One Year P.G. Dip. in Remote Sensing and GIS

Banaras Hindu University

Department of Geography, Faculty of Science

Distribution of Courses and Credits in Various Semesters

Semester-I

Course Code	Title	Credits
GID101	Fundamentals of Geomorphology & Cartography	**5**
GID102	Principles of Remote Sensing	**5**
GID103	Fundamentals of GIS	**5**
GID104	Remote Sensing I (Practical)	**3**
GID105	GIS Analysis I (Practical)	**3**
	Total	**21**

Semester-II

Course Code	Title	Credits
GID201	Advances in Remote Sensing and GIS	**5**
GID202	Digital Image Processing	**5**
GID203	Remote Sensing and GIS Applications	**5**
GID204	Remote Sensing II (Practical)	**3**
GID205	GIS Analysis II (Practical)	**3**
GID206	Project/Dissertation*	**6**
	Total	**27**
	Grand Total of Credits	**48**

*to be submitted 35-45 days after the last theory/practical examination whichever is later, but 15 days before the official reopening of the university after summer vacation

One Year PG Diploma in Remote Sensing and GIS

Department of Geography, Banaras Hindu University Varanasi-221005, U.P.

FIRST SEMESTER

GID101- Fundamentals of Geomorphology and Cartography (5 Credits)

Lithosphere: Earth's Interior and Crust; Rocks; Volcanism; Earthquakes; Faults, Folds and Topography; Mountain Building; Types of Mountains.

Geomorphic Processes and Landforms: Geomorphic Processes—Weathering, Mass Movements, Erosion, Transportation and Deposition; Anthropogenic Process; Landforms in Humid, Arid, Karst, Glacial and Coastal Environments; Geomorphic Processes and Landforms in relation to Natural Resources, Natural Hazards and Disasters, Human Settlements and Economic Activities.

Cartography: Earth's Size and Shape—Spheroidal and Geoidal Earth; Spheroidal and Geoidal Datums; Co-ordinate Systems—Cartesian, Rectangular and Geographical; Grid Systems; Map Projections—Polyconic, Albers Conical Equal Area, LCC, Mercator and UTM.

Reference & Text Books:

1. Bloom,A.L. 2001 Geomorphology, Prentice Hall of India, New Delhi.
2. Burton, I. and Rates, R.W. 1978 Readings in Resource Management and Conservation, McGraw Hill, NY.
3. Clark, G.L., Feldman, M.P. and Gertler, M.S., (Ed.) 2000 The Oxford Handbook of Economic Geography, Oxford Univeristy Press, Oxford.
4. Ehrlich, P.R., Ehrlich, R.H. and Holdren, J.P., 1998 Ecoscience: Population, Resources and Development, Freeman & Co., San Francisco.
5. Fairbridge, R.W. (Ed.) 1968 Encyclopaedia of Geomorphology,
6. King, C.A.M., 1966 Tehniques in Geomorphology, Edward Arnold, London.
7. Mailing, D.H., 1973 Co-ordinate Systems and Map Projections, George Philip & Son Ltd.
8. Raisz, E., 1962 Principles of Cartography, McGraw Hill Books Co., Inc. NY.
9. Rhind, B. and Adams, T. (Ed.) Computers in Cartography, British Cartographic Society, London.
10. Robinson A.H. et al., 2002 Elements of Cartography, John Wiley & Sons, NY.
11. Sparks, B.W., 1960 Geomorphology, Longmans, London.
12. Strahler, A.N., 1971 The Earth Science, Harper and Row, NY.
13. Thornbury, W.D., 2001, Principles of Geomorphology, John Wiley, NY.
14. Wooldridge, S.W. and Morgan, R.S., 1959 The Physical Basis of Geography, Longman, London.

