Banaras Hindu University
Institute of Science, Department of Geography
One-Year P.G. Diploma in Remote Sensing and GIS
Course Outline, 2019-20

Semester-I

Paper Code	Type	Title	Credits
GID101	Theory	Fundamentals of Geography and Cartography	4
GID102	Theory	Principles of Remote Sensing	4
GID 103	Theory	Fundamentals of GIS	4
GID104	Practical	Remote Sensing-I	3
GID105	Practical	GIS-I	3
TOTAL			**18**

Semester-II

Paper Code	Type	Title	Credits
GID 201	Theory	Advances in Remote Sensing and GIS	4
GID 202	Theory	Digital Image Processing	4
GID 203	Theory	Remote Sensing and GIS Applications	4
GID 204	Practical	Remote Sensing-II	3
GID 205	Practical	GIS-II	3
GID 206	Project Work	Project Work/Dissertation*	4
TOTAL			**22**

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One-Year P.G. Diploma in Remote Sensing and GIS
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SEMESTER – I
GID101: Theory
Fundamentals of Geography and Cartography

Credits: 4
Number of Lectures: 52

Unit I
Lithosphere: Earth's interior and crust; Rocks; Vulcanism; Earthquakes; Faults, Folds and topography; Mountain building; Types of mountains.

Unit II
Geomorphic Processes and Landforms: Geomorphic processes: Weathering, mass movements, Erosion and deposition; Landforms in humid, arid, karst, glacial and coastal environments.

Unit III
Cultural Landscape: Human settlement: types, patterns and origin; Resources: concept, classification and appraisal; Population, resources and development interrelations; Natural hazards and disasters.

Unit IV
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, Alber's conical equal area, LCC, Mercator and UTM

Books Recommended
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. Ehrlich, P.R., Ehrlich, R.H. and Holdren, J.P., 1998 Ecoscience: Population, Resources and Development, Freeman & Co., San Francisco.
4. Mailing, D.H., 1973 Co-ordinate Systems and Map Projections, George Philip & Son Ltd.
5. Raisz, E., 1962 Principles of Cartography, McGraw Hill Books Co., Inc. NY.
6. Robinson A.H. et al., 2002 Elements of Cartography, John Wiley & Sons, NY.
7. Singh, R. L., Singh, K.N. and Singh, Rana P.B., (eds.) (1975): Readings in Rural Settlement Geography, National Geographical Society of India, Varanasi.
8. Sparks, B.W., 1960 Geomorphology, Longmans, London.
9. Strahler, A.N., 1971 The Earth Science, Harper and Row, NY.
10. Thakur, B. (ed.) (2004): Population, Resources and Development. Vol. II, Perspectives in Resource Management in Developing Countries. Concept Publishing. Company, New Delhi.
11. Thornbury, W.D., 2001, Principles of Geomorphology, John Wiley, NY.
12. Tiwari, R. C. (2000): Settlement Geography; in Hindi. Prayag Pustak Bhawan Allahabad.
13. Wood, M. (2005): Rural Geography: Processes, Responses and Experiences of Rural Restructuring. Sage Publication, London.

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SEMESTER – I
GID102: Theory
Principles of Remote Sensing

Credits: 4
Number of Lectures: 52

Unit I
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.

Unit II
Data Characteristics: Spectral characteristics of common natural and man-made objects; Atmospheric effects on remote sensing data; Spectral signatures and spectral response patterns; Resolutions of remote sensing data; Characteristics of raw remote sensing data

Unit III
Aerial Photos: Aerial Photos: types, scale, resolution; Geometric properties of single aerial, vertical aerial photo; Stereoscopy; Stereoscopic parallax; Relief displacement.

Unit IV
Basics of Data Interpretation: Nature of qualitative information and sequence in interpretation; Elements of image interpretation; Elements of image patterns: landforms, drainage, erosion details.

Books Recommended
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.

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SEMESTER – I
GID103: Theory
Fundamentals of GIS

Credits: 4
Number of Lectures: 52

Unit I
Basics: Development of GIS; Components of GIS; Basic terminologies connected with GIS; Geographical data characteristics and GIS; Coordinate systems, Datums and projections in GIS.

Unit II
Data Structures and Data Base Design: Digital representation of geographic data; Data models in GIS; Geographic data representation and conversion; Digitization: methods and errors; Topology building.

Unit III
GIS Data Standards and Modeling: 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.

Unit IV
Application Methodologies: Data compression techniques; Data interpolation; Spatial analysis through GIS; DEM/DTM models; Remote sensing data and GIS integration; GIS in project design and planning; GIS information products.

