Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

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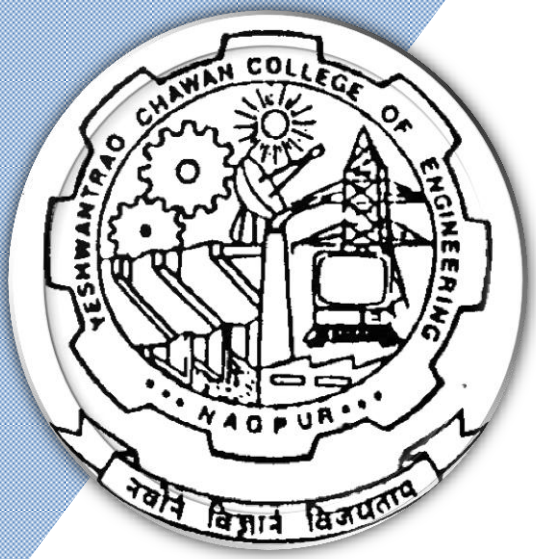

Bachelor of Engineering

Civil Engineering

Minors in Remote Sensing & GIS

SoE & Syllabus 2020

28 June 2020

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2020-21

Civil Engineering

Minors in Remote Sensing & GIS

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
1	V	PC	CV2601	Introduction to Remote Sensing	**T**	3	0	0	3	3	30	30	40	3
2	V	PC	CV2602	**Lab-** Remote Sensing	**T**	0	0	2	2	1		60	40	
3	VI	PC	CV2611	Geographical Information Systems	**P**	3	0	0	3	3	30	30	40	3
4	VI	PC	CV2612	**Lab**- Geographical Information System	**T**	0	0	2	2	1		60	40	
5	VI	PC	CV2613	Applications of RS-GIS for Urban Planning	**T**	3	0	0	3	3	30	30	40	3
6	VII	PC	CV2621	GIS for Environmental Management	**T**	3	0	0	3	3	30	30	40	3
7	VII	PC	CV2622	Advanced GIS Modelling	**P**	3	0	0	3	3	30	30	40	3
8	VII	PC	CV2623	**Lab**- Surveying using GPS	**P**	0	0	2	2	1		60	40	
					TOTAL	**15**	**0**	**6**	**21**	**18**				

MSEs* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 20 marks on lecture quizzes, 8 marks on assignments, 2 marks on class performance

TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.00**	**Applicable for AY 2020-21 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

V Semester
CV2601 : INTRODUCTION TO REMOTE SENSING

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide exposure to students in gaining knowledge on concepts of Geo-informatics. 2. To provide the knowledge of Geo-informatics for various surveys, information extraction, and its application.	The students will be able to 1. Explain the principles of Geo-informatics. 2. Describe the process of data acquisition of satellite images and their characteristics. 3. Illustrate knowledge of remote sensing and GIS in different civil engineering applications.
Mapped Program Outcomes: 1,2,5,10	

UNIT–1 : Basics of Remote Sensing: Definition of Remote sensing ,Principles of Remote Sensing, Electromagnetic spectrum, Interaction of EM Radiation with atmosphere, and target, Atmospheric Widows, Spectral signature of various land cover features.	**[06 Hrs.]**
UNIT–2 : Elements of Remote Sensing System : Platforms : Types of platforms, ground, airborne, and space born platforms, Orbit of satellites, satellites for Earth observations studies, Sensors : Types and classification of sensors, sensor resolutions. Scanners : Types of scanners, push broom scanner, whiskbroom scanner.	**[07 Hrs.]**
UNIT–3 : Basics of Aerial Photogrammetry, Determination and calculation of elevation from RS data**,** Relief displacement, image parallax and vertical exaggeration, Visual Image Interpretation: Elements of interpretation, interpretation key.	**[07 Hrs.]**
UNIT–4 : Digital Image Processing : Basics of DIP, Image Rectification and Registration, Image Enhancement, Image Classification . Remote Sensing Data Formats.	**[07 Hrs.]**
UNIT–5 : Introduction to Geographical Information System, Introduction to Global Positioning System (GPS).	**[06 Hrs.]**
UNIT–6 : Role of Remote Sensing and GIS in Natural Resources Management, Environmental Imapct Assessment, Agriculture, Land use & Land Cover, Disaster Management.	**[06 Hrs.]**

Text Books :

1. Basudeb Bhatta: Remote Sensing And Gis Oxford University Press
2. Dr. B. C. Panda, Remote Sensing Principles And Applications Viva Books Pvt. Ltd.

