Government of Pakistan

National Vocational and Technical Training Commission

Prime Minister's Hunarmand Pakistan Program

"Skills for All"

Course Contents / Lesson Plan

Course Title: Applied GIS (Geographic Information System)

Duration: 3 Months

Revised Edition

Trainer Name	
Course Title	**Applied GIS (Geographic Information System)**
Objectives and Expectations	**Employable skills and hands on practice for Applied GIS (Geographic Information System)** The objectives of an Applied Geographic Information Systems (GIS) curriculum typically aim to provide students with the necessary knowledge and skills to effectively use GIS technology in real-world applications. Develop a fundamental understanding of the principles and concepts of Geographic Information Systems. Learn techniques for spatial analysis, including overlay analysis, proximity analysis, and terrain modeling. Develop skills in cartographic design to effectively communicate spatial information through maps and visualizations. Apply GIS tools to urban and regional planning scenarios, including land-use planning and infrastructure development. **Main Expectations:** Expectations for an Applied Geographic Information Systems (GIS) course typically revolve around the acquisition of practical skills, and professional development. • Should gain a strong understanding of GIS principles, tools, and technologies. They should be proficient in using GIS software for data analysis, mapping, and problem-solving. • The course should provide ample hands-on experiences, allowing trainees to apply theoretical knowledge to real-world scenarios. Practical tasks should be designed to enhance skills in data collection, spatial analysis, and map creation. • Investigate the power of maps and spatial data to document and illustrate local and global issues. Apply GIS principles and tools to create your own maps from freely-available online spatial data.
Entry-level of trainees	Intermediate
Learning Outcomes of the course	By the end of this course, students will be able to: • Proficiency in GIS software like ArcGIS & Google Earth Pro etc. • Ability to conduct spatial analysis techniques (buffering, overlay analysis, interpolation). • Data collection, processing, and management from diverse sources. • Skills in cartographic design and effective map visualization. • Application of GIS in fields like environmental science, urban planning, etc. • Project management skills for GIS projects. • Understanding of ethical and legal considerations in GIS data usage. • Improved collaboration and communication skills for stakeholders.
Course Execution Plan	The total duration of the course: **3 months (12 Weeks)** Class hours: **4 hours per day** Theory: **20%** Practical: **80%** Weekly hours: **20 hours per week** Total contact hours: 24**0 hours**

Companies offering jobs in the respective trade	1- **Private Firms (Geomapping Solutions, R2V, Zonemics Fiberhome etc)** 2- **NGOs** 3- **Urban planning firms** 4- **Government Institutes (Survey of Pakistan, Agriculture Department, Board of Revenue, NDMA etc)** 5- **PTCL** 6- **Freelancing**
Job Opportunities	• **GIS Technician** • **GIS Surveyor** • **Freelancer**
No of Students	25
Learning Place	Classroom / Lab
Instructional Resources	**GIS Books** • https://www.amazon.com/GIS-Fundamentals-Geographic-Information-Systems/dp/1593995520 • https://www.amazon.com/GIS-Mapping-Public-Safety-First/dp/1478273909 **YouTube links** • **A Complete Beginner's Guide to ArcGIS Desktop (Part 1)** **https://youtu.be/BbUctneHfKc?list=PLLxyyob7YmEENK-d7gotA6IoX7277rsQP** • **A Complete Beginner's Guide to ArcGIS Desktop (Part 2)** https://youtu.be/t7ZnT5NgqlM?list=PLLxyyob7YmEENK-d7gotA6IoX7277rsQP • **A Complete Beginner's Guide to ArcGIS Desktop (Part 3**) https://youtu.be/RSEWZU-1zzM?list=PLLxyyob7YmEENK-d7gotA6IoX7277rsQP