GID102 - Principles of Remote Sensing (5 Credits)

Basics: Electromagnetic Radiation as Remote Sensing Medium—Interactions with atmosphere and matter, Remote Sensing Regions and Bands; General Mechanism of Remote Sensing Data Recording; General Characteristics of Remote Sensing Platforms; General Characteristics of Remote Sensing Sensors

Data Characteristics: Spectral Characteristics of Common Natural Objects; Atmospheric Effects on Remote Sensing Data; Spectral Signatures and Spectral Response Patterns; Resolutions of Remote Sensing Data; Characteristics of Raw Remote Sensing Data

Aerial Photos: Basic Infrastructure and specification of Aerial photographs; Types, Scale, Resolution; Geometric properties of Single Aerial Vertical Aerial Photo; Stereoscopy; Stereoscopic Parallax; Relief Displacement

Remote Sensing Data Interpretation: Nature of Qualitative Information and Sequence in Interpretation; Elements of Image Interpretation; Elements of Image Patterns–Landforms, Drainage, Erosion Details;

Reference & Text Books:

1. Campbell, J. B. (2002): *Introduction to Remote Sensing*. 5th ed. Taylor & Francis, London.
2. Cracknell, A. *et al.* (1990): *Remote Sensing Year Book*, Taylor and Francis, London.
3. Curran, P.J. (1985): *Principles of Remote Sensing*, Longman, London.
4. Deekshatulu, B.L. & Rajan, Y.S. (ed.) (1984): *Remote Sensing*. Indian Acd. of Science, Bangalore.
5. Floyd, F., Sabins, Jr. (1986): *Remote Sensing : Principles and Interpretation*, W.H. Freeman, New York.
6. Guham, P. K. (2003): *Remote Sensing for Beginners*. Affiliated East-West Press Pvt. Ltd., New Delhi.

7. Hallert, B. (1960): *Photogrammetry*, McGraw Hill Book Co. Inc.
8. Harry, C.A. (ed.) (1978): *Digital Image Processing*, IEEE Computer Society.
9. Hord, R.M. (1982): *Digital Image Processing of Remotely Sensed Data*, Academic Press, New York.
10. Leuder, D.R. (1959): *Aerial Photographic Interpretation: Principles and Application*. McGraw Hill, New York.
11. Lillesand, T.M. and Kiefer, R.W. (2000): *Remote Sensing and Image Interpretation*. 4th ed. John Wiley and Sons, New York.
12. Nag, P. (Ed.) 1992: *Thematic Cartography and Remote Sensing*, Concept Pub. Co., New Delhi.
13. Reeves, R.G. (ed.) (1983): *Manual of Remote Sensing*, Vols. 1 & 2, American Society of Photogrammetry & Remote Sensing, Falls Church, Virginia.
14. Siegel, B.S. and Gillespie, R. (1985): *Remote Sensing in Geology*, John Wiley and Sons, New York.
15. Silver, M. & Balmori, D. (eds.) (2003): *Mapping in an Age of Digital Media*. Wiley-Academy, New York & Chichester.
16. Spurr, R. (1960): *Photogrammetry and Photo Interpretation*, The Roland Press Co., London.
17. Survey of India, (1973): *Photogrammetry*, Survey of India, Dehradun.
18. Swain, P.H. and Davis, S.M. (ed.), (1978): *Remote Sensing: The Quantitative Approach*. McGraw Hill, New York.

GID103 - Fundamentals of GIS (5 Credits)

Basics: Definitions of GIS and Related Terms; Development of GIS; Components of GIS; Geographical Data Characteristics and GIS; Coordinate Systems, Datums and Projections in GIS.

Data Structures and Data Base Design: Digital representation of Geographic Data; Raster and Vector models for Geographic Data Representation and Conversion; Digitization—Methods and Errors; Topology Building; GIS Data Standards—Concepts and Components; Data and Information Sources for GIS; GIS Data Base Management Systems--Conceptual and Logical Data Modelling; Spatial Data Quality and Error Analysis; GIS Customization.

Application Methodologies: Spatial Analysis through GIS; DEM/DTM and Derivatives**;** Remote Sensing Data and GIS Integration; GIS Project Design and Planning Methodologies; GIS Information Products.