Reference Books :

1. Jensen ,Remote Sensing Of The Environment: An Earth Resource Perspective, Jensen ,2nd Edition , Pearson, India
2. Emilio Chuvieco ,Fundamentals of Satellite Remote sensing: An Environmental Approach, , 2nd Edition, CRC Press/Taylor & Francis, Boca Raton, Florida, USA. 2016
3. Dale A. Quattrochi, Elizabeth Wentz, Nina Siu-Ngan Lam, and Charles W. Emerson, Integrating Scale in Remote Sensing and GIS: Boca Raton: CRC Press, 2017
4. James B. Campbell, Randolph H. Wynne, Introduction to Remote Sensing, , Guilford Press,2011.

V Semester
CV2602 : LAB - REMOTE SENSING

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Familiarization with image processing, registration, enhancement, techniques, interpretation, classification, Accuracy assessment. 2. Vector layer operations in images. 3. Digital Photogrammetry.	Students will be able to 1. Develop image processing technique and its accuracy assessment. 2. Understand vector layer operations in image for AOI and estimation of area and perimeter. 3. Apply stereo data & 3D aerial triangulation, point measurement auto tie point generations.
Mapped Program Outcomes: 1,2,3,4,5,10,11	

Lab Session - 1 : Familiarization with image processing – Image data loading, visual understanding of image and identification of objects, image histogram and layer information,

Lab Session - 2 : Image registration and analysis- base map / topo map registration, image to map and image to image registration, raster data extraction and working with mask, mosaic.

Lab Session - 3 : Image enhancement techniques- linear and non-linear contrast enhancement, details band composition, edge enhancement, high pass and low pass filtering.

Lab session - 4 : Visual image interpretation- identification of features on image (Physical features, urban features, forest and agricultural landuse), true color and FCC, Interpretation of thermal and Radar images.

Lab session - 5 : Image classification- supervised and unsupervised classification with maximum likelihood, minimum distance to mean technique.

Lab session – 6 : Accuracy assessment of image- understanding error matrix, overall and mapping accuracy, kappa coefficient, ground truth.

Lab session – 7 : Vector layer operations in image- open vector layer for AOI concept understanding, area and perimeter estimation.

Lab session -8: Digital Photogrammetry –understanding stereo data & 3D, aerial triangulation, point measurement, auto tie point generations, understanding DTM & DSM, ortho data.

Reference Books :

1. Lillesand T.M and Kiefer R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, 2008.
2. Lueder, D.R., Aerial Photographic Interpretation, Mc Graw Hill Book Company, New York, 1959

VI Semester
CV2611 : GEOGRAPHICAL INFORMATION SYSTEMS

COURSE OBJECTIVES	COURSE OUTCOMES
1. To introduce the fundamentals and components of Geographic Information System. 2. To provide details of spatial data structures and input, management and output processes.	The students will be able to understand; 1. The basic concepts and components of GIS. 2. Concepts of spatial and non spatial data, map projections and operations.
Mapped Program Outcomes : 1,2,5,10	

UNIT–1 : Introduction - A Brief History of GIS - Geographical concepts and terminology - Essential components of GIS -utility of GIS- Hardware, Software, Data, People, Methods – Proprietary and open source Software Various GIS packages.	**[06 Hrs.]**
UNIT–2 : Data: Spatial and Non-Spatial Data Spatial Data: Points, Lines, Polygons/Area and Surface - Non-Spatial Data - Scales/Levels of Measurement. Data Base: Data sources, Data Base Structure models.	**[07 Hrs.]**
UNIT–3 : Data acquisition: Vector Data Models, Raster data model, Data Compression, arc-node data structure - Raster to vector conversion - Topology and spatial relationships - Data storage verification and editing.	**[07 Hrs.]**
UNIT–4 : Coordinate systems, Datums- Map projections - Coordinate transformation, Georeferencing, Digitization- Methods of digitization, Common errors in digitization.	**[06 Hrs.]**
UNIT–5 : Discrete and continuous surfaces- Digital elevation models, sources of DEM, TIN structure, Extraction of topographic parameters: slope, aspect, delineation of watershed and drainage network DEM applications.	**[06 Hrs.]**
UNIT–6 : Operations in GIS - Overlay, Buffers, Spatial analysis, Network analysis, Application of GIS to various natural resources mapping and monitoring and other civil engineering related problems.	**[07 Hrs.]**

