

Jawaharlal Nehru Engineering College

Laboratory Manual

Geographical Information System
For

Final year IT Students

© Author JNEC, Aurangabad

Vision

To develop expertise of budding technocrats by imparting technical knowledge and value based education.

Mission

- Equipping the students with technical skills, soft skills and professional attitude.
- Providing the state of art facilities to the students to excel as competent professionals, entrepreneurs and researchers.

Program Specific Outcomes

PSO1. An ability to design, develop and implement computer programs in the areas related to Algorithms, Multimedia, Website Design, System Software, DBMS and Networking.

PSO2. Develop software systems that would perform tasks related to Research, Education and Training and/or E governance.

PSO3. and mobiles by utilizing new technologies to an individual or organizations.

Program Outcomes

- PO1. Engineering Design, develop, test and maintain application software that would perform tasks related to information management Knowledge
- PO2. Problem Analysis
- PO3. Design/Development of Problem
- PO4. Conduct Investigation of Complex Problem
- PO5. Modern Tool Usage
- PO6. The Engineer and society
- PO7. Environment and Sustainability
- PO8. Ethics
- PO9. Individual and Team work.
- PO10. Communication
- PO11. Project Management
- PO12. Life Long Learning.

FORWARD

It is my great pleasure to present this laboratory manual for final year engineering students for the subject of Geographical Information System, keeping in view the vast coverage required for understanding the concept and applications of GIS .

As a student, many of you may be wondering with some of the questions in your mind regarding the subject and exactly what has been tried is to answer through this manual.

As you may be aware that MGM has already been awarded with ISO 9000 certification and it is our endeavor to technically equip our students taking the advantage of the procedural aspects of ISO 9000 Certification.

Faculty members are also advised that covering these aspects in initial stage itself, will greatly relieve them in future as much of the load will be taken care by the enthusiasm energies of the students once they are conceptually clear.

Dr.H.H.Shinde
Principal

LABORATORY MANUAL CONTENTS

This manual is intended for the the final year IT students in the subject of GIS. This manual typically contains practical/Lab Sessions related to GIS covering various aspects related to the subject to enhanced understanding.

Although, as per the syllabus, concepts of Geographical Information system ,data type vector and raster, approaches for designing GIS application ,data base handling is prescribed, we have made the efforts to cover various aspects of GIS covering different applications like site selection and identification, decision making analysis and monitoring etc. various examples of geographical entities ,spatial data Attribute data specifications.

Various input data sources primary and secondary , I/P data editing etc.

Students are advised to thoroughly go through this manual rather than only topics mentioned in the syllabus as practical aspects are the key to understanding and conceptual visualization of theoretical aspects covered in the books.

Good Luck for your Enjoyable Laboratory Sessions

A.M.Mohsin

DOs and DON'T DOs in Laboratory:

1. Do not handle any equipment before reading the instructions/Instruction manuals
2. Read carefully the power ratings of the equipment before it is switched on whether ratings 230 V/50 Hz or 115V/60 Hz. For Indian equipments, the power ratings are normally 230V/50Hz. If you have equipment with 115/60 Hz ratings, do not insert power plug, as our normal supply is 230V/50 Hz, which will damage the equipment.
3. Observe type of sockets of equipment power to avoid mechanical damage
4. Do not forcefully place connectors to avoid the damage
5. Strictly observe the instructions given by the teacher/Lab Instructor

Instruction for Laboratory Teachers::

1. Submission related to whatever lab work has been completed should be done during the next lab session. The immediate arrangements for printouts related to submission on the day of practical assignments.
2. Students should be taught for taking the printouts under the observation of lab teacher.
3. The promptness of submission should be encouraged by way of marking and evaluation patterns that will benefit the sincere students.

WARMUP EXERCISES:

Define Geography.

Define GIS.

What are the various sources for getting geographical information.

What are maps.

List different types of maps

List different applications of GIS.

What is decision making.