MODULES

Weeks	Module Title	Day	Hour	Learning Units	Tasks
Week 1	Introduction to GIS	1	1	What is a GIS?	
			2	Why Do We Need GIS?	
			3	Defining GIS, Functional Definition of GIS	
			4	Overview of institutes offering GIS jobs (for Development of Interest in students)	Task 1
		2	1	What is Remote Sensing?	
			2	Types of Satellites (Weather, Telecommunication, Remote Sensing Satellites)	Task 2
			3	Passive Vs Active Remote Sensing	
			4	Types of Resolutions (Spatial, Spectral, Radiometric, Temporal)	
		3	1	Introduction to software's for GIS	Task 3
			2	Introduction to ArcGIS	
			3	ArcGIS Installations	
			4	ArcGIS Interface and Preference	
		4	1	ArcGIS Installations	
			2	ArcGIS Interface and Preference	
			3,4	Assignment of tasks	
		5	1 -4	Discussion and evaluation of tasks	
Week 2	GIS Components & GIS Data types	1	1	Discussion of GIS Components	
			2	Application component	
			3	Technology component	
			4	Data Component & User (Professional) Component	
		2	1	Representation of GIS data	
			2	Fields Vs Objects	
			3	Data Types	

			4	Geographic Vs Attribute data	
		3	1	Getting know to ArcGIS	
			2	Software Interface Overview	Task 4
			3	Different packages of ArcGIS	
			4	Getting to know with tools & toolbar using ArcGIS	
		4	1-4	Webinar / Session with GIS Professional from Industry/ TVET	
		5	1	Introduction to ArcMap	
			2	ArcMap VS Arc Catalogue	
			3	Toolbar in ArcMap	
			4	How to Connect Folder, Add data, change symbol / colors	Task 5
Week 3	**Data Models**	**1**	1	Motivational Lecture	
			2	Introduction to Spatial Data models	
			3	Vector Data Model	
			4	Vector Topology, tables & structure	
		2	1	Raster Data model	
			2	Raster Feature & Attribute Data	
			3-4	Comparison Between Raster & Vector Data model	
		3	1-4	ArcMap Software Practices	Task 6
		4	1	Class Discussion	
			2-4	Overview of Different Freelancing Platforms	Task 7
		5	1-4	Discussion and Task evaluation	
Week 4	**Projections, Datum & Coordinate Systems**	**1**	1	Success stories	
			2-3	Georeferencing & shape of earth	
			4	Ellipsoid , Geoid	
		2	1	Datum (horizontal & vertical)	
			2-3	Map Projections	
			4	Coordinate Systems, UTM	
		3	1-2	Coordinate transformations	Task 8
			3-4	Transformations using Software	
		4	1-2	Longitudes vs Latitudes	
			3	Equator Vs Prime Meridian	

			4	Task relevant assignments	Task 9
		5	1-2	Motivational Lecture	
			3-4	Discussion and evaluation of tasks	
Week 5	**GNSS & GPS**	**1**	1	GNSS Basics	
			2	GPS Basics	
			3-4	Introduction to Google earth	Task 10
		2	1	Components Of GPS	
			2	Ground Segment	
			3	Space Segment	
			4	User Segment	
		3	1-2	Data collection Using GPS/Handheld device (mobile)	Task 11
			3-4	Plotting Collected data on software	Task 12
		4	1-2	Differential GPS	
			3-4	GPS Vs DGPS	
		5	1	Precision VS Accuracy	
			2	Triangulation Vs Trilateration	
			3-4	Data collection Using RTK-GPS and Visualization	Task 13
Week 6	Midterm & Task (CV Writing)				
Week 7	**Geo-Data Capturing, Sources, Standards & Data Management**	**1**	1	History and evolution of GIS	
			2	Data Structure & Models	
			3	Data Sources	
			4	Data Capturing	Task 14
		2	1	Data Standards	
			2	Metadata	
			3	Building a Geodatabase	Task 15
			4	Shapefile Vs Feature class	
		3	1	Map Types	
			2	Map Scale & Large Vs Small Scale	
			3-4	The Digitizing Process	Task 16
		4	1	Aerial Imagery	
			2	Satellite Imagery	
			3-**4**	Aerial or Satellite Images : Which to Use?	