Text Books / Reference Books :

1. Paul Longley., Geographic Information systems and Science, John Wiley & Sons, 2005
2. John E. Harmon & Steven J. Anderson., The design and implementation of Geographic Information Systems, John Wiley & Sons, 2003.
3. Marble, D.F & Calkins, H.W., Basic Readings in Geographic Information System, Spad System Ltd, 1990.
4. Kang Tsung Chang., Introduction to Geographic Information Systems, Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2008.
5. Burrough, P.A., Principles of GIS for Land Resource Assessment, Oxford Publications, 2005.
6. C.P.Lo & Albert K. W.Yeung, Concepts and Techniques of Geographic Information Systems, Prentice Hall India Pvt.Ltd, 2002.
7. Bradley A. Shellito,Introduction to Geospatial Technologies,Fourth Edition, Macmillan Learning
8. John Stillwell , Graham Clarke , Applied GIS and Spatial Analysis,Wiley Publications
9. Paul Bolstad, GIS Fundamentals: A First Text on Geographic Information Systems, Eider Press, 2002

VI Semester
CV2612 : LAB - GEOGRAPHICAL INFORMATION SYSTEM

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Georeferencing application- with special reference to UTM, WGS and Geodatabase handling 2. Spatial analysis- by geoprocessing tools and Network analysis by creating network model 3. Map design and its presentation	Students will be able to 1. Apply The Fundamental Principles of GIS And Related Applications. 2. Understand Geoprocessing Tools, Analyze And Create Network Model 3. Carry Out Map Design and Its Presentation
Mapped Program Outcomes : 1,2,3,5,10,11	

Lab session - 1 : Georeferencing application- Coordinates system, datum conversion/map projection use and types with special reference to UTM and WGS.

Lab session – 2 : Spatial data input- scanning, Heads-up/on screen digitization, creating new features, selecting features, editing features, understanding and use of topology, linear and area measurement, linking of attributes data with geographic features.

Lab session – 3 : Attribute data input- Use of MS Office, excel and access, data updating, queries of table in GIS software (union, intersection, join, relate), creation of graphs.

Lab session -4 : Geodatabase handling- Spatial data formats, feature dataset, feature classes, import of data, understanding layers and data frames, map symbology, labelling features.

Lab session – 5 : Spatial analysis- Query (location and attribute), geoprocessing tools and wizard. Spatial searching (buffer analysis).

Lab session - 6 : Network analysis- utility of network, network model creation, shortest path analysis.

Lab session- 7: Map design and presentation**-** Map layout presentation with scale, index, north line, coordinate etc., thematic maps, export map with different formats.

Reference Books :

1. Ian Heywood / Sarah Cornelius / Steve Carver , An Introduction to Geographical Information Systems, Prentice Hall
2. Elangovan, GIS: Fundamentals, Applications and Implementations , NIPA
3. Patrick McHaffie ,Sungsoon Hwang,Cassie Follett, GIS-An Introduction to Mapping Technologies, CRC PRESS

VI Semester
CV2613 : APPLICATIONS OF RS-GIS FOR URBAN PLANNING

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide students a set of operational skills enabling them to support urban planning and management with remote sensing and GIS-based assessment	The students will be able to understand; 1. Basic concepts of urban planning 2. The use of modern techniques of remote sensing and GIS in key areas of urban planning
Mapped Program Outcomes: 1,2,5,10	

UNIT–1 : **Basic** Concepts of Urbanization and Urban Areas - concept of regions - formal and functional regions - census classification of urban areas - Planning Goals: Natural Resources Management.	**[06 Hrs.]**
UNIT–2 : Urban Socio-economic management and infrastructure planning - Planning physical structures and functional domains - data and information for urban and regional planning by Remote Sensing - Planning goals for urban areas and regions.	**[07 Hrs.]**
UNIT–3 : Urban morphology – Housing typology – Population estimation from remote sensing – Infrastructure demand analysis – Land suitability analysis for Urban renewal – Plan formulation for sectoral and regional, development.	**[07 Hrs.]**
UNIT–4 : Site specific GIS: Housing development, parks and social facilities planning. Use of remote sensing and GIS in assessment, estimation and projections - Design of Urban and regional information systems – revenue and tax collection GIS.	**[07 Hrs.]**
UNIT–5 : Classification of traffic – Optimum route and plans / shortest path – Alignment planning – Traffic and flow management – Accident analysis – case studies. Utility Planning and Asset Management – urban and regional transportation corridors - wholesale and retail trade interactions – commuting.	**[06 Hrs.]**
UNIT–6 : Application of RS and GIS for smarcity concepts, Study for various departmental models and for urban area as well as for rural development schemes. Basic use of LIDAR and Drone technology for smart city.	**[06 Hrs.]**

