



Gondwana University, Gadchiroli

DIRECTION NO 31 of 2023

Admission of Students and Conduct of Examinations Leading to the Award of One Year Diploma Program entitled “Diploma in Geographical Information System (GIS)” under Credit System in the Faculty of Science & Technology, Direction 2023”

Whereas, The Maharashtra Public Universities Act, 2016 (Maharashtra Act No. VI of 2017) (hereinafter the "Act") governs the Gondwana University, Gadchiroli (hereinafter the "University");

AND

Whereas, the National Education Policy (NEP) 2020 focuses on education and skill development as per the needs of the community. Therefore, the University is introducing one-year Diploma Programme entitled “**Diploma in Geographical Information System (GIS)**” under credit system in the Faculty of Science & Technology and it will be offered by the Model Degree College, a constituent college of the University;

AND

Whereas, as per provisions of section 73(1) of the Act, an ordinance is required to frame to lay down the conditions under which students can be admitted to courses of study for award of a Diploma but since, making of an ordinance is a time-consuming process and there is an urgency for introduction of one-year Diploma Programme entitled “**Diploma in Geographical Information System (GIS)**” under credit system in the Faculty Science & Technology;

Now, therefore, I, Dr. Prashant Shridhar Bokare, Vice-Chancellor of the University, in exercise of my powers under section 12(8) of the Act, do hereby issue the following Directions.

This Direction shall be called **Admission of Students and Conduct of Examinations Leading to the Award of One Year Diploma Program entitled “Diploma in Geographical Information System (GIS)” under Credit System in the Faculty of Science & Technology, Direction 2023”**

1. This direction shall come into force from the date of its issuance.
2. Definitions: -In this Direction, unless the context requires otherwise, the words and phrases shall have the meaning given hereunder.
 - a) “Program” means the full-time one-year Diploma entitled “**Diploma in Geographical Information System (GIS)**” “Application Form” means a form prescribed by the University for seeking admission to Program under this direction.
 - b) “Competent Authority” means the Authority appointed by the Vice-Chancellor, for any specific purpose of the Program under this Direction.
 - c) "Course" means a subject or a paper offered in any semester under this Program.
 - d) “Credit” refers to the weightage given to a course, in terms of the number of instructional hours per week assigned to it. In this direction one credit means one hour of teaching work or two hours of practical work.
 - e) “Credit System” means, the system in which weightage of credits is spread over to different semesters during the period of study.
 - f) 'Grade letter' is an index to indicate the performance of a student in particular course. It is the depiction of actual marks secured by a student by a letter, the Grade letters are as given in **Table**
 - g) 'Grade point' is the weightage allotted to each grade letter depending on the range of marks awarded in a course.

- h) “Qualifying Examination” means an examination on the basis of which a candidate becomes eligible for admission to this Program.
- In order to conduct the admission process for admitting students to this Program, the Vice Chancellor shall appoint the “Competent Authority”.
 - Intake capacity, Eligibility for application, Admission fees, Curriculum, Examination fees for this Program will be as shown in Table 1 below:

Table: 1

Sr. No.	Subtitle	Details
1	Intake Capacity	20
2	Eligibility for application	Any Graduation
3	Admission Fees	Admission fees shall be as prescribed/ revised and notified from time to time by the University.
4	Curriculum	As specified in Annexure-I
5	Examination Fees	The Examination fees shall be as prescribed/ revised and notified from time to time by the University.

5. Objectives of the Program: -

- This course aims to impart proficiency in Geographical Information System (GIS).
- Foster Problem-solving skill using data structure and enable data analysis.
- Instill visualization techniques for applied statistics and computing and advanced surveying and field work.

