Annexure - 4

DEPARTMENT OF GEOGRAPHY, MAHARSHI DAYANAND UNIVERSITY, ROHTAK
(NAAC Accredited 'A+' Grade University)
Scheme of Examination For
PG DIPLOMA IN REMOTE SENSING AND GIS (PGDRG1)
Session: 2023-24 onwards

First Semester: (Total Credits - 24)

Sr. No.	Course Code	Nomenclature	Hours / Week (L+T+P)	Maximum Marks			Examination Hours	Credits
				Internal	End Semester	Total		
01	23GEOD101DS01	Air Photo and Remote Sensing Techniques	04(4+0+0)	30	70	100	03	4
02	23GEOD101DS02	Geographical Information System	04(4+0+0)	30	70	100	03	4
03	23GEOD101DS03	Global Navigation Satellite System	04(4+0+0)	30	70	100	03	4
04	23GEOD101DS04	Statistical Analysis using R and Python	04(4+0+0)	30	70	100	04	4
05	23GEOD101DS05	Practical: Air Photo and Satellite ImageInterpretation	08 / Student	30	70	100	03	4
06	23GEOD101SE01	Practical: Geographical Information System	08 / Student	30	70	100	04	4

Annexure 4

Name of the Department: Geography
Name of the Course:Air Photo and Remote Sensing Techniques
Semester-I

Course Code	23GEOD101DS01	Course Credits	4 (L: 4 T: 0 P: 0)
Max. Marks	100{External (term-end exam) – 70}(Internal – 30)	Time of end term examination	3 Hours

Note: The question paper will have five units. The unit first shall be compulsory and shall contain 07 short answer type questions covering the entire syllabus. Rest of the four units of question paper will contain two questions from each unit of the syllabus. Candidate(s) are required to attempt one question from each unit. All questions carry equal marks.

Learning Objectives:
The course is designed to:
1. impart the knowledge about aerial photographs and photogrammetry
2. introduce the basic concepts and significance of photogrammetry
3. impart the knowledge about concepts and significance of remote sensing techniques
4. know the sensor characteristics of various remote sensing systems
5. impart the knowledge about the Indian Remote Sensing satellites

Learning Outcomes:
Students would be able to:
1. know about various aspects of aerial photographs and photogrammetry
2. understand the basic concepts and significance of photogrammetry
3. know the concepts and significance of remote sensing techniques
4. enhance their knowledge about sensor characteristics of various remote sensing systems
5. know the characteristics of Indian remote sensing satellites

Unit - I

Aerial Photography: History and development; Classification of aerial photographs; Availability and procurement of aerial photographs in India,Photogrammetry: Concept; Principles; History and significance;Measurement of photo scale; Elements of photographic interpretation

Unit – II

Satellite Remote Sensing: Basic concept; Principles; Historical development and significance; Stages of remote sensing, Electromagnetic radiation: Energy interaction in the atmosphere; Energy interaction with earth surface features,Remote sensing platforms: Types and characteristics, Satellite orbits: Near polar and geostationary orbits, Sensors: Types, specifications; resolutions and scanning system

Unit – III

Types of remote sensing: Active and passive,Microwave remote sensing: Basic concept; principles; radar system;radar imaging andaffecting factors,Thermal remote sensing:Basic principles; characteristics and limitations, Hyperspectral remote sensing: Basic concept; hyperspectral sensors; platforms and sensor specifications

Unit – IV

Remote Sensing Satellite Series: Indian satellites- JIRS; GSAT; CARTOSAT; Chandrayana, Foreign Satellite: Landsat; Sentinal; SPOT; GeoEye

Suggested Readings:

1. Chandra, A.M. and S.K. Ghosh. 2006. *Remote Sensing and Geographical Information System,*Narosa Publishing House, New Delhi.
2. Chaunial, D.D. 2016. *Principles of Remote Sensing and Geographical Information System (In Hindi),* Sharda Pustak Bhawan, Allahabad.
3. Floyd F. Sabins Jr.; James M. Ellis. 2020. *Remote Sensing: Principles, Interpretation, and Applications,* Waveland Press, Inc. USA.
4. James B. Campbell; Randolph H Wynne, Valeria A Thomas.; 2023. *Introduction to Remote Sensing,* The Guilford Press, New York.
5. Joseph, G. Jeganathan C. 2018. *Fundamentals of Remote Sensing,* The Orient Blackswan; New Delhi.