Which type of data structures are used in building GIS application

What do you mean by Layer based approach in building GIS.

What do you mean by object oriented approach in building GIS.

Geographical Information System

List of Practical Assignments:

Minimum 08 assignments should be conducted.

1. Introduction to GIS with study of one GIS application in detail.
2. Study of overview of Open source Quantum GIS.
3. Importing Raster Layer and Vector Layer in GIS using Quantum GIS
4. Demonstrating the concept of Symbolism in GIS using Quantum GIS.
5. Demonstrating the concept of Labeling in GIS using Quantum GIS
6. Demonstrating the concept of Overlaying in GIS using Quantum GIS.
7. Drawing map of our institute using Map Maker.
8. Study of Databases in GIS.
9. Case Studies of Hydrological Project and Lavasa.

(Minimum 08 assignments should be conducted.)

EXP.NO.1: Introduction to GIS with study of one GIS application in detail.

- Definitions
- History, background
- Importance
- Elements
- Features, characteristics
- Applications
- NIREX application in detail

EXP.NO.2: Study of overview of Open source Quantum GIS.

QGIS (previously known as **Quantum GIS**) is a cross-platform free and open-source desktop geographic information system (GIS) application that supports viewing, editing, and analysis of geospatial data.

QGIS 2.2 showing the redesigned menus.

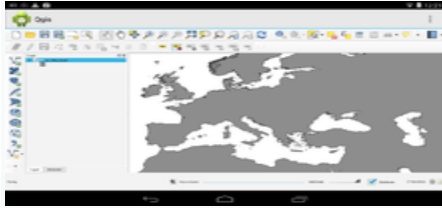
Developer(s)	QGIS Development Team
Initial release	July 2002
Stable release	2.18.10 (Las Palmas) ^[1] / June 24, 2017; 8 days ago
Repository	github.com/qgis/QGIS
Written in	C++, <u>Python</u> , Qt
Platform	Windows, Linux, Mac OS X, Android ^(beta)
Available in	Multilingual
Type	Geographic information system
License	GNU GPL
Website	qgis.org

1 Functionality

- QGIS functions as geographic information system (GIS) software, allowing users to analyze and edit spatial information, in addition to composing and exporting graphical maps. QGIS supports both raster and vector layers; vector data is stored as either point, line, or polygon features. Multiple formats of raster images are supported, and the software can dereference images.
- QGIS supports shape files, coverage's, personal geo databases, dxf, MapInfo, PostGIS, and other formats. Web services, including Web Map Service and Web Feature Service, are also supported to allow use of data from external sources.
- QGIS integrates with other open-source GIS packages, including Post GIS, GRASS GIS, and Map Server. Plugins written in Python or C++ extend QGIS's capabilities. Plugins can geocode using the Google Geocoding API, perform geoprocessing functions, which are similar to the standard tools found in ArcGIS, and interface with PostgreSQL/PostGIS, SpatialLite and MySQL databases.

2 Development

- Gary Sherman began development of Quantum GIS in early 2002, and it became an incubator project of the Open Source Geospatial Foundation in 2007. Version 1.0 was released in January 2009.
- Written in C++, QGIS makes extensive use of the Qt library. In addition to Qt, required dependencies of QGIS include GEOS and SQLite. GDAL, GRASS GIS, PostGIS, and PostgreSQL are also recommended, as they provide access to additional data formats.



A screenshot from QGIS-Android in 2014.

- As of 2017, QGIS is available for multiple operating systems including Mac OS X, Linux, Unix, and Microsoft Windows. A mobile version of QGIS was under development for Android as of 2014.
- For Mac users, the advantage of QGIS over GRASS GIS is that it does not require the X11 windowing system in order to run, and the interface is much cleaner and faster. QGIS can also be used as a graphical user interface to GRASS. QGIS has a small install footprint on the host file system compared to commercial GIS's and generally requires less RAM and processing power; hence it can be used on older hardware or running simultaneously with other applications where CPU power may be limited.
- QGIS is maintained by volunteer developers who regularly release updates and bug fixes. As of 2012, developers have translated QGIS into 48 languages and the application is used internationally in academic and professional environments. Several companies offer support and feature development services.

