

DEPARTMENT OF GEOGRAPHY & APPLIED GEOGRAPHY
UNIVERSITY OF NORTH BENGAL

Accredited by NAAC with grade B⁺⁺

Ph. D COURSE WORK SYLLABUS, 2023
Geography & Applied Geography



সমানো মনন: সমিতি: সমানী

Duration: 6 Months, Total Marks: 250, Total Credits: 10

Course Code	Course Name	Type	Instruction Hour/ Week	Total Marks	Exam Duration	Credits
CWGAG101	Research Methodology	Theory	4 Hours	50	2 Hours	2
CWGAG102	Quantitative Techniques	Theory	4 Hours	50	2 Hours	2
CWGAG103	Methods and Applications of GIS	Theory	4 Hours	50	2 Hours	2
CWGAG104	Remote Sensing, Air-Photo & GPS	Theory	4 Hours	50	2 Hours	2
RPE	Research and Publication Ethics (Framed by University Authority)	Theory & Practice	30 Hours	50	2 Hours	2
Total				250	-	10

Course Outcome

- **Knowledge Gained:** *Gaining the basic knowledge of research in geography, its epistemology, ontology and details methodological design, use of geospatial and statistical tools in geographical research, and organising and writing research report.*
- **Skill Gained:** *Gaining computational and mapping skill required in geographic research gaining skill in handling the GIS and statistical software.*
- **Competency Developed:** *Getting competency in pursuing Ph.D and conducting research project in the domain of Geography and Applied Geography.*

CWGAG 101: Research Methodology (Theory)

Total Marks: 50, Total Credits: 2

Unit-I: Basic Understanding of Research

Research: Definition, types, approach, epistemological, ontological, and methodological enquiries; Research processes (steps of research): Defining research problem & objective, Review of literature (for framing research question, identifying research gap and its types, and transforming gap into research problem), Formulating research hypothesis (Not to be confused with statistical hypothesis), Making research design (Research plan), Execution of research (Data collection, tabulation, and data tidying, checking validity & reliability), Data analysis, Interpretation and Report writing.

Unit-II: Data, Measurement Scale, and Variable

Data sources: Primary and secondary; Data types: Metric (Numeric) and Non-metric (Opinion and Fact); Types of data series: Cross sectional data, Time series data, Pooled and Panel data; Scale: Nominal (Non-metric), Ordinal (Non-metric: Rating, Ranking, and Likert), Interval (Metric and Likert scale) and Ratio (Metric); Method of formulating Likert's scale (Case, Items and Response); Difference between Likert's scale and Rating scale; Variables and Construct; Types of variables: Independent variable, Dependent variable, Control variable, Mediating variable, Moderating variable, Confounding variable, and Marker variable.

Unit-III: Sampling and Data Collection

Concept of population and sample; Types of Population: Target population (Theoretical population) and Study population (Accessible population); Sampling: Sampling unit, Sampling frame (its difference with population), Sample size, Sampling method (Probability and non-probability sampling), Sampling weight and Inclusion probability, Sampling and Non-sampling error; Data collection method: Interview, Questionnaire, Schedule (Enumerator), Observation, and Focus group survey; Data coding and Designing master table; Data cleaning: Check for missing frequency, improper coding (Typing error), outlier, category merging, and unengaged response; Checking Reliability: Test-retest, Interrater, Parallel forms, and Internal consistency (Cronbach's Alpha for Likert's scale); Checking Validity: Construct validity, Content validity, Face validity, and Criterion validity.

Unit-IV: Principles of Data Analysis and Report Writing

Principle of data analysis and relevant statistical tools: Findig differences when same items occur in different conditions (Tools: Hypothesis test), and finding relation when different items occur in same condition (Tools: Correlation and regression); Method of content analysis for qualitative studies; Thesis layout and formatting; Thesis DTP in MS Word: Creating multilevel headings, writing equation, inserting caption to figure and table, creating automatic table of contents, automatic list of figures, automatic list of tables, inserting foot note, citation and referencing, inserting cross reference, creating section break & page break, and page numbering.