6. EVALUATION OF THE PROGRAM

The internal and university assessment of student performance shall be carrying the weightage as mentioned in the Teaching and Examination Scheme given below:

Table 2: Teaching and Examination Scheme

“Diploma in Geographical Information System (GIS)”

Teaching & Examination Scheme

Semester - I

Sr.No.	Subject	Cre dit	Teaching scheme Hrs/week			Examination Scheme Total Marks The./Pra.									
			Theory Period	Pra. Period	Total	Theory				Practical					
						Duration Hrs.	Max. Theory		Total	Min Pass	Du. Hrs	Max Marks		Min.Pass Marks	Total Marks
							UA	CA				UA	CA		
1	Fundamentals of Remote Sensing & Photogrammetry	4	4	-	4	3	80	20	100	40	-	-	-	-	100
2	Fundamentals of GIS & GPS	4	4	-	4	3	80	20	100	40	-	-	-	-	100
3	Database Management System: Concept & Methods	4	4	-	4	3	80	20	100	40	-	-	-	-	100
4	Applied Statistics and computing	4	4	-	4	3	80	20	100	40	-	-	-	-	100
5	Practical in Spatial Data Processing	4	-	8	8	3					3	60	40	50	100
Total		20	16	8	28	15	320	80	400	160	3	60	40	50	500

Semester - II

Sr. No.	Subject	Credit	Teaching scheme Hrs/week			Examination Scheme Total Marks The./Pra.									
			Theory Period	Pra. Period	Total	Theory					Practical				
						Duration Hrs.	Max. Theory		Total	Min Pass	Dur. Hrs.	Max Marks		Min. Pass Marks	Total Marks
							UA	CA				UA	CA		
1	Digital Image Processing	4	4	-	4	3	80	20	100	40					100
2	Geospatial analysis:	4	4	-	4	3	80	20	100	40					100
3	Open Source GIS	4	4	-	4	3	80	20	100	40					100
4	Advanced Surveying And Field Work	4		8	8	2	-	-	-	-	2	60	40	50	100
5	Practical in Digital Image Processing	2	-	4	4	-					3	30	20	25	50
6	Practical in Geospatial analysis	2	-	4	4	-					3	30	20	25	50
7	Project Work	4		8	8	-							100	50	100
Total		24	12	24	36	11	240	60	300	-	8	120	180	-	600

Note:

1. Th=Theory; Pr = Practical; PR=Project; INT=Internship IA = Internal Assessment UA = University Assessment.
 Credit Calculations: (1) One credit would mean equivalent of 15 periods of 60 minutes each for Theory.(2) For practical /project /internship/Field work, the Credit Weightage for equivalent hours shall be 50% of that for theory. (3) The strength of Batch of Practical /Workshop / Field visit / Project shall be 20. (4) 10 contact hours equals to 3 credits per semester and 6 credits for two semesters viz one year duration for Project/Field Visit/Industrial Training/Internship

*On Job Training

a. Marks to Letter Grade & Grade Point Conversion

The marks scored by the examinees in their courses/heads of passing of the program shall be converted into Letter Grade and Grade Point as per Table given below:

Table 3: Conversion of marks into letter grade and grade points

SCORED MARKS (x)	Letter Grade	Grade Point (G) (10 point scale)
$85 \leq x \leq 100$	A+	10
$80 \leq x < 85$	A	9
$75 \leq x < 80$	B+	8
$70 \leq x < 75$	B	7
$65 \leq x < 70$	C+	6
$60 \leq x < 65$	C	5
$50 \leq x < 60$	D	4
$0 \leq x < 50$	F	0
Absent in Examination	Z	-

*Note: As such, the lowest passing Grade in any passing head shall be 'D'.

b. Calculation of Grade Point Average (GPA)

The Grade Point Average (GPA) shall be calculated for the program and shall be evaluated as mentioned below:

$$GPA = \frac{\sum_{i=1}^n (C_i \times G_i)}{\sum_{i=1}^n C_i}$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

The percentage of marks scored based on obtained GPA can be evaluated using below given formula.

$$\text{Percentage} = (\text{GPA} - 0.75) * 10$$

8. Division of Passing

The Division of Passing shall be based on GPA secured by an Examinee as shown in the Table 3 below:

Table 3: Interpretation of GPA into Division of Passing

INTERVAL OF GPA	DIVISION OF PASSING
$GPA \geq 8.25$	First with Distinction
$6.75 \leq GPA < 8.25$	First
$6.00 \leq GPA < 6.75$	Second
$5.00 \leq GPA < 6.00$	Pass