Books Recommended
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.

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SEMESTER – I
GID104: Practical
Remote Sensing-I

Credits: 3

Preparation of thematic maps from remote sensing data: lithology, structure, geomorphic mapping; Land use, soils, groundwater potential zones through on-screen digitization.

SEMESTER – I
GID105: Practical
GIS-I

Credits: 3
Number of Lectures: 52

Geo-referencing; Creation of PGDB; Creation of shape files, layers; On-Screen digitization of polygons, points and lines and adding attributes; Conversions and topology; Spatial analysis (In Arc-GIS and Q-GIS)

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SEMESTER – II
GID201: Theory
Advances in Remote Sensing and GIS

Credits: 4
Number of Lectures: 52

Unit I

Thermal and Microwave Remote Sensing: Factors affecting thermal imagery; Principles, characteristics and applications of thermal data; Principles, characteristics and applications of microwave data

Unit II

Recent Advances in Remote Sensing: Hyperspectral remote sensing; LIDAR; image fusions; Object oriented classification; Digital photogrammetry.

Unit III

Spatial Analysis and Modeling: Network analysis and shortest route characteristics; Spatial decision support system; Multi-criteria decision analysis; Spatial data infrastructures (NSDIs).

Unit IV

Recent Advances in GIS: 3D virtual GIS; Internet and Web-GIS; GPS in GIS applications; Mobile computing; Interoperability and open source GIS; Cartographic animation.

Books Recommended

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. Floyd, F., Sabins, Jr. (1986): *Remote Sensing : Principles and Interpretation*, W.H. Freeman, New York.
5. Guham, P. K. (2003): *Remote Sensing for Beginners*. Affiliated East-West Press Pvt. Ltd., New Delhi.
6. Hallert, B. (1960): *Photogrammetry*, McGraw Hill Book Co. Inc.
7. Harry, C.A. (ed.) (1978): *Digital Image Processing*, IEEE Computer Society.
8. Hord, R.M. (1982): *Digital Image Processing of Remotely Sensed Data*, Academic Press, New York.
9. Lillesand, T.M. and Kiefer, R.W. (2000): *Remote Sensing and Image Interpretation.* 4th ed. John Wiley and Sons, New York.
10. Spurr, R. (1960): *Photogrammetry and Photo Interpretation*, The Roland Press Co., London.
11. Swain, P.H. and Davis, S.M. (ed.), (1978): *Remote Sensing: The Quantitative Approach*. McGraw Hill, New York.
12. Bonham, Carter G.F. (1995): *Information Systems for Geoscientists – Modelling with GIS*. Pergamon, Oxford.
13. Burrough, P.A. and McDonnell, R. (1998): *Principles of Geographic Information Systems*. Oxford University Press, Oxford.
14. Chang, K.T. (2003): *Introduction to Geographic Information Systems*. Tata McGraw Hill Publications Co., New Delhi.
15. Demers, M. N. (2000): *Fundamentals of Geographic Information Systems*. John Wiley & Sons, Singapore.
16. Fraser Taylor, D.R. (1991): *Geographic Information Systems*. Pergamon Press, Oxford.
17. George, J. (2003): *Fundamentals of Remote Sensing*. Universities Press (Pvt.) Ltd, Hyderabad.
18. Girard, M. C. and Girard, C. M. (2003): *Processing of Remote Sensing Data.* Oxford & IBH, New Delhi.
19. Goodchild, M.F.; Park, B. O. and Steyaert, L. T. (eds.) (1993): *Environmental Modelling with GIS*. Oxford University Press, Oxford.

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20. Heywood, I. (2003): *An Introduction to Geographical Information Systems*. 2nd ed. Pearson Publ. Co., Singapore.
21. Lo, C.P. and Yeung, A. K. W. (2002): *Concepts and Techniques of Geographic Information Systems*. Prentice Hall of India, New Delhi.
22. Longley, P. and Batty, M. (eds.) (1996): *Spatial Analysis: Modelling in a GIS Environment*. GeoInformation International, Cambridge.
23. Longley, P., Goodchild, M.F., Maguire, D. and Rhind, D. (1999): *Geographic Information Systems. Principles, Techniques, Management, Applications*. John Wiley & Sons, New York.
24. Maguire, 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.
25. Martin, D. (1996): *Geographic Information Systems: Socioeconomic Implications*. Routledge, London.
26. Michael F. G. and Karan K. K. (ed.) (1990): *Introduction to GIS*. NCGIA, Santa Barbara, California.
27. Ripple, W. J. (ed.) (1989): *Fundamentals of Geographic Information Systems: A Compendium*. ASPRS/ ACSM, Falls Church.
28. Star, J. and Estes, J. (1990): *Geographic Information Systems – An Introduction*. Prentice-Hall, Englewood Cliffs, New Jersey.
29. Worboys, M. F. (1995): *GIS, a Computing Perspective*. Taylor and Francis, London.

