; Introduction to Cartography and Surveying; Significance of Geoinformatics; Multidisciplinary nature & applications of Geoinformatics.

UNIT 2: Understanding Maps

Definition of a map; Properties of maps; Types of maps; Present day significance of maps.

UNIT 3: Map Projection in GIS

Map Projection Systems; Map Projections for Hemispheres and the World; Map Projections for Continents and Regions; Universal Transverse Mercator projection; International Terrestrial Reference Frame in GIS.

UNIT 4: Basics of Geodesy and Spatial Referencing Systems

Shape and size of the earth; Ellipsoids and Datum; Co-ordinate Systems

UNIT 5: Introduction to Geographic Information Systems

Basic Concepts of Geographic Information Systems; Components of a GIS; Advantages of GIS; Social and Institutional Context of GIS; Contemporary Development of GIS.

UNIT 6: Introduction to database management system

Overview of database in computer science; Basics of database system; Fundamentals of geo-database management system; Creation of geo-database for applications in geo-informatics.

UNIT 7: GIS Data Types

Raster Data, Vector Data, TIN; Topological Relationships; Raster & Vector Data Formats.

UNIT 8: Sources and Nature of Geospatial data

Spatial and non-spatial Data; DEM (SRTM, GTOPO, GLOBE, LiDAR) and Other Data Sources; Data Input Output Processes and Devices; Data Verification, Correction and Storage; Data Conversion in GIS.

COURSE: 2
Course Name: Basics of Remote Sensing and Global Navigation Satellite System
Course Code: GI-02

Credits - 4 **Marks: 100**

UNIT- 1: Introduction to Remote Sensing

Introduction to Remote Sensing; Concepts and Definition; History and Development; EMR Spectrum; EMR Interaction with Earth's atmosphere and Earth's surface; Spectral Signature and resolutions.

UNIT- 2: Remote Sensing Platforms and Sensors

Platforms and Sensors: History of Space Imaging; Sensors and their characteristics; Types of Satellites: Meteorological Satellites; Remote Sensing in India: India's Remote Sensing Programme, Future Missions; Overviews of Imageries from various Satellites.

UNIT- 3: Remote Sensing Data Products

Data Products; Data characteristics; Overview of imageries from various products; Accessing Remote Sensing Data

UNIT- 4: Fundamentals of Thermal Remote Sensing

Concept of Thermal Remote Sensing; Thermal Inertia: Temperature from Radiance Values; Thermal Sensors and Scanners; Optomechanical CCD Arrays: Uncooled Infrared Detectors, Cooled Infrared Detectors; Interpretation of Thermal Scanner Imagery; Application of Thermal data.

UNIT- 5: Introduction to Microwave Remote Sensing

Basic Concept of Microwave Remote Sensing; Microwave Sensors; Spectral and Spatial Resolution; Microwave Data Sets; Application of Microwave Satellite Data.

UNIT- 6: What and why of Hyperspectral of Remote Sensing

Hyperspectral Remote Sensing: Basic concepts, Satellites, Sensors; Spectral and Spatial Resolution; Data characteristics and Applications of Hyperspectral Data Cubes.

UNIT- 7: Aerial Photographs

Basic Concepts of Aerial Photography; Types of Aerial Photography: Vertical photographs, Oblique Photographs; Photogrammetry

UNIT- 8: Image Enhancements and Interpretation

Basic idea of image enhancement techniques; Elements of Image Interpretation; Techniques of Visual and Digital Interpretation.

UNIT 9: Basics of Global Navigation Satellite System

Introduction to Global Positioning System; GPS Satellites Constellations: GPS segments; GLONASS, Galileo, GAGAN, IRNSS; GPS Antennas, Signals and Codes; GPS Receivers: Types of Receivers; Modes of Measurements.

UNIT 10: GPS Data and Applications

Factors Affecting Accuracy of GPS Data, Post Processing of data; GPS surveys and applications.