Reference & Text Books:

1. Bonham, Carter G.F. (1995): *Information Systems for Geoscientists – Modelling with GIS*. Pergamon, Oxford.
2. Burrough, P.A. and McDonnell, R. (1998): *Principles of Geographic Information Systems*. Oxford University Press, Oxford.
3. Chang, K.T. (2003): *Introduction to Geographic Information Systems*. Tata McGraw Hill Publications Co., New Delhi.
4. Demers, M. N. (2000): *Fundamentals of Geographic Information Systems*. John Wiley & Sons, Singapore.
5. Fraser Taylor, D.R. (1991): *Geographic Information Systems*. Pergamon Press, Oxford.
6. George, J. (2003): *Fundamentals of Remote Sensing*. Universities Press (Pvt.) Ltd, Hyderabad.

7. Girard, M. C. and Girard, C. M. (2003): *Processing of Remote Sensing Data*. Oxford & IBH, New Delhi.
8. Goodchild, M.F.; Park, B. O. and Steyaert, L. T. (eds.) (1993): *Environmental Modelling with GIS*. Oxford University Press, Oxford.
9. Heywood, I. (2003): *An Introduction to Geographical Information Systems*. 2nd ed. Pearson Publ. Co., Singapore.
10. Lo, C.P. and Yeung, A. K. W. (2002): *Concepts and Techniques of Geographic Information Systems*. Prentice Hall of India, New Delhi.
11. Longley, P. and Batty, M. (eds.) (1996): *Spatial Analysis: Modelling in a GIS Environment*. GeoInformation International, Cambridge.
12. Longley, P., Goodchild, M.F., Maguire, D. and Rhind, D. (1999): *Geographic Information Systems. Principles, Techniques, Management, Applications*. John Wiley & Sons, New York.
13. Maguirre, D. J.; Michael F. G. and David W. R. (1999): *Geographical Information Systems: Principles and Application*. Geo Information International, Vol.2, Longman Pub., New York.
14. Martin, D. (1996): *Geographic Information Systems: Socioeconomic Implications*. Routledge, London.
15. Michael F. G. and Karan K. K. (ed.) (1990): *Introduction to GIS*. NCGIA, Santa Barbara, California.
16. Ripple, W. J. (ed.) (1989): *Fundamentals of Geographic Information Systems: A Compendium*. ASPRS/ ACSM, Falls Church.
17. Star, J. and Estes, J. (1990): *Geographic Information Systems – An Introduction*. Prentice-Hall, Englewood Cliffs, New Jersey.
18. Worboys, M. F. (1995): *GIS, a Computing Perspective*. Taylor and Francis, London.

GID104 - Remote Sensing-I (3 Credits)

Identification of Forms and Features from Stereograms; Preparation of Thematic Maps from Remote Sensing Data—Lithology, Structure, Geomorphic Mapping; Land Use, Soils, Groundwater Potential Zones through on-screen digitization

GID105 – GIS-I (3 Credits)

Georeferencing; Creation of PGDB; Creation of Shape Files, Layers; On-Screen Digitization of Polygons, Points and Lines and adding Attributes; Conversions and Topology; Spatial Analysis

SECOND SEMESTER

GID201 - Advances in Remote Sensing and GIS (5 Credits)

Thermal and Microwave Remote Sensing: Factors affecting Thermal Imagery; Thermal Data Interpretation—Qualitative and Quantitative; Principles of Microwave Remote Sensing; Characteristics of Microwave Remote Sensing Data

Recent Advances in Remote Sensing: Hyperspectral Remote Sensing; LIDAR; Image Fusions; Object oriented classification; Digital Photogrammetry and Information Extraction Techniques

Spatial Analysis and Modeling; Network Analysis and Shortest Route Characteristics; Spatial Decision Support System; Multi-criteria Decision Analysis; Spatial Data Infrastructures (NSDIs)

Recent Advances in GIS: 3D Virtual GIS; Internet and WEB GIS; GPS in GIS Applications; Mobile Computing; Interoperability and Open GIS; Internet GIS; Cartographic Animation.