CWGAG 102: Quantitative Techniques (Theory)

Total Marks: 50, Total Credits: 2

Unit – I: Probability Distribution & Hypothesis Testing

Inferential statistics and its relevance in geographical research; Probability functions: PMF, PDF, and CDF; Properties and application of Normal distribution (continuous), Poisson distribution (discrete but infinite), and Binomial distribution (discrete and finite); Properties of sampling distribution: t-Distribution, F-Distribution, and Chi-square distribution; Hypothesis testing: Test statistic, Types of Null and Alternative hypotheses and associated distribution under Null and Alternative; Decision rules: Comparing test statistic with corresponding table value, Confidence interval for population mean, and Comparing α with p -Value; Type-I and Type-II error, and Power of test.

Unit-II: Analysis of Differences

Comparing Means: t-Test: One sample, two independent samples and two related samples; Non-parametric counter parts of t-Test: Mann-Whitney (Two independent samples) and Wilcoxon (Two related samples); ANOVA and F-Test: One-way ANOVA (CRD), Two-way ANOVA with repetition (Factorial) and without repetition (RBD), One-way repeated measures ANOVA, Effect size by Partial Eta Square, Post-Hoc analysis by Tukey and Games-Howell, Levene's test for homogeneity of variance, Welch test (for violation of equal variance assumption), Mauchly's test of sphericity (K related samples), Non-parametric counter parts of ANOVA: Kruskal-Wallis (K independent samples) and Friedman test (K related samples), ANCOVA to compare group means while controlling covariate; *Comparing Variances:* Chi-square test (Parametric) for comparing variance with hypothesized variance, F-Test for comparing variances of two normal populations; *Comparing Proportions:* Binomial test with z approximation for one sample and two independent samples.

Unit-III: Analysis of Relations

Metric data: Variance, covariance, and correlation; Part and partial correlation; Autocorrelation and Spatial autocorrelation (Moran's I), Hypothesis testing for correlation co-efficient; Measurement of distance (Euclidean); Bi-variate and Multiple regression: Assumption, model formulation, and interpretation of slope, Optimizing model parameters (Intercept and Slope) by matrix algebra (Definition, types, and application of matrix), Model fit (Multiple R, Standard error of estimate), Hypothesis test for model parameters (t-Test), Estimation of explained and unexplained variance by ANOVA and F-Test, Effect size: R^2 and Adjusted R^2 , Autocorrelation of residual by Durbin-Watson statistic, Check for multicollinearity (VIF), Checking homoscedasticity: plotting z-residual against z-predicted; *Non-metric Data:* Dummy variable regression; Chi-square test for independence and estimation of the association by Phi, Cramer's V, Somers' d, Kendall's tau (b and c), and Eta.

Unit-IV: Multivariate Tools and Time Series Analysis

Application of Cluster analysis (K-means and Hierarchical CA) and Discriminant analysis (LDA and MDA); Formulation, and interpretation of Binary and Multinomial logistic regression; Objective and application of Principal Component analysis (PCA); Application of Correspondence Analysis; Introducing MANOVA, MANCOVA, Path Analysis (PA) and Structural Equation Model (SEM); Concept and components of Time Series (Trend, Seasonality, Cyclic event, and Irregularity), Trend analysis by Mann-Kendall test, Formulation of ARIMA model.

CWGAG 103: Methods and Applications of GIS (Theory)

Total Marks: 50, Total Credits: 2

Unit-I: Overview of GIS Data and Georeferencing

Data types: Spatial and Attribute; Data format: Raster and Vector (Point, line, and polygon); Concept of Geodatabase file and Shape file; Visualising vector and raster data in GIS environment; Exploring attribute table of vector data: Point, Line, and Polygon; Concept and use of coordinate system: Geographic Coordinate and Projected Coordinate; Georeferencing for raster layer: Image rectification (Assigning CPC to Image from keyboard) and Image registration (Image to image georeferencing); Reproject raster and vector layer.