Text Books /Reference Books:

1. Xiaojun Yang., Urban Remote Sensing: Monitoring, Synthesis and Modeling in the Urban Environment, Wiley-Blackwell, 2011
2. Zhenjiang Shen., Geospatial Techniques in Urban Planning, Springer-Verlag, Berlin Heidelberg, 2012.
3. Henk J. Scholten John C. H. Stillwell (Eds.), Geographical Information Systems for Urban and Regional Planning, Springer, Dorddrecht, 1990.
4. Harry Timmermans (Ed.), Decision Support Systems in Urban Planning, E&FN SPON, London, 1997.
5. Carol L. Stimmel, Building Smart Cities: Analytics, ICT, and Design Thinking, CRC Press, New York, 2016.

VII Semester
CV2621 : GIS FOR ENVIRONMENTAL MANAGEMENT

COURSE OBJECTIVES	COURSE OUTCOMES
1. To enable the students to have a sound knowledge of application of remote sensing and GIS and for understanding the changes in environment, monitoring the pollution affected areas.	The students will be able to understand; 1. Concept of use of satellite imaging for environmental management. 2. Use of remote sensing for soil characterization. 3. Use of GIS for forest management 4. Application of GIS tools and software to water quality management.
Mapped Program Outcomes:1,2,5,10	

UNIT–1 : Introduction - Environmental satellite Mission: GEOS, NOAA, AVHRR, CZCS, Oceansat, Kalpana and others – Spectral characteristics - Data Products – Analysis Tools - Monitoring land, water, atmosphere and ocean using Remote Sensing Data.	**[06 Hrs.]**
UNIT–2 : Soil classifications – Soil survey, Types and methods – Hydrological Soil grouping - Factors influencing soil reflectance properties – Characteristics of saline & alkaline Soils –principle component analysis and orthogonal rotation transformation - Soil mapping - watershed management - Problem soil identification – land evaluation – Case studies.	**[07 Hrs.]**
UNIT–3 : Concepts of Integrated surveys– global effects and climatic changes: land degradation and desertification, extreme events, - effect on forest produces health, forest hazards, sustainable forest Management and practice - biodiversity issues – invasive biotics – mitigation and adaptation – RS & GIS for drawing out action plans – watershed approach – landuse planning for sustainable development – precision farming – Case studies.	**[07 Hrs.]**
UNIT–4 : Forest taxonomy – inventory of forest land – forest types and density mapping – Forest stock mapping – factors influencing degradation of forest – Delineation of degraded forest - Forest change detection and monitoring – Forest fire mapping & damage assessment.	**[07 Hrs.]**
UNIT–5 : Classification of water quality - Sampling procedure - Quality analysis and GIS modeling Pipe Network Design using GIS - Spectral responses of clear and contaminated water.	**[06 Hrs.]**
UNIT–6 : Definition – sources – identification of storage and collection location - Analysis of collection route - Site selection: Transfer station, Disposal site – Waste allocation – design of leachate and gas collection in sanitary landfills – leachate model - case studies.	**[06 Hrs.]**

Text Books/ Reference Books:

1. Chatterjee, S. N., Water Resources Conservation and Management, Atlantic Publishers, 2008.
2. Murthy, V.V.N., Land and Water Management, Khalyani Publishers, 2004.
3. Muthy, J. V. S., Watershed Management, New Age International Publishers, 1998.
4. Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 1998.:
5. Lynn E. Johnson, Geographic Information Systems in Water Resources Engineering, CRC Press, 2008
6. Praveen Kumar, Mike Folk, Momcilo Markus and Jay C. Alameda, Hydroinformatics: Data Integrative Approaches in Computation, Analysis, and Modeling, CRC Press, 2005.
7. Allan Brimicombe, GIS, Environmental Modeling and Engineering, Second Edition, CRC Press, 2009.
8. Andrew Skidmore (Editor, Environmental Modelling with GIS and Remote Sensing, CRC Press), 2002.