3 Licensing

As a [free software](#) application under the [GNU GPL](#), QGIS can be freely modified to perform different or more specialized tasks. Two examples are the QGIS Browser and QGIS Server applications, which use the same code for data access and rendering, but present different front-end interfaces.

4 Adoptions

A number of public and private organizations have adopted QGIS, including the Austrian state of [Vorarlberg](#), and the Swiss cantons of [Glarus](#) and Solothurn.

EXP.NO.3: Importing Raster Layer and Vector Layer in GIS using Quantum GIS

(Quantum GIS Manual with step by step explanation is made available to students)

Getting Familiarized with QGIS Menu and Toolbars

- Open QGIS from Desktop Shortcut or Program Files menu
- Add Raster data. Raster file is located under the data folder i.e. C:\One Day WorkShop\QGIS\Data\Raster\
○ File Name P143r47_1993.tiff
- Add Vector data. Vector file is located under the data folder i.e. C:\OneDayWorkShop\QGIS\Data\Vector
○ File name: TN_Districts.shp
- Use the Map Navigation tools to Zoom In\Zoom Out\Pan data
- Use Identify Feature tool and check feature's attributes
- Save the project.

EXP.NO.4: Demonstrating the concept of Symbolism in GIS using Quantum GIS.

(Quantum GIS Manual with step by step explanation is made available to students)

Viewing/Classifying the vector data by using QGIS Symbology properties for the below exercise add the following layers to map view

1. TN_Districts
2. TN_NH_Roads
3. TN_District_Capitals
 - Single symbol
 - Change the Symbol for all TN_District_Capitals in TN_District_Capitals Layer
 - Graduated symbol
 - Choose TN_NH_Roads
 - Create 2 classes of buildings based on the number of floors and provide individual colors for each Classification. Classification Criteria
 - ⌚ Width 1 – 75 – Blue
 - ⌚ Width 76 – 150– Red
 - Unique value
 - Choose TN_Districts
 - Classify the Districts according to its name

EXP.NO.5: Demonstrating the concept of Labeling in GIS using Quantum GIS

(Quantum GIS Manual with step by step explanation is made available to students)

Labeling the vector data by using QGIS Labels properties For the below exercise add the following layers to map view

1. TN_Districts

- Display the Districts names in the map view for each Districts

EXP.NO.6: Demonstrating the concept of Overlaying in GIS using Quantum GIS.

(Quantum GIS Manual with step by step explanation is available for students)

EXP.NO.7: Drawing map of our institute using Map Maker.

Outline map of JNEC Building – top view topographic Map
(Map maker manual is available for students)

EXP.NO.8: Study of Databases in GIS.

Theoretical concepts in GIS database for :

- Spatial data
- Entities (Point, line, area ,network, elevation)
- Temporal data
- Geo referencing data
- 3RD Dimension Data
- Raster and Vector Data
- 4th Dimension Data, etc.

EXP NO.9: Case Studies of Hydrological Project and Lavasa.

Points to consider in case studies

- **Need of the Project**
- **Advantages of Implementing GIS**
- **Design, using GIS**
- **Implementation Process**

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12. Evaluation and marking system:

Basic honesty in the evaluation and marking system is absolutely essential and in the process impartial nature of the evaluator is required in the examination system to become popular amongst the students. It is a wrong approach or concept to award the students by way of easy marking to get cheap popularity among the students to which they do not deserve. It is a primary responsibility of the teacher that right students who are really putting up lot of hard work with right kind of intelligence are correctly awarded.

The marking patterns should be justifiable to the students without any ambiguity and teacher should see that students are faced with unjust circumstances.