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SEMESTER – II
GID202: Theory
Digital Image Processing

Credits: 4
Number of Lectures: 52

Unit I
Basic Operations: Digital image, digital data format, LUT; Image restoration; Noise reduction; Data registration, rectification and resampling; Histogram significance.

Unit II
Image Enhancements: Correction of data: Radiometric and geometric. Radiometric enhancement; Spatial enhancements; Multi-band enhancement techniques: band ratios, vegetation indices, PCA, spatial filtering; Resolution merging techniques.

Unit III
Classification Methods: Pattern recognition; Supervised, unsupervised, object oriented and hybrid classification methods; Contrast stretching: linear, non-linear methods and histogram equalization.

Unit IV
Information Extraction Procedures: Multi-spectral patterns; Signature bank; Parametric and non-parametric classifiers; Multi-date data analysis and change detection processes, accuracy assessment.

Books Recommended
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.
11. Swain, P.H. and Davis, S.M. (ed.), (1978): *Remote Sensing: The Quantitative Approach.* McGraw Hill, New York.

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SEMESTER – II
GID203: Theory
Remote Sensing and GIS Applications

Credits: 4
Number of Lectures: 52

A. Remote Sensing Applications
Unit I
Natural Resource mapping; Environmental mapping and monitoring; Geomorphic/geological mapping: lithology and structure; Mineral resource identification and assessment; Land use mapping;

Unit II
Evaluation of surface water resources; Ground water exploration; Flood zones; Surface runoff estimation; Glacier mapping: inventory and retreat; Soils and soil salinity mapping.

B. GIS Applications
Unit III
Rural and urban land use and information system; Crop types and crop yield estimations: disease and stress detection; rural and urban planning; Forest fire mapping.

Unit IV
GIS in health services and disease mapping; Solid waste management; Wild life habitat suitability studies; Shortest path characteristics; Spatial decision support system.

Books Recommended
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. 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. Lillesand, T.M. and Kiefer, R.W. (2000): *Remote Sensing and Image Interpretation*. 4th ed. John Wiley and Sons, New York.
8. Reeves, R.G. (ed.) (1983): *Manual of Remote Sensing*, Vols. 1 & 2, American Society of Photogrammetry & Remote Sensing, Falls Church, Virginia.
9. Siegel, B.S. and Gillespie, R. (1985): *Remote Sensing in Geology*, John Wiley and Sons, New York.
10. Swain, P.H. and Davis, S.M. (ed.), (1978): *Remote Sensing: The Quantitative Approach*. McGraw Hill, New York.
11. Bonham, Carter G.F. (1995): *Information Systems for Geoscientists – Modelling with GIS*. Pergamon, Oxford.
12. Burrough, P.A. and McDonnell, R. (1998): *Principles of Geographic Information Systems*. Oxford University Press, Oxford.
13. Fraser Taylor, D.R. (1991): *Geographic Information Systems*. Pergamon Press, Oxford.
14. Girard, M. C. and Girard, C. M. (2003): *Processing of Remote Sensing Data*. Oxford & IBH, New Delhi.
15. Goodchild, M.F.; Park, B. O. and Steyaert, L. T. (eds.) (1993): *Environmental Modelling with GIS*. Oxford University Press, Oxford.
16. Lo, C.P. and Yeung, A. K. W. (2002): *Concepts and Techniques of Geographic Information Systems*. Prentice Hall of India, New Delhi.
17. Longley, P. and Batty, M. (eds.) (1996): *Spatial Analysis: Modelling in a GIS Environment*. GeoInformation International, Cambridge.

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SEMESTER – II
GID204: Practical
Remote Sensing-II

Credits: 3

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 (in ERDAS Imagine and ENVI software).

SEMESTER – II
GID205: Practical
GIS-II

Credits:3

Coverages in Arc-Info; Editing of coverages; Source data registration; Spatial modeling and analysis; Data interpolation; Data integration; Query building; Network analysis; TIN/DEM models and derivatives; 3D virtual GIS; DGPS and total station survey and plotting in GIS.

SEMESTER – II
GID206: Practical
Project Work/Dissertation*

Credits:4

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 and 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