VII Semester
CV2622 : ADVANCED GIS MODELLING

COURSE OBJECTIVES	COURSE OUTCOMES
1. To acquire a profound knowledge and understanding of advanced concepts and techniques used in modeling geographic reality and analysis of geo-data and acquire a capability to apply these techniques independently	The students will be able to; 1. Conduct advanced spatial analyses using GIS tools. 2. Study GIS data with complex geospatial models 3. Solve the geospatial problems using programming tools
Mapped Program Outcomes:1,2,5,10	

UNIT–1 : Aquifer Vulnerability: Intrinsic and specific vulnerability - DRASTIC, SINTACS – Ground Water Quality Modelling: MODFLOW, MT3D – Sea water Intrusion Modelling – pollution diffusion model in river - Case studies.	**[06 Hrs.]**
UNIT–2 : Introduction to Geographic Resources Analysis Support System (GRASS) GIS - Raster data handling – Reclassification, recode - map algebra - Resampling and interpolation of raster data – Overlaying - Spatial analysis Neighborhood analysis and cross-category statistics - Buffering - Cost surfaces.	**[07 Hrs.]**
UNIT–3 : Terrain and watershed analysis – Modeling raster data – Vector data handling - Topological operations – Buffering – Overlay – Dissolve – clip, union intersect – Network analysis – Spatial interpolation – handling LIDAR point cloud data.	**[07 Hrs.]**
UNIT–4 : Introduction - creating raster surface from points - interpolating a raster surface - creating TIN surface vector data - building TIN - creating a TIN from a raster- creating a raster from a TIN.	**[07 Hrs.]**
UNIT–5 : Introduction - Need for Spatial models- Conceptual model for solving spatial problems- steps involved, Types of Spatial Models- Descriptive and Process models - Types of Spatial Models- Descriptive and Process models - Types of Process models - Creating Conceptual models - Site Suitability model.	**[06 Hrs.]**
UNIT–6 : DEM and socio-economic – Land use Transportation interaction models – Intelligent transportation systems –Risk, vulnerability models in crime, accidents and disasters - case studies.	**[06 Hrs.]**

Text Books / Reference Books:

1. Burrough, P. A and Racael A. McDonnell, Principles of Geographical Information Systems, Oxford University Publications, 1998.
2. C.P.Lo., Albert K and W.Yeung, Concepts and Techniques of Geographic Information Systems, Prentice Hall India Pvt.Ltd, New Delhi, 2002.
3. ArcGIS 10.1 User Manuals, ESRI, 2013. 4. Kraak, M. and Brown, A. Web Cartography: Development and Prospects, Taylor and Francis, London, 2001.
4. Tereshenkov, A., Web GIS Application in Local Government, VDM Verlag, 2009.
5. Pinde Fu and Jiulin Sun, Web GIS: Principles and Applications, ESRI Press, 2011
6. Maximiliano Firtman., jQuery Mobile: Up and Running, O'Reilly, 2012

VII Semester
CV2623 : LAB - SURVEYING USING GPS

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Inputting GPS Data, DGPS Survey for Analysis. 2. Geospatial Industry for Understanding Current Trend of GIS And Remote Sensing In Project. 3. Field Using Satellite Images, Aerial Photographs and Maps, With GPS Data for Better Interpretation.	Students will be able to 1. Process and Analyze DGPS Survey Data. 2. Understand Current Trend Of GIS And Remote Sensing In Actual Project. 3. Develop & Analyze The Satellite Images, GPS Data And Its Practical Application To Actual Field.
Mapped Program Outcomes : 1,2,3,4,5,10,11	

Lab session -1: GPS- methods of coordinate collection, GPS accuracy and signals, inputting GPS data in computer for analysis.

Lab session -2: DGPS survey-Selection of reference station, DGPS data collection, data processing and accuracy. Navigation.

Lab session -3: Industry tour- Visiting any geospatial industry and understanding current trend of GIS and Remote Sensing, project understanding, discussing and training session.

Lab session -4: Study tour- Identification and understanding of features in the field using satellite images, aerial photographs and maps, ground truth verification with GPS data collection, features photograph collection for better interpretation.

Text Books/Reference Books

1. Satheesh Gopi, R. Sathikumar, N. Madhu, Advanced Surveying - Total Station, GIS And Surveying, Pearson.
2. Jan Van Sickle, GPS For Land Surveys, CRC Press
3. B. Hofmann- Wellenhof, H. Lichtenegger And J. Collins, GPS Theory And Practics, Springer Wien New York
4. Ben Levitan, Lawrence Harte, GPS System: Technology, Operation And Application, Discover Net Publishing