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Name of the Department: Geography
Name of the Course:Geographical Information System
Semester-I

Course Code	23GEOD101DS02	Course Credits	4 (L: 4 T: 0 P: 0)
Max. Marks	100{External (term-end exam) – 70} (Internal – 30)	Time of end term examination	3 Hours

Note: The question paper will have five units. The unit first shall be compulsory and shall contain 07 short answer type questions covering the entire syllabus. Rest of the four units of question paper will contain two questions from each unit of the syllabus. Candidate(s) are required to attempt one question from each unit. All questions carry equal marks.

Learning Objectives:
The course is designed to:
1.impart the knowledge about fundamental conceptsof GIS
2. enhance the understanding about spatial data structure and their characteristics
3. impart the knowledge about basic functions of GIS
4. develop the skills of geographical thinking
5. develop the skills of spatial data handling and analysis

Learning Outcomes:
Students would be able to:
1. understand the basic concept of GIS
2. acquaint withthe structure and characteristics of spatial data
3. learn the skills of spatial data handling and processing in GIS
4. learn aboutthe modern components and progress in the field of GIS
5. have the skill of effective decision making and real-world problem solving

Unit - I

Introduction to GIS: Meaning;Concept;History andDevelopment;Scope and significance of GIS;Componentsand basic functions of GIS; Integration of remote sensing and GIS; GIS interface with global positioning system; Significance of GIS in geography

Unit – II

GIS data characteristics and sources:Nature; Types; Sources; Accessibility and availability, Spatial data models and structures: Object based and field-based model; Raster and vector structure of spatial data, Spatial data quality issues and errors: Accuracy; Precision and resolution; Consistency and completeness; Types and sources of error

Unit – III

GIS Database structure and Data base management system: Hierarchical; Network and relational database structure, Spatial data analysis: Buffering techniques; Overlay analysis; Spatial interpolation and Surface modelling

Unit – IV

Recent trends in GIS:Open-source GIS platforms; software and libraries; Web based geodatabase; Spatial decision support system: Introduction;Concept and applications; Web & internet GIS: Introduction, development, applications and significance, Virtual GIS: Introduction;Concept and applications, GIS education in India:Issues; progress and challenges

Suggested Readings:

1. Bhatta B. 2023. *Remote Sensing and GIS,*Oxford University Press, New Delhi.
2. Chang, K.T.2019. *Introduction to Geographic Information Systems,* Tata McGraw-Hill Publishing Company Ltd, New York.
3. Pinde F. 2022.*Getting to Know Web GIS,* Esri Press, California USA.
4. Paul B. 2019. *GIS Fundamentals: A First Text on Geographic Information Systems,*Eider Press, USA.
5. Reddy, M. A. 2012. *Remote Sensing and Geographic Information Systems*, B S Publications, Hyderabad.

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Name of the Department: Geography

Name of the Course:Global Navigation Satellite System

Semester-I

Course Code	23GEOD101DS03	Course Credits	4 (L: 4 T: 0 P: 0)
Max. Marks	100{External (term-end exam) – 70} (Internal – 30)	Time of end term examination	3 Hours

Note: The question paper will have five units. The unit first shall be compulsory and shall contain 07 short answer type questions covering the entire syllabus. Rest of the four units of question paper will contain two questions from each unit of the syllabus. Candidate(s) are required to attempt one question from each unit. All questions carry equal marks.

Learning Objectives:

The course is designed to:

1.impart basic knowledge of GNSS.
2.expose the students about components, operations, functions of GNSS & data capture.
3.enhance the skills in spatial data analysis.
4.learn of tools and techniques for real-time data-based applications.
5.develop skills for solving various societal problems.

Learning Outcomes:

Students would be able to:

1. know historical development of navigation
2. understand the mechanism behind the working of navigation systems
3. learn and understand various data collection methods and techniques
4. analyze variations in spatial and non-spatial data
5. learn use of navigation instruments for field operations

Unit - I

GNSS: Concept and Characteristics; Historical background; Segments; Features of navigation satellites, Principles of operation

Unit – II

Geodesy and Signals: Satellite Geodesy; Datum; Co-ordinate Systems related to GNSS; Signals; Receivers and Antennas; Sources of Errors

Unit – III

Global Satellite Navigation Systems:GPS; GLONASS;GALILEO; BEIDOU;IRNSS; QZSS

Unit – IV

Augmentation Systems: Satellite Based Augmentation System (SBAS); Ground Based Augmentation System (GBAS); Aircraft-Based Augmentation System (ABAS); Location-based Services: Practical Applications

Suggested Readings:

1. Alfred, L. 2004. *GPS Satellite Surveying*, John Wiley & Sons, Inc., Hoboken, NewJersey.
2. Bhatta B. 2010.*Global Navigation Satellite Systems Insights into GPS, GLONASS, Galileo, Compass, and others*, BS Publications Hyderabad.
3. Gopi, S. 2005. *Global Positioning System Principles and Applications*. Tata McGraw-Hill, New York.
4. Kennedy, M. 2002. *The Global Positioning System and GIS: An Introduction*, Taylor and FrancisInc. New York.
5. Rabbany, A.El. 2002. *Introduction to GPS The global Positioning System*. Artech House Boston. London.