Reference and Text Books:

1. Campbell, J. B. (2002): *Introduction to Remote Sensing*. 5th ed. Taylor & Francis, London.
2. Curran, P.J. (1985): *Principles of Remote Sensing*, Longman, London.
3. Floyd, F., Sabins, Jr. (1986): *Remote Sensing : Principles and Interpretation*, W.H. Freeman, New York.
4. Guham, P. K. (2003): *Remote Sensing for Beginners*. Affiliated East-West Press Pvt. Ltd., New Delhi.
5. Harry, C.A. (ed.) (1978): *Digital Image Processing*, IEEE Computer Society.
6. Hord, R.M. (1982): *Digital Image Processing of Remotely Sensed Data*, Academic Press, New York.
7. Leuder, D.R. (1959): *Aerial Photographic Interpretation: Principles and Application*. McGraw Hill, New York.
8. Lillesand, T.M. and Kiefer, R.W. (2000): *Remote Sensing and Image Interpretation*. 4th ed. John Wiley and Sons, New York.
9. Reeves, R.G. (ed.) (1983): *Manual of Remote Sensing*, Vols. 1 & 2, American Society of Photogrammetry & Remote Sensing, Falls Church, Virginia.
10. Swain, P.H. and Davis, S.M. (ed.), (1978): *Remote Sensing: The Quantitative Approach*. McGraw Hill, New York.
11. Burrough, P.A. and McDonnell, R. (1998): *Principles of Geographic Information Systems*. Oxford University Press, Oxford.
12. George, J. (2003): *Fundamentals of Remote Sensing*. Universities Press (Pvt.) Ltd, Hyderabad.
13. Girard, M. C. and Girard, C. M. (2003): *Processing of Remote Sensing Data*. Oxford & IBH, New Delhi.
14. Heywood, I. (2003): *An Introduction to Geographical Information Systems*. 2nd ed. Pearson Publ. Co., Singapore.
15. Lo, C.P. and Yeung, A. K. W. (2002): *Concepts and Techniques of Geographic Information Systems*. Prentice Hall of India, New Delhi.

GID202 - Digital Image Processing (5 Credits)

Pre-processing Operations: History and Architecture of Computer; Digital Image, Digital Data Format, LUT; Image Restoration; Noise Reduction; Radiometric Correction of Data; Geometric Correction of Data; Linear and Non-linear Transformations for Geometric Corrections; Histogram Significance

Image Enhancements: Radiometric Enhancement; Spatial Enhancements; Contrast stretching—Linear and Non-linear Methods; Multi-band Enhancement Techniques—Band Ratios, Vegetation Indices, PCA, Spatial Filtering; Resolution Merge Techniques or Image Fusion

Thematic Information Extraction Procedures: Multi-spectral Patterns; Spectral Discrimination and Signature Bank; Parametric and Non-parametric Classifiers; Supervised and Unsupervised Classification Methods; Multi-date Data Analysis and Change Detection Processes, Accuracy Assessment

Reference and Text Books:

1. Campbell, J. B. (2002): *Introduction to Remote Sensing*. 5th ed. Taylor & Francis, London.
2. Cracknell, A. *et al*. (1990): *Remote Sensing Year Book*, Taylor and Francis, London.
3. Deekshatulu, B.L. & Rajan, Y.S. (ed.) (1984): *Remote Sensing*. Indian Acd. of Science, Bangalore.
4. Floyd, F., Sabins, Jr. (1986): *Remote Sensing : Principles and Interpretation*, W.H. Freeman, New York.
5. Harry, C.A. (ed.) (1978): *Digital Image Processing*, IEEE Computer Society.
6. Hord, R.M. (1982): *Digital Image Processing of Remotely Sensed Data*, Academic Press, New York.
7. Jensen, R.J. 1986 Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice Hall, Englewood Cliffs, NJ.
8. Lillesand, T.M. and Kiefer, R.W. (2000): *Remote Sensing and Image Interpretation*. 4th ed. John Wiley and Sons, New York.
9. Reeves, R.G. (ed.) (1983): *Manual of Remote Sensing*, Vols. 1 & 2, American Society of Photogrammetry & Remote Sensing, Falls Church, Virginia.
10. Siegel, B.S. and Gillespie, R. (1985): *Remote Sensing in Geology*, John Wiley and Sons, New York.