9. Declaration of result is based on the Grade Point Average (GPA) earned towards the end of the program as given in Table 3. The names of the successful examinees passing the examination as a whole in the minimum prescribed period and obtaining prescribed number of places securing the grades as per adopted credit-grade system shall be arranged in order of merit as provided in ordinance relating to examinations in general.
10. Provisions with respect to grace marks for passing in a particular course/ head of passing and improvement of Division (Higher Class) and getting Distinction in any course shall be as per relevant Direction/Ordinance of the University.
11. An examinee who does not qualify in examination or remain absent for the examination, shall be eligible to appear in the same re-examination, on payment of re-examination fee and such other fees as may be prescribed from time to time, within 30 days from the date of result.
12. Successful examinees who secure minimum prescribed registered credits (44) for the program duration shall be entitled to receive a Diploma of full time six months diploma entitled "**Diploma in Geographical Information System (GIS)**" in the Faculty of Science & Technology signed by the Vice Chancellor of the University on payment of prescribed fees.
13. In the event of any query regarding interpretation/application of any provision of this direction, the Director of Board of Examinations and Evaluation shall refer the matter for the decision of the Dean of the Faculty of Science & Technology or alternatively to the Board of Deans if found necessary.
14. For any other matter pertaining to this Program and its final award which is beyond the purview of this Direction, it shall be referred to the Vice-Chancellor and that the decision of the Vice-Chancellor shall be final and binding on all the concerned.

Place: Gadchiroli

Date: / /2023



(Dr. Prashant S. Bokare)

Vice-Chancellor

Syllabus
Semester I

Code: GR 101 Fundamentals of Remote Sensing and Photogrammetry		
No. of Credits: 04		No. of Lectures:
60		
Sr. No.	Topic	Lectures
1	Introduction to Remote Sensing: Concepts, Definition, History Development, Stages in RS-EMR, EMR Spectrum, Theories of EMR, Types of RS and Laws of Radiation, basic of solar radiation	8
2	Interaction of EMR: Interaction with Earth's Atmosphere and Atmospheric window	8
3	Spectral Signature: Interaction with Soil, Water and Vegetation	6
4	Platforms, Sensors, Orbits: Types of Platform, Types of Sensors, Cameras and Satellite Orbits	8
5	Data Products: Satellite Data Generation, Type of data Formats and Aerial Photography Products, FCC & TCC images and its applications	8
6	Aerial Photography: Introduction to Aerial Photography and Basic Photogrammetry	4
7	Measurements: Geometry of Aerial Photographs, Determination of Scale, Height on Aerial Photograph	4
8	Aerial Photo and Image Interpretation: Interpretation of Aerial Photos: Single, Vertical Stereo Pairs. Interpretation of Satellite Imagery: Derived From PAN, LISS, Wifs, OCM Sensors. Study and Visual Interpretation of Satellite Images for Physical Features, Urban, Forest and Agricultural Uses	4
9	Field Work/Study Tour: Identification of Features in the Field Using Aerial Photographs and/or Satellite Images	4

Books:

1. Joseph, G. (2004): Fundamentals of Remote Sensing, Universities Press, Hyderabad, India
2. Lillesand, T. M., Kiefer, R. W. and Chipman, J. W. (2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
3. Sabins, F. F. (1996): Remote Sensing: Principles and Interpretation, W. H. Freeman and Company, San Francisco
4. Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
5. Drury, S. A. (2001): Image Interpretation in Geology, Blackwell, Oxford
6. Campbell, J. (2002): Introduction to Remote Sensing, Taylor & Francis, London
7. Anji Reddy, M. (2008): Textbook of Remote Sensing and Geographic Information System, B.S. Publication Hyderabad
8. Wolf, P. R. (1974): Elements of Photogrammetry, McGraw Hill Inc., Kogaknsc