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Name of the Department: Geography

Name of the Course: Statistical Analysis using R and Python (Sem 1)

Course Code	23GEOD101DS04	Course Credits	4 (L: 4 T: 0 P: 0)
Max. Marks	100{External (term-end exam) – 70} (Internal – 30)	Time of end term examination	3 Hours

Note: The question paper will have five units. The unit first shall be compulsory and shall contain 07 short answer type questions covering entire. Rest of the four units of question paper will contain two questions from each unit of the syllabus. Candidate(s) are required to attempt one question from each unit. All questions carry equal marks.

Learning Objectives:

The course designed to:

1.expose the students on basics statistics.
2.enhance the capability of understanding of matrix.
3.impartthe basics of R Statistical Software.
4.develop the skills ofstatistical analysis.
5.understand the importance of statistics for decision making.

Learning Outcomes:

Students would be able to:

1. understand the basics of statistics.
2. know the different types of data sets and their presentation.
3. learn programming with python.
4.understandthe basics ofR Statistical Software.
5. learnthe basics functions of R Statistical Software.

Unit - I

Basic Statistics: Presentation of Data, Measures of Central Tendency and Dispersions, Skewness and Kurtosis; Correlation Co-efficient, Linear Regression and Prediction, Fitting of Curves; Analysis and Consistency of Categorical Data.

Unit – II

Introduction to R software: Basics Concepts, Matrix notation; Matrix transposition; Matrix summation; Matrix addition and subtraction; Matrix multiplication; Polynomial equation; Determinants of matrix.

Unit – III

Introduction to R software: Basics Concepts, Data Objects in R, Creating Vectors, Creating Matrices, Data Frame, Manipulating Data,Univariate and Multivariate Analysis, Measures Mean, Median, Variance, Covariance and Correlation.

Unit – IV

Report writing: Identification of research problem; review of literature; database and research methodology; research ethics and report writing; reference and citation writing formats.

Suggested Readings:

1. Bhatta, B.2020. Remote Sensing and GIS, Oxford University Press, New Delhi.
2. Maheta, D. 2021. *Data Analysis Using R: A Primer for Data Scientist*, Narosa Publishing House, New Delhi.
3. McKinney, W. 2013. *Python for Data Analysis,*O'Reilly Media, USA.
4. Peter A. Rogerson, 2020. *Statistical Methods for Geography:A Student's Guide,*SAGE Publications Ltd, New Delhi.
5. Shirvastava, V.K. & Prasad, M. 2007. Statistical Methods in Geography (in Hindi), VasundharaPrakashan, Gorakhpur.

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Name of the Department: Geography

Name of the Course:: Practical : Air Photo and Satellite Image Interpretation

Semester-I

Course Code	23GEOD101DS05	Course Credits	4 (L: T: 0 P: 8)
Max. Marks	100{External (Written Test: 60; Viva Voce:10) – 70} {Internal (Attendance: 5; Lab Record File 25) – 30}	Time of end term examination	4 Hours

Note: (i)The question paper shall contain eight questions in all, including two questions from each unit. Candidate(s) are required to attempt four questions in all selecting at least one question from each unit. All questions carry equal marks.

(ii)Candidates shall produce their lab work record before the Board of Examiners forevaluation at the time of their viva-voce examination.

Learning Objectives:

The course is designed to:

1. impart understanding of the basics of photogrammetry
2. acquaint the students about the principles and methods of aerial photo interpretation
3. develop the skills on image interpretation
4. make familiar with the kinds of satellite images
5. develop the skills of geographical thinking

Learning Outcomes:

Students would be able to:

1. learn the basic concepts and significance of photogrammetry
2. understand the principles and methods of measurement from aerial photographs
3. explore the usefulness of satellite data
4. learn the interpretation techniques of satellite image
5. understand the geography through geospatial technology products

Unit - I

1.1. Stereo vision test, orientation of stereo model under mirror stereoscope
1.2. Determination of scale on an aerial photograph
1.3. Preparation of Index map
1.4. Preparation of stereogram and stereo triplet
1.5. Preparation of air photo mosaic