		5	**1-4**	Discussion and tasks Evaluation	Task 17
Week 8	**Spatial Data Analysis**	**1**	**1**	Basic introduction of spatial Analysis	
			2	Tables: Physical, Logical, and Conceptual Structures of tables	
			3	Joining Tables , Spatial query	
			4	Primary Vs Foreign Keys	
		2	**1**	Geo-Processing Tools	Task 18
			2	Conversion tools	Task 19
			3	Interpolation	Task 20
			4	Topology	Task 21
		3	**1**	Proximity Analysis	Task 22
			2-4	Tasks and Practical Performance evaluation	Task 23
		4	**1**	Overlay Analysis	Task 24
			2-4	Tasks and Practical Performance	Task 25
		5	**1**	Network Analysis	Task 26
			2-4	Tasks and Practical Performance	Task 27
Week 9	**Raster & Terrain Analysis**	**1**	**1**	Intro to Raster Analysis	
			2	Raster Calculator	Task 28
			3-4	Tasks on Raster Data set	Task 29
		2	**1**	Band Composite	Task 30
			2	Image Analysis tools	Task 31
			3-4	Vegetation Indices	Task 32
		3	**1**	Terrain Analysis	
			2	Slope & Aspect	

			3	DEM	Task 33
			4	Contour lines	Task 34
		4	1-2	Change Detection	
			3-4	Practical performance	Task 35
		5	1-4	Discussion & Tasks Evaluation	Task 36
Week 10	**Applications of GIS**	**1**	1	GIS Application in Agriculture	
			2-4	Practical Performance	Task 37
		2	1	GIS Application in Hydrology	
			2-4	Practical Performance	Task 38
		3	1	GIS Application in Urban Planning	
			2-4	Practical Performance	Task 39
		4	1	GIS Application in Disaster Management	
			2-4	Practical Performance	Task 40
		5	1-4	Complete Tasks Evaluation And discussion with class	Task 41
Week 11	**Data Visualization**	1	1-4	Cartographic Basics	

		2	1-4	Interactive Maps Generation	Task 42
		3	1-4	Tasks discussion	Task 43
		4	1-4	Tasks evaluation	Task 44
		5	1-2	Class Discussion	Task 45
			3-4	Overall Summary	Task 46
Week 12	**Final Exams & Task (Report Writing)**				

Annexure-I

Tasks for Certificate in Applied GIS (Geographic Information System)

Task No	Task	Description	Week
1.	**GIS institutes**	Assign task to check out institutions offering GIS jobs	Week 1
2.	**Remote Sensing Satellites**	Discussion regarding satellites of Pakistan especially remote sensing satellites	
3.	**ArcGIS Interference**	ArcGIS Installation & Preferences	
4.	**ArcMap**	Basic overview and tools overview of software	Week 2
5.	**ArcMap Tools**	Practical performance using ArcMap (toolbar, data Add etc)	
6.	**Tools**	Symbology, data visualization	Week 3
7.	**Freelancing Platform**	Discussion with students regarding different freelancing Platforms	
8.	**Coordinate Conversion**	Manual / Mathematical Conversions Degree Minutes Second to X,Y coordinates	Week 4
9.	**Georeferencing**	Practical performance of Georeferencing	
10.	**Google Earth Pro**	Introduction to google earth pro	Week 5
11.	**Field Data collection**	Collect coordinates from fields (survey)	
12.	**Survey data plotting**	Using software data plotting and visualization	
13.	**Survey RTK-GPS**	Survey using RTK-GPS and data post processing	
14.	**Data Capturing**	Collection of GIS-Based data from different websites/sources	Week 7
15.	**Geodatabases**	Geodatabases Handling, import data etc	
16.	**Digitizing**	Complete Digitization Process Using ArcMap	
17.	**Task evaluation**	Discussion and evaluation of tasks performed in this week	
18.	**Geoprocessing Tools**	Geoprocessing tools using ArcMap	Week 8
19.	**Conversion tools**	Different conversion tools using ArcMap	
20.	**Interpolation**	Complete performance of interpolation tools using ArcMap	
21.	**Topology**	Topology Using ArcMap	
22.	**Proximity Analysis**	Performing Proximity analysis using ArcMap	