Code: GR 102		Fundamentals of GIS and GPS	
No. of Credits: 03 45		No. of Lectures:	
Sr. No.	Topic	Lectures	
1	Introduction to GIS:Definitions, Evolution, Components and Objectives	3	
2	Hardware & Software Requirements: Hardware: Basic Blocks of Computer, Processor, Memory, Secondary Storage Devices, Input/Output Devices, Binary Numbers. Software: Operating System, Application, Compilers, Editors. Overview of GIS Software Packages	5	
3	Spatial Data:Types of Geographic Data, Levels Of Measurements.Concepts of Space and Time, Layers Coverage.Spatial Data Models, Representation of Geographic Features in Vector, Raster Data Models. Concept of Arc, Node, Vertices and Topology. Object Oriented Models: Advantages and Disadvantages. Computer Representation for Storing Spatial Data: Block Code, Run-Length Encoding, Chain Coding, Quad tree.Issues Governing Choice of Models.	12	
4	Non-Spatial Data:Advantages of Data Base Management System. Conceptual Implementation Models, Hierarchical, Network, Relational Models. RDBMS: Components, Concept, Database Schema, Tables and Relationships. Database Design Normalization (1NF, 2NF, 3NF Forms) Data Definition Manipulation Using SQL, SQL-Query Processing, Operations on Tables, Integrity Constraints, Database Security, Role of Database Administrator (DBA). Metadata	12	
5	Spatial Data Input:Digitization, Error Identification.Errors: Types, Sources, Correction. Editing and Topology Building	5	
6	Concepts of GPS: Spherical trigonometry, History, Types, Navigation Systems and Applications , Introduction to IRNSS	8	

Books:

1. Longley, P. A., Goodchild, M. F., Maguire, D. J., Rhind, D. W. (2002): Geographical Information Systems and Science, John Wiley & Sons, Chichester
2. Lo, C. P., Yeung, A. W. (2002): Concepts Techniques of Geographical Information Systems, Prentice-Hall of India, New Delhi
3. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
4. Korte, G. B. (2001): The GIS Book, Onward Press, Bangalore
5. Demers, M. N. (2000): Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi
6. Burrough, P. A. and McDonnell, R. A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
7. Heywood, I., Cornelius, S., Carver, S. (2011): An Introduction to Geographical Information Systems, Pearson Education, New Delhi
8. Ahmed, E. L. Rabbany (2002): Introduction to Global Positioning Systems, Artech House, Boston

Code: GR 106		Applied statistics and computing
No. of Credits: 03		No. of Practical:15
Sr. No.	Topic	Practical
1	Geographic Data: Sources, Types, Discrete and Continuous Series, Scales of Measurements.	3
2	Organization of Data: Frequency Distribution, Moments of Distribution, Measures of Central Tendency.	4
3	Matrices: Matrix Algebra: Types and Properties of Matrices. Addition, Subtraction, Multiplication and Inverse.	4
4	Correlation and Regression:Correlation: Concepts and Methods Regression: Bi-Variate, Linear, Exponential, Logarithmic, Power-Law.	4

Note: a) For 3 credits 3 hours practical per week.

b) The concerned teacher may add some points related to the subject.

Books:

1. Hammond, R. and McCullagh, P.(1991):Quantitative Techniques in Geography,ClarendonPress,Oxford
2. Gregory, S.(1978):Statistical Methods for Geographers, Longman, London
3. Frank, H. andAlthoen, S.C. (1994): Statistics: Concepts Applications, Cambridge University Press,Cambridge
4. Ebdon, D. (1977): Statistics in Geography, Basil Blackwell, Oxford
5. Rogerson, P.A.(2010): Statistical Methods for Geography, Sage Publications, London

Code: GR 104 Database Management Systems: Concept and Methods		
No. of Credits: 03 15		No. of Practical:
Sr. No.	Topic	Practical
1	Introduction: DBMS, RDBMS, SQL Database Security Concept and Advantages of RDBMS and ER Modeling.	2
2	Controlling User Access: Control Database Access, Privileges, Creating User, Concept of Role, Creating, Granting Privileges to Role, Revoking Privileges. Changing Password	3
3	Managing Schema Object: Data Types, DDL, DML, DCL Constraints: Types of Constraints, Primary Key, Foreign Key, Check Constraint, Not Null, Altering Constraint, Concept of Backup Recovery. Overview of Index.	3
4	Manipulating Dataset using SQL Statement: Basic Select Statement, Selecting Specific Column, Using Arithmetic Expressions, Defining Column Alias, using Where Clause	2
5	Restricting & Sorting Data: using Comparison Condition (=, <=, >=Etc), Using Logical Operator: AND, OR, NOT, using BETWEEN, LIKE Conditions Rule of Precedence, using Order by Clause	5