COURSE 3
Course Name: SPATIAL ANALYSIS AND APPLICATION IN GEOINFORMATICS
Course Code: GI-03

Credit: 4 **Marks: 100**

UNIT-1: Spatial Data Modeling & Database Management
Spatial Data and Its Characteristics; Various Sources of Spatial Data; Spatial Data Models: Raster Data Model, Vector Data Model, Topology; Spatial Data Structures: Raster Data Structure, Vector Data Structure; Database Management Technology in GIS; Methods of Data Input and Data Editing: Georeferencing of Objects, Data Input and Methods, Data Editing.

UNIT-2: Data Analysis
Introduction to Data Analysis basics; Database Queries; Geospatial Measurements; Neighbourhood Operations, Overlay Operations; Surface Analysis Uses of DEM / DTM / DSM; Network Analysis.

UNIT- 3: Geoprocessing Functions and Tools
Vector overlay; Raster overlay; Spatial Buffering; Union and Intersection; Spatial Autocorrelation; Weighted Regression.

UNIT-4: Analytical Modeling and Output
Analytical Modeling basics; Process Models: Physical and Environmental Process Modeling, Decision Making Process Modelling, Human Process Modelling; Output of GIS: Maps as output; Spatial Decision Support Systems; Some functional applications of a GIS.

UNIT- 5: Basics of Image Processing-I
Introduction to Digital Image Processing (DIP); DIP software Systems: User interface of DIP software, Conversion of Digital Data in DIP Software; Image properties: Spatial resolution, Radiometric resolution, Image histogram; Data preparation: Geometric corrections, Radiometric corrections; reprojection and resampling of digital data; Subsetting digital images.

UNIT- 6: Basics of Image Processing-II
Geo-referencing Data; Pattern Recognition in Digital Image Processing; Image enhancement: Image filtering, Band ratio, Principal component analysis

UNIT- 7: Basics of Image Classification
Introduction to Image Classification; Unsupervised Classification, Supervised Classification.

UNIT- 8: Accuracy Assessment in Image Classification
Concept of Accuracy Assessment**:** Need for accuracy assessment; Types of accuracy assessment.

UNIT- 9: Geoinformatics for Natural Resources Assessments
Application of Geoinformatics in land use / land cover classification systems; Mapping and change detection analysis; Geo-environmental studies; biotic resource assessments.

UNIT-10: Geoinformatics for Environmental Studies, Planning and Development
Geoinformatics for environmental pollution and climate change studies; Floods and drought Prone Area mapping; Early warning systems for disasters and hazards; Rural and urban infrastructure survey; Mapping and planning.

COURSE 4
GI-04 HANDS ON GIS AND REMOTE SENSING SOFTWARE

Marks: 100

Credit: 6

PRACTICALS IN GEOGRAPHIC INFORMATION SYSTEMS

Exercise 1- Geo-reference of maps and imageries

Exercise 2- Graphical Representation of Spatial data (Raster/Vector Method)

Exercise 3- Sub-setting an area of interest from a satellite image

Exercise 4- Import / Export of files in different formats

Exercise 5- Creating DEM/TIN surface from vector/ raster data

Exercise 6- Multi Criteria decision making for site selection

PRACTICALS IN GPS

Exercise 7- Data collection in GPS

Exercise 8- Processing of GPS data in the software

PRACTICALS IN REMOTE SENSING & IMAGE INTERPRETATION

Exercise 9- Introduction to maps and satellite imageries

Exercise 10- Identification of different Features using TM, FCC and Thermal Imagery

Exercise 11- Layer stacking and mosaicing Images

Exercise 12- Interpretation of different bands of satellite imageries

Exercise 13- Image to image rectification and image to map registration

Exercise 14- Image enhancement techniques, Filtration: High, Low frequency

Exercise 15- Classification: Supervised and Unsupervised methods.

4. Course Assessment

Assessment in a course is based on two components—(a) assignments and (b) End-Term examination. Learners are expected to learn and fully utilise the course materials provided in the form of Self Learning Materials (SLMs), and read some of the books from the Further Reading list provided at the end of each unit. You are strongly advised to read extra materials related to this course and discuss topics of interest with your course-mates. Ensure that you have fully prepared before submitting your assignments.