23.	**Task evaluation**	Practical Tasks evaluation	
24.	**Overlay Analysis**	Overlay analysis & tools Using ArcMap	
25.	**Task evaluation**	Discussion And evaluation of overlay analysis	
26.	**Network Analysis**	Compete practical of network Analysis	
27.	**Task evaluation**	Compete practical of network Analysis	
28.	**Raster Calculator**	Complete overview of Raster Calculator	Week 9
29.	**Raster Analysis**	Different Tools performed on Raster Dataset(clip, Merge etc)	
30.	**Band Composite**	Band composite tool & different Band combinations	
31.	**Image Analysis Tool**	Different Image analysis tools & Classification	
32.	**Vegetation Indices**	Calculation of different Indices (NDVI,NDWI,SAVI etc)	
33.	**DEM**	DEM analysis Using ArcMap	
34.	**Contour Lines**	Contour lines Analysis using ArcMap	
35.	**Change Detection**	Change detection practical using ArcMap	
36.	**Task evaluation & Discussion**	Discussions regarding all the practical's performed in this week	
37.	**GIS Application Agriculture**	Practical performance of GIS Application in Agriculture (LULC, Image classification crop type mapping)	Week 10
38.	**GIS Application in Hydrology**	Practical performance of GIS Application in Hydrology (watershed delineation etc)	
39.	**GIS Application in Urban Planning**	Practical performance of GIS Application in Urban planning (3D modeling, Society Layouts etc)	
40.	**GIS Application in Disaster Management**	Practical performance of GIS Application in Disaster Management (Flood mapping, drought monitoring etc)	
41.	**Application of GIS**	Discussion & Evaluation of GIS Applications in Various fields performed in week	
42.	**Cartography**	How to develop Interactive Maps	Week 11
43.	**Task discussion**	Complete overview of tasks performed in class during course	
44.	**Task Evaluation**	Complete Evaluation & assessment of Tasks Performed in class during course	
45.	**Class Discussion**	Take input (Assessment of instructor) from the class	
46.	**Overall Summary**	Complete summary of the course	
47.	**Report Writing**	How to develop a professional report	**Week 12**

Annexure-II:

Motivational Lectures and resources

Applied GIS (Geographic Information System)

What Is the Role of Good Manners in the Workplace? By Qasim Ali Shah | In Urdu

https://www.youtube.com/watch?v=Qi6Xn7yKIlQ

GIS video Link

https://www.youtube.com/watch?v=vlkStMiIcp4&list=PL0JtGFJGnWTOWwAMZGr-5Kyqtv07W-BV7

https://www.youtube.com/watch?v=p4NbRw3QkGk&pp=ygUMQVBQSUxFRCBHSVMg

Geographic Information system books

https://www.amazon.com/GIS-Fundamentals-Geographic-Information-Systems/dp/1593995520
https://www.amazon.com/GIS-Mapping-Public-Safety-First/dp/1478273909

YouTube links

- **A Complete Beginner's Guide to ArcGIS Desktop (Part 1)**
  https://youtu.be/BbUctneHfKc?list=PLLxyyob7YmEENK-d7gotA6IoX7277rsQP
- **A Complete Beginner's Guide to ArcGIS Desktop (Part 2)**
  https://youtu.be/t7ZnT5NgqlM?list=PLLxyyob7YmEENK-d7gotA6IoX7277rsQP
- **A Complete Beginner's Guide to ArcGIS Desktop (Part 3**)
  https://youtu.be/RSEWZU-1zzM?list=PLLxyyob7YmEENK-d7gotA6IoX7277rsQP

Startup Links

MOTIVATIONAL LECTURES LINKS.