Books:

1. SPRS Technical Commission VII (2002): Symposium on Resource Environmental Monitoring, ISRS Annual Convention, IIRS, Dehradun
2. Deekshatulu, B. L. (1990): Description and use of Land use/Landcover, NRSA, Hyderabad
3. Sudershana, R. Mitra, D. Mishra, Roy, P.S., Rao, D. P. (2000): Subtle Issues in Coastal Management, IIRS, Dehradun
4. Harris, J. E. (1990): Earthwatch – The Climate from space, Ellishorwood Ltd., Midsower Norton
5. Lal, D. S. (1998): Climatology, Chaitanya Publishing House, Allahabad
6. Escalante, R. B. (2012): Remote Sensing- Advances techniques and Platforms, Intech, Rijeka Croatia
7. Escalante, R. B. (2012): Remote Sensing Application, Intech, Rijeka Croatia
8. Roy, P.S., Dwivedi, R. S. (2010): Remote Sensing Application [www.nrsc.gov.in/Learning-Center, E Book.html](http://www.nrsc.gov.in/Learning-Center_E-Book.html)
9. NRSA (2002): Symposium Tutorial on Sustainable Agriculture (Volume of Lectures), Hyderabad

Code: GR 103		Practical in Spatial Data Processing	
No. of Credits: 03		No. of Practical:	
15			
Sr. No.	Topic	Practical	
1	Overview of ArcGIS: Arc map, Arc catalog and ArcToolBox	1	
2	Attribute Data Input:Creationof Schema, Tables, Data Definition, and Data Input, Data Updating, Queries on Tables, Simple-Complex Query with Two or More Tables Using SQL. Queries Using Union, Intersection, Join Etc Operations.Use of MS-Excel and MS Access	2	
3	Spatial Data Input:VectorData Formats with File Extensions. Scanning, On-Screen Digitization, Editing, Topology Creation, Line and Area Measurements, Data Attribution	2	
4	Geodatabasein Arccatalog and Arcmap:Feature Dataset, Feature Classes, Import of Data, Spatial Data Formats, Shape/Coverage Files and Layers, Data Frames, Maps, Managing TOC	3	
5	Georeferencing Data:Coordinate Systems, Datum Conversions, Map Projections, Types, Storing- Viewing Projection Information	3	
6	Working with Layers in Arcmap:Building Templates, Classification, Displaying Qualitative andquantitative Values, Labeling Features and Map Creation.	1	
7	GPS: GPS Survey, Data Import, Processing and Mapping	3	

Note: a) For 4 credits 4 hours practical per week.

b) The concerned teacher may add some points related to the subject.

Books:

1. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
2. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The ARC/INFO Method, ESRI Press, Redland
3. Ahmed, E. L., Rabbany (2002): Introduction to Global Positioning System, Artech House, Boston
4. Kresse, W. and Danko, D. (2002): Springer Handbook of Geographic Information, Springer Drecht, London
5. Bao, J., Tsui, Y. (2005): Fundamentals of Global Positioning System Receivers, John Wiley Sons, Inc., Hoboken

Semester II

Code: GR 201		Digital Image Processing: Theory	
No. of Credits: 03		No. of Lectures:	
45			
Sr. No.	Topic	Lectures	
1	Introduction to Digital Image Processing: Digital Images: Types Sources of Errors: Atmospheric, Radiometric and Geometric. Image Rectification: Geometric Correction, Radiometric Correction, Noise Removal	12	
2	Image Enhancement Techniques Contrast Enhancement: Linear, Non-Linear, Logarithmic and Exponential, Gaussian Stretch, Density Slicing. Spatial Filtering: Low Frequency, High Frequency, Edge Enhancement, Band Rationing and Band Combination	15	
3	Digital Image Classification: Classification Scheme: Supervised Classification: Training Sites Selection and Statistical Information Extraction, Discriminate Functions. Classifier: Maximum Likelihood, Euclidian Distance, Mahalanobis Distance, Parallelopiped, Unsupervised Classification. Classification Accuracy Assessment and Error Matrix	10	
4	Object oriented classification : Segmentation, Object oriented vs. pixel based classification, Algorithms for classification	8	

Note: a) For 3 credits 3 hours practical per week.

b) The concerned teacher may add some points related to the subject.