Unit-II: GIS Data Creation

Creating vector data: Point, Line, and Polygon features (Shared and non-shared boundary); Creating point file based on XY data from Excel; Editing vector data: Shifting the point features, Reshaping the Line and Polygon features; Dissolving the polygon; Creating vector data in Google Earth and exporting the same to Shape file; Handling Attribute Table: Inserting new field and populating the same, Renaming and deleting the existing field, Calculating geometry: length of line and area of polygon, Calculating attribute based on existing attributes, Join and Relate operation; Overlay operation: Erase, Union, and Intersection; Extraction by point and mask; Creating buffer for line layer; Raster to Vector and Vector to Raster conversion; Feature to point, line, and polygon; Create Fishnet; Feature vertices to point; Map Composition and Export.

Unit-III: Thematic Mapping, Spatial and Non-spatial Queries

Creating choropleth: Population density map; Creating isopleth: Contour map based on DEM and isohyet map based on point rainfall data; Creating DEM based on spot heights and contours; Creating altitudinal zone map based on DEM; Image classification and Land use land cover (LULC) mapping; Forest cover mapping by using NDVI; Waterbody mapping by using NDWI; Urban built-up area mapping by using NDBI; Non-spatial queries: Select point, line, and polygon features by attributes; Spatial queries: Select features based on location, Display statistics of selected features and export the selected features.

Unit-IV: Spatial Data Analysis

Site suitability analysis for construction of a school (in vector domain) and for development of a firm (in raster domain); LULC change analysis; Nearest neighbour analysis; Analysis of distribution pattern of a specific types of objects (detecting random, clustered, and dispersed pattern); DEM hydro-processing to delineating drainage basin and extract drainage network and analysis of stream ordering; Making basin average rainfall based on Thiessen Polygon; Runoff estimation by NRCS-CN model; Soil erosion estimation by USLE.

CWGAG104: Remote Sensing, Air-Photo & GPS (Theory)

Total Marks: 50, Total Credit: 2

Unit-I: Techniques of Remote Sensing

Remote Sensing: Energy sources and radiation principles, Energy interactions in the atmosphere, Energy interactions with Earth surface features, Data acquisition and interpretation, Multispectral, Thermal and Hyperspectral Sensing, Earth Resource Satellites and Optical Spectrum, Digital Image Processing, Image Rectification and Restoration, Spatial Image Manipulation. Multi-Image Manipulation, Image Classification, Data Merging, Microwave Sensing.

Unit-II: Application of Remote Sensing

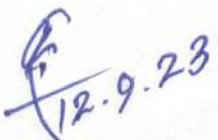
Applications of Remote Sensing: Remote Sensing over Fishing Zones, Impact of Mining Activities on Environment, Remote Sensing and Biodiversity, Estimating and Monitoring Forest Cover and Digital Forest Management, Remote Sensing for Route Alignment, Remote Sensing for Flood Management, Monitoring Urban Growth using Remote Sensing, Mapping Wastelands through Remote Sensing, Preventing Natural Disasters, Remote Sensing for Managing Water Resources, Using land through Remote Sensing, Watersheds and Remote Sensing, Crop Forecast from Satellite Data, Remote Sensing to Help Boost Tourism, Managing Groundwater.

Unit-III: Air-Photo

Spectral Sensitivity of films, Film resolution, Electronic imaging, Photogrammetric activities, Basic Geometry and Scale of Aerial Photographs, Mapping with Aerial Photographs, Flight Planning, Basic Visual Image Interpretation Equipment, Land Use/Land Cover Mapping.

Unit-IV: GPS

The Global Positioning System: Basic concept and fundamentals of GPS, Development of GPS System, User-Satellite Geometry, Structure and segments of GPS, Communication formats of GPS, Accuracy enhancement of GPS, Applications of GPS.


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