TOPIC	SPEAKER	LINK
How to Face Problems In Life	Qasim Ali Shah	https://www.youtube.com/watch?v=OrQte08Ml90
Just Control Your Emotions	Qasim Ali Shah	https://www.youtube.com/watch?v=JzFs__yJt-w
How to Communicate Effectively	Qasim Ali Shah	https://www.youtube.com/watch?v=PhHAQEGehKc
Your ATTITUDE is Everything	Tony Robbins Les Brown David Goggins Jocko Willink Wayne Dyer Eckart Tolle	https://www.youtube.com/watch?v=5fS3rj6eIFg
Control Your EMOTIONS	Jim Rohn Les Brown	https://www.youtube.com/watch?v=chn86sH0O5U

	TD Jakes **Tony Robbins**	
Defeat Fear, Build Confidence	**Shaykh Atif Ahmed**	**https://www.youtube.com/watch?v=s10dzfbozd4**
Wisdom of the Eagle	**Learn Kurooji**	**https://www.youtube.com/watch?v=bEU7V5rJTtw**
The Power of ATTITUDE	**Titan Man**	**https://www.youtube.com/watch?v=r8LJ5X2ejqU**
STOP WASTING TIME	**Arnold Schwarzenegger**	**https://www.youtube.com/watch?v=kzSBrJmXqdg**
Risk of Success	**Denzel Washington**	**https://www.youtube.com/watch?v=tbnzAVRZ9Xc**

Annexure-III:

Workplace/Institute Ethics Guide

Work ethic is a standard of conduct and values for job performance. The modern definition of what constitutes good work ethics often varies. Different businesses have different expectations. Work ethic is a belief that hard work and diligence have a moral benefit and an inherent ability, virtue, or value to strengthen character and individual abilities. It is a set of values-centered on the importance of work and manifested by determination or desire to work hard.

The following ten work ethics are defined as essential for student success:

1. **Attendance:**

   Be at work every day possible, plan your absences don't abuse leave time. Be punctual every day.

2. **Character:**

   Honesty is the single most important factor having a direct bearing on the final success of an individual, corporation, or product. Complete assigned tasks correctly and promptly. Look to improve your skills.

3. **Team Work:**

   The ability to get along with others including those you don't necessarily like. The ability to carry your weight and help others who are struggling. Recognize when to speak up with an idea and when to compromise by blend ideas together.

4. **Appearance:**

   Dress for success set your best foot forward, personal hygiene, good manner, remember that the first impression of who you are can last a lifetime

5. **Attitude:**

   Listen to suggestions and be positive, accept responsibility. If you make a mistake, admit it. Values workplace safety rules and precautions for personal and co-worker safety. Avoids unnecessary risks. Willing to learn new processes, systems, and procedures in light of changing responsibilities.

6. **Productivity:**

   Do the work correctly, quality and timelines are prized. Get along with fellows, cooperation is the key to productivity. Help out whenever asked, do extra without being asked. Take pride in your work, do things the best you know-how. Eagerly focuses energy on accomplishing tasks, also referred to as demonstrating ownership. Takes pride in work.

7. **Organizational Skills:**

Make an effort to improve, learn ways to better yourself. Time management; utilize time and resources to get the most out of both. Take an appropriate approach to social interactions at work. Maintains focus on work responsibilities.

8. **Communication:**

   Written communication, being able to correctly write reports and memos. Verbal communications, being able to communicate one on one or to a group.

9. **Cooperation:**

   Follow institute rules and regulations, learn and follow expectations. Get along with fellows, cooperation is the key to productivity. Able to welcome and adapt to changing work situations and the application of new or different skills.

10. **Respect:**

    Work hard, work to the best of your ability. Carry out orders, do what's asked the first time. Show respect, accept, and acknowledge an individual's talents and knowledge. Respects diversity in the workplace, including showing due respect for different perspectives, opinions, and suggestions.