GID203 - Remote Sensing and GIS Applications (5 Credits)

Remote Sensing Applications: Natural Resource Mapping; Environmental Mapping and Monitoring; Geomorphic/Geological Mapping—Lithology and Structure; Mineral Resource Identification and Assessment; Land Use Mapping; Evaluation of Surface Water Resources; Ground Water Exploration; Flood Zones; Surface Runoff Estimation; Glacier Mapping; Disease and Stress Detection; Soils and Soil Salinity Mapping; Crop Types and Crop Yield Estimations.

GIS Applications: Rural and Urban Land Use; Rural and Urban Change; Rural and Urban Information System; GIS in Planning; Forest Fire Mapping; GIS in Health Services and Disease Mapping; Solid Waste Management; Wild Life Habitat Suitability Studies; Shortest Path Characteristics; Spatial Decision Support System.

Reference and Text Books:

1. Campbell, J. B. (2002): *Introduction to Remote Sensing*. 5th ed. Taylor & Francis, London.
2. Curran, P.J. (1985): *Principles of Remote Sensing*, Longman, London.
3. Floyd, F., Sabins, Jr. (1986): *Remote Sensing : Principles and Interpretation*, W.H. Freeman, New York.
4. Harry, C.A. (ed.) (1978): *Digital Image Processing*, IEEE Computer Society.
5. Hord, R.M. (1982): *Digital Image Processing of Remotely Sensed Data*, Academic Press, New York.
6. Lillesand, T.M. and Kiefer, R.W. (2000): *Remote Sensing and Image Interpretation*. 4th ed. John Wiley and Sons, New York.
7. Reeves, R.G. (ed.) (1983): *Manual of Remote Sensing*, Vols. 1 & 2, American Society of Photogrammetry & Remote Sensing, Falls Church, Virginia.
8. Siegel, B.S. and Gillespie, R. (1985): *Remote Sensing in Geology*, John Wiley and Sons, New York.
9. Swain, P.H. and Davis, S.M. (ed.), (1978): *Remote Sensing: The Quantitative Approach*. McGraw Hill, New York.

10. Bonham, Carter G.F. (1995): *Information Systems for Geoscientists – Modelling with GIS*. Pergamon, Oxford.
11. Burrough, P.A. and McDonnell, R. (1998): *Principles of Geographic Information Systems*. Oxford University Press, Oxford.
12. Fraser Taylor, D.R. (1991): *Geographic Information Systems*. Pergamon Press, Oxford.
13. Girard, M. C. and Girard, C. M. (2003): *Processing of Remote Sensing Data*. Oxford & IBH, New Delhi.
14. Goodchild, M.F.; Park, B. O. and Steyaert, L. T. (eds.) (1993): *Environmental Modelling with GIS*. Oxford University Press, Oxford.
15. Lo, C.P. and Yeung, A. K. W. (2002): *Concepts and Techniques of Geographic Information Systems*. Prentice Hall of India, New Delhi.
16. Longley, P. and Batty, M. (eds.) (1996): *Spatial Analysis: Modelling in a GIS Environment*. GeoInformation International, Cambridge.

GID204 - Remote Sensing-II (3 Credits)

Data Import; Geometric Corrections and Geo-referencing of Data; Enhancements; Subsetting; Vegetation Indices; Use of Filters and PCA; Supervised and Unsupervised Classifications; Map Composition; Microwave Data Processing and Interpretation; DEM/DTM creation and 3D Visualization and Virtual Image

GID205 – GIS-II (3 Credits)

Coverages in ArcInfo; Editing of Coverages; Source Data Registration; Spatial Modeling and Analysis; Query building; Network Analysis; TIN/DEM models and derivatives; 3D Virtual GIS; GPS and Total Station Survey and Plotting

GID206 - Project Work/Dissertation* (6 Credits)

To be finalized and assigned at the end of First Semester; laboratory and/or field work based; to be done in the department/elsewhere; to be submitted 35 to 45 days after the last theory/practical examination whichever is later but definitely 15 days before the reopening of the university after summer vacation

*__Specialization in__:

(i) GIS data organization and analysis
(ii) GIS Web Services
(iii) Natural Resource & Environment Mapping and Monitoring
(iv) Spatial Decision Support System
(v) Digital Image Analysis and Accuracy Assessment
(vi) Automated Information Extraction Methods
(vii) Rural and Urban Land Use Planning