

SEMESTER -III

REMOTE SENSING AND GIS FOR WATER RESOURCES

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UNIT I REMOTE SENSING

Physics of remote sensing, electromagnetic radiation (EMR), Interaction of EMR with atmosphere, earth surface, soil, water and vegetation; Remote sensing platforms – Monitoring atmosphere, land and water resources - LANDSAT, SPOT, ERS, IKONOS and others, Indian Space Programme.

UNIT II DIGITAL IMAGE PROCESSING

Satellite Data analysis - Visual interpretation – Digital image processing – Image preprocessing – Image enhancement – Image classification – Data Merging.

UNIT III GEOGRAPHIC INFORMATION SYSTEM

Definition – Basic components of GIS – Map projections and co-ordinate system – Spatial data structure: raster, vector – Spatial Relationship – Topology – Geodatabase models: hierarchical, network, relational, object oriented models – Integrated GIS database -common sources of error – Data quality: Macro, Micro and Usage level components - Meta data - Spatial data transfer standards.

UNIT IV SPATIAL ANALYSIS

Thematic mapping – Measurement in GIS: length, perimeter and areas – Query analysis – Reclassification – Buffering - Neighbourhood functions - Map overlay: vector and raster overlay – Interpolation – Network analysis –Digital elevation modelling. Analytical Hierarchy Process, – Object oriented GIS – AM/FM/GIS – Web Based GIS

UNIT V WATER RESOURCES APPLICATIONS

Spatial data sources – 4M GIS approach water resources system – Thematic maps - Rainfall-runoff modelling – Groundwater modeling – Water quality modeling - Flood inundation mapping and Modelling – Drought monitoring – Cropping pattern change analysis –Performance evaluation of irrigation commands. Site selection for artificial recharge - Reservoir sedimentation.

REFERENCES:

1. Lillesand, T.M. and Kiefer, R.W., Remote Sensing and Image Interpretation III Edition. John Wiley and Sons, New York. 1993.
2. Burrough P.A. and McDonnell R.A., Principles of Geographical Information Systems,.Oxford University Press. New York. 1998.
3. Ian Heywood Sarah, Cornelius and Steve Carver An Introduction to Geographical Information Systems. Pearson Education. New Delhi, 2002.

ELECTIVE - V
ENVIRONMENTAL IMPACT ASSESSMENT OF WATER
RESOURCES PROJECTS

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UNIT I ENVIRONMENTAL ISSUES

Water resources development and environmental issues – Environment in water resources project planning – Environmental regulations and requirements – The EIA (Environmental Impact Assessment) notification.

UNIT II EIA FUNDAMENTALS

Environmental Impact Assessment (EIA) – Environmental Impact Statement – EIA in Project Cycle – Legal and Regulatory aspects in India according to Ministry of Environment and Forests – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Participation of Public and Non-Governmental Organizations in environmental decision making

UNIT III ENVIRONMENTAL IMPACTS

Hydrological and water quality impacts – Ecological and biological impacts – Social and cultural impacts – Soil and landscape changes – Agro economic issues – Human health impacts – Ecosystem changes.

UNIT IV METHODS OF EIA

EIA team formation – Development of scope, mandate and study design – Base line survey – Check lists – Ad hoc procedures – Network and matrix methods – Semi-quantitative methods – ICID checklist – Economic approaches – Environmental Impact Statement (EIS) preparation.

UNIT V ENVIRONMENTAL MANAGEMENT

In-stream ecological water requirements - Public participation in environmental decision making – Sustainable water resources development – Eco restoration – Hydrology and global climate change – Human ecology – Ecosystem services – Environmental monitoring programs.

REFERENCES:

1. Canter, L.W., Environmental Impact Assessment. McGraw Hill International Edition, New York. 1995.
2. Barathwal, R.R., Environmental Impact Assessment. New Age International Publishers, New Delhi. 2002.
3. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science London. 1999.
4. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Inter Science, New Jersey. 2003.
5. Arnel, N., Hydrology and global environmental change. Prentice Hall, Harlow. 2002.
6. Chari. B., Richa Sharma and S.A. Abbasi, Comprehensive Environmental Impact Assessment of Water Resources Projects : With Special Reference to Sathanur Reservoir