

**Syllabus  
for  
Certificate Programme  
In  
Geographic Information System (GIS) and Remote Sensing**



आर्यभट्ट ज्ञान विश्वविद्यालय  
ARYABHATTA KNOWLEDGE UNIVERSITY

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27/10/21

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## CERTIFICATE COURSE FOR GIS AND REMOTE SENSING

Credits: L: 3 T: 12 P: 2 = 17

COURSE CODE	COURSE TITLE	L	T	P	CREDIT
CCGISRS 101	PRINCIPLES OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM AND SATELLITE NAVIGATION SYSTEMS	0	3	0	3
CCGISRS 102	SPATIAL INFORMATION SYSTEM	0	3	0	3
CCGISRS 103	ENVIRONMENTAL MAPPING & INTERPRETATION	0	3	0	3
CCGISRS 104	DIGITAL SURVEYING	0	3	0	3
CCGISRS 105	PRACTICAL/ LAB	3	0	2	5

### **CCGISRS 101 - PRINCIPLES OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM AND SATELLITE NAVIGATION SYSTEMS**

#### **UNIT 1: BASIC CONCEPTS**

Remote Sensing: History, Development, Definition, Concept & Principles, Electromagnetic Radiation (EMR) and Its Characteristics, Wavelength Regions and their Significance, Interaction of EMR with Atmosphere and Earth's Surface: Absorption, Reflectance and Scattering, Atmospheric Windows, Energy Balance Equation, Spectral Response and Spectral Signature, Spectral, Spatial, Temporal and Radiometric resolutions.

#### **UNIT 2: DATA ACQUISITION**

Platform: Balloon, Rocket, Helicopter, Aircraft and Spacecraft, Aerial vs. Satellite Remote Sensing, Satellites and their Specifications: LANDSAT, SPOT, ENVISAT, RADARSAT, IRS, IKONOS, Sensors and their Specifications: MSS, TM, LISS (I,II,III,IV), PAN, WiFS, AWiFS, MODIS, Weather & Communication Satellites.

#### **UNIT 3: BASIC CONCEPTS OF GIS**

Definition, Philosophy & Historical evolution of GIS, Spatial vs. non-spatial data, Components of GIS, Spatial data models – Raster and Vector; advantages & disadvantages, Raster Data & its Representation: Data Structure & File format, Data Compression (block code, chain code, run length code, quadtree, MrSID), Vector data representation: Data Structure & File format, Topology, Advantage of DBMS in Context of GIS, Relational and Object Oriented DBMS.

#### **UNIT 4: DATA INPUT AND GEO-CORRECTION**

Sources of Spatial Data (Raster and Vector), Data Acquisition Through Scanners and on-screen Digitisation, Projections, Geometric Transformations of Raster and Vector Data (Affine Transformation and Transformation Coefficients), RMS Error, Types of Co-ordinate Systems, Spheroid and Datums, Sources of Errors, Spatial Data Quality: Accuracy, Precision, Error and uncertainty.

### **CCGISRS 102 - SPATIAL INFORMATION SYSTEM**

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## **UNIT I FUNDAMENTALS OF CARTOGRAPHY AND GIS 9**

Definition of Map - Mapping Organisation in India- Classification based on Function, Scale, Characteristics – Ellipsoid and Geoid – Co-ordinate Systems - Rectangular and Geographic Coordinates – UTM and UPS - Projection – Function - Types of Map Projections – Transformations – Function - Affine transformation - Choice of Map Projection – Evolution of cartography- Geo-Spatial, Spatial and Non-spatial data – Definition of GIS – Evolution GIS – Components of GIS.

## **UNIT 2 GIS DATA MODELS AND DATA INPUT 9**

Point, Line Polygon / Area, elevation and surface – Tessellations - Attributes and Levels of Measurement - Data Sources – Ground and Remote Sensing survey – Collateral data collection –

**UNIT 3** Input: Map scanning and digitization, Registration and Georeferencing – Concepts of RDBMS - Raster Data Model – Grid – Data Encoding - Data Compression – Vector Data Model

– Topological properties – Arc Node Data Structure – Raster Vs. Vector Comparison – File Formats for Raster and Vector – Data conversion between Raster and vector.

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## **UNIT 4 RASTER AND VECTOR DATA ANALYSIS 9**

Raster Data analysis: Local, Neighborhood and Regional Operations – Map Algebra – Vector Data

Analysis: Topological Analysis, point-in-polygon, Line-in-polygon, Polygon-in-Polygon – Proximity Analysis: buffering, Thiessen Polygon – Non-topological analysis: Attribute data Analysis- concepts of SQL– ODBC

## **CCGISRS 103 - ENVIRONMENTAL MAPPING & INTERPRETATION**

Importance of Image Interpretation, Image interpretation for delineation of lithology (Rocks), minerals and their characteristics, Geological structures - Folds, Faults and Joints and their field characteristics, Various important land forms, Image characteristics of geological structures and major land forms, Visual and Digital Satellite Image Interpretation, Elements of image interpretation, development of interpretation keys, Image interpretation for LU/LC and Vegetation mapping, Image interpretation for ocean and coastal monitoring.

## **CCGISRS 104 - DIGITAL SURVEYING**

### **FUNDAMENTALS OF TOTAL STATION AND GPS**

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Global Navigation System, Regional Navigation System and SBAS - Basic concepts of GNSS, Glonass, IRNSS -Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion

- Keplerian motion – Kepler's Law - Perturbing forces - Geodetic satellite - Doppler effect- Different Coordinate and Time System.

### **GPS SATELLITE SYSTEM**

GPS - Different segments - space, control and user segments - satellite configuration - GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability – Task of control segment - GPS receivers.

## **CCGISRS 105 PRACTICAL/ LAB**