Unit – II

2.1. Measurement of height of an object on single vertical aerial photograph
2.2. Identification, mapping and interpretation of natural features with the help of air photos
2.3.Identification, mapping and interpretation of cultural features with the help of air photos
2.4. Land use mapping and measurement with the help of air photos
2.5. Field checking, observation and accuracy assessment of land use mapping

Unit – III

3.1. Kinds of satellite images
3.2. Study of a satellite image annotation
3.3. Satellite data products: Types and characteristics
3.4. Marking of basic elements of image interpretation on satellite image
3.5. Interpretation of satellite image

Unit – IV

4.1. Identification and mapping of natural features on satelliteimage
4.2.Identification and mapping of cultural features on satellite image
4.3. Identification and mappingof natural & cultural features on satellite image
4.4. Land use/land cover mapping
4.5.Field checking, observation and accuracy assessment

Suggested Readings:

1. Chauniyal, D.D. 2016. *Principles of Remote Sensing and Geographical*

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InformationSystem(Hindi version), ShardaPustakBhawan, Allahabad.
2. Chandra, A.M. and S.K. Ghosh. 2006. *Remote Sensing and Geographical Information System,*Narosa Publishing House, New Delhi.
3. Joseph, G. Jeganathan C. 2018. *Fundamentals of Remote Sensing,*The Orient Blackswan; New Delhi.
4. Paul R. Wolf, Paul Wolf, Bon A. DeWitt, Benjamin E. Wilkinson. 2013.*Elements of Photogrammetry with Application in GIS,*McGraw Hill LLC, New York
5. Wolf, Paul. R. Dewitt, Bon. A. Wilkinson, Benjamin E.2014. *Elements of Photogrammetry with Applications in GIS,* McGraw-Hill, New York

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Name of the Department: Geography
Name of the Course:Practical : Geographical Information System
Semester-I

Course Code	23GEOD101SE01	Course Credits	4 (L: T: 0 P: 8)
Max. Marks	100{External (Written Test: 60; Viva Voce:10) – 70} {Internal (Attendance: 5; Lab Record File 25) – 30}	Time of end term examination	4 Hours

Note: (i)The question paper shall contain eight questions in all, including two questions from each unit. Candidate(s) are required to attempt four questions in all selecting at least one question from each unit. All questions carry equal marks.
(ii)Candidates shall produce their lab work record before the Board of Examiners forevaluation at the time of their viva-voce examination.

Learning Objectives:
The course is designed to:
1. develop the basic knowledge ofGIS
2. understand the principles and methods of GIS
3. introduce the kinds of GIS data types, structures and formats
4.develop the skillsin spatial data handling
5. inculcate geographical thinking through data processing

Learning Outcomes:
Students would be able to:
1. know the basic concepts and significance of GIS
2. understand the principles and methods of measurementsin GIS
3. explore the usefulness of GIS
4. learn the geographical data handling and processing in GIS
5. understand and solve the real-world problems

Unit – I

1.1.Data import and export
1.2. Geocoding, georeferencing and reprojection of spatial data
1.3. Digitization of geographic features
1.4. Linking attribute data with spatial data
1.5. Spatial data encodingand geodatabase creation

Unit – II

2.1. Parcel fabric making and editing
2.2. Vector overlay operations
2.3.Raster overlay operations
2.4. Building topology
2.5. Buffering analysis

Unit – III

3.1. Generation of digital terrain model
3.2.Generation of digital surface model
3.3. Spatial interpolation by IDW and Kriging methods
3.4. Watershed delineation and characterization
3.5. Calculation of flow accumulation, direction and stream ordering

Unit – IV

4.1. Network analysis: Network tracing, routing and allocation
4.2.Measurement in GIS: Distance; area; shape; volume and density
4.3. Vector data query building
4.4. Raster data query building
4.5.Map layout design: Quantitative and qualitative

Suggested Readings:
1. A.M. and S.K. Ghosh. 2006. *Remote Sensing and Geographical Information System,*Narosa

Publishing House, New Delhi.
2. Bhatta B. 2023. *Remote Sensing and GIS*, Oxford University Press, New Delhi.
3. Cynthia A. B. 2015. *Designing Better Maps: A Guide for GIS Users*, Esri Press, California USA.
4. Gopi S, R. Sathikumar, N. Madhu. 2018. *Advances Surveying: Total Station, GPS, GIS and Remote Sensing*, Person India Education Services Pvt. Ltd, Noida 201309, Uttar Pradesh, India.
5. Saha K., Yngve K. F. 2022. *Learning GIS Using Open Source Software: An Applied Guide for Geo-spatial Analysis*, Routledge New York.

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