Books:

1. Richards, J. A, Jia, X. (1999): Remote Sensing and Digital Image Processing, Springer, Verlag Berlin
2. Cha, B., Dattaa, D., Majumdar (2001): Digital Image Processing Analysis, Prentice-Hall of India, New Delhi
3. Nag, P. Kudrat, M. (1998): Digital Remote Sensing, Concept Publishing Company, New Delhi
4. Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
5. Lillesand, T. M., Kiefer, R. W. Chipman, J. W. (2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
6. Sabins, F. F. (1996): Remote Sensing: Principles an Interpretation, W. H. Freeman Company, New Y

Code: GR 202		Geospatial analysis: Theory	
No. of Credits: 03		No. of Lectures:	
45			
Sr. No.	Topic	Lectures	
1	Introduction to Spatial Analysis:Significance of Spatial Analysis.Overview of Tools For Analysis	2	
2	Spatial Analysis - Vector Based: Overlay Operations: Point-In-Polygon, Line-In-Polygon, Polygon-In-Polygon. Single Layer Operations: Feature Identification, Extraction, Classification Manipulation. Multilayer Operation: Union, Intersection, Symmetrical Difference, Update, Merge, Append and Dissolve	5	
3	Spatial Analysis - Raster Based:Map Algebra, Grid Based Operations, Local, Focal, Zonal and Global Functions, Cost Surface Analysis, Optimal Path and Proximity Search	5	
4	Network Analysis:Concepts, Evaluation of Network Complexity Using Alpha-Gamma Indices.C-Matrices for Evaluating Connectivity of the Network.Network Data Model.Path Analysis. Linear Referencing and Segmentation. Types of Network Analysis: Optimum Cyclic Path, Vehicle Routing, Path Determination and Cost-Path Analysis.Geocoding	8	
5	Point Pattern Analysis:Methods for Evaluating Point Patterns: Clustered and Random Distribution	5	
6	Surface Analysis:Interpolation Methods: Trend Surface Analysis, IDW, Kriging, Measures of Arrangement and Dispersion, Autocorrelation, Semi-Variogram, DEM, TIN, Slope, Aspect, Hillshade and Viewshed	10	
7	Spatial Modeling:Role of Spatial Model, Explanative, Predictive and Normative Models. Correlation-Regression Analysis in Model Building. Handling Complex Spatial Query and Case Studies	8	
8	Introduction to Spatial Analysis using 'R'	2	

Note: a) For 3 credits 3 hours practical per week.

b) The concerned teacher may add some points related to the subject.

Books:

1. Demers, M. N. (2000): Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi
2. Burrough, P. A. and McDonnell, R. A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
3. Makrewski, J. (1999): GIS Multi-criteria Analysis, John Wiley and Sons, New York
4. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
5. Longley, P. A., Goodchild, M. F., Maguire, D. J. Rhind, D. W. (2002): Geographical Information Systems and Science, John Wiley & Sons, Chichester
6. Lo, C. P. Yeung, A. W. (2002): Concepts Techniques of Geographical Information Systems, Prentice-Hall of India, New Delhi

Code: GR 105		Open Source GIS	
No. of Credits: 03 15		No. of Practical:	
Sr. No.	Topic	Practical	
1	Open source GIS: basic concepts, Conventional Vs, Database modeling with open source GIS, Introduction to Open source software	4	
2	Open Geospatial Consortium, Introduction to QGIS, Generation of vector layers, Retrieving properties of vector and raster datasets, Attribution, Map composition	4	
3	Open source GIS platforms, software, Libraries.	3	
4	Application of Open source GIS	4	

Note: a) For 3 credits 3 hours practical per week.

b) The concerned teacher may add some points related to the subject.

Books:

1. Markus Neteler And Helena Mitasova (2007): Open Source GIS: A GRASS approach, Springer-VerlagBerlin, Heidelberg
2. Andrew Cutts, Anita Graser (2018): Learn QGIS , <https://www.packtpub.com/application-development/learn-qgis-fourth-edition>