4.1 Assignments and Term-End Examination

Assignments:

Each course of PGCG Programme has single set of Assignments of 50 marks. Submission of assignment is mandetory. The assignment carries 30% weightage in the final result. You must submit the assignment responses at your study centres as per the date specified. Please note that assignment is an important component of your study. The purpose of assignments is to help you get through the courses. The assignments, being a process of formative evaluation, will help you to understand how you are progressing in your studies.

Note: Several ill practices have been reported to the University Headquarters regarding submission of assignments written by others or copying and submission of the same answers by several learners. After detection of such anomalies, KKHSOU reserves the right to penalise such learners. It should always be kept in mind that by adopting unfair practices, the learner is not cheating others except himself or herself.

The following are some important guidelines for writing your assignment responses:

- Make sure that you have answered all the questions of an assignment before you send them to the Study Centre. Incomplete assignments shall bring you poor grades, or non-submission of assignments in time may lead to withholding of results.
- Answer the questions of the assignment as directed after a careful study of the Units available in the SLMs.
- You should not send printed articles as your answers for assignments, nor should you reproduce the text of the SLMs verbatim. Write assignments in your own words and in your own handwriting. However, don't forget to put your signature at the end. Typed assignment responses are never allowed.
- Ensure that you keep a copy of the assignment responses with yourself. You might need them in case you have to re-submit the assignment responses due to some unforeseen circumstances or you may require it for preparation of end term examination.
- While submitting the assignment, don't forget to collect the receipt. The format of the receipt is available at the end of each assignment. You may also get the receipt signature from the study centre on the assignment copy kept with you.
- Be precise in your response. Keep the word limit of the assignments in mind.

Term-End Examination:

KKHSOU conducts Term-end examination of PGCG programme once in a year. To appear for the Term-end Examination you should have submitted all the assignments in the prescribed format and within time. The final examination shall be conducted at the designated examination centre. The examination will be a proctored examination of three-hour duration for full paper and 2 hours for half paper. The Term-end examination contributes 70% of the total course marks. The overall assessment is done as per the following:

Assignments: 30%

Term-end Examination: 70%

Total marks: 100%

4.2 Guidelines for Practical Components:

The PGCG programme includes a 6-credit (100 marks) practical course designed to provide learners with hands-on experience in GIS techniques, map creation, data visualization, and spatial data analysis. Learners must carefully read the practical manual before performing the experiments.

5. Other Useful Information

5.1 Study Centre Related Matters:

All activities concerning Study Centres such as address changes, corrections, relocation of Study Centres, and other related matters are governed by the Standard Operating Procedure (SOP).

The SOP for Study Centre can be accessed through the following link.
https://kkhsou.ac.in/web/index_page_details.php?page=b3JrcXVyMlpzRkVVT3BXaE02TVBQUT09

5.2 Examination-Related Matters

All matters related to examinations such as examination centres, pre-examination and post-examination processes, certificate-related issues, etc. are outlined in the Standard Operating Procedure (SOP).

The SOP for Examinations can be accessed through the following link.
https://kkhsou.ac.in/web/index_page_details.php?page=Nkp6OVk0NVdXT1BjVDJWZUVtN2ZDQT09&title=rules-and-regulation-and-sop

Learners are encouraged to carefully read both SOPs to gain a clear understanding of various matters related to Study Centres and Examinations.

5.3 Some Important Links

i. Link of ESLM of PGCG programme
https://lmskkhsou.in/eservices/e-Resources/#Resources%2Fe-SLM%2FNEP%2FDiploma%20%26%20Certificate%2F1st%20Semester%2FPost%20Graduate%20Certificate%20Programme%20in%20Geoinformatics

ii. Link to Old Question Papers
https://lmskkhsou.in/eservices/e-Resources/#Resources%2FQuestion%20Papers%2FCertificates

iii. Link to Form for re-evaluation of Answer script
https://kkhsou.ac.in/web/storage/uploads/forms/3/rescrform-pdf377089.pdf

iv. Link to Form for transfer of Study Centre
https://kkhsou.ac.in/web/storage/uploads/forms/2/studycentretransferform-pdf334476.pdf

v. Link to Form for Applying Original Certificate
https://kkhsou.ac.in/web/storage/uploads/forms/3/certificateapplyform-pdf885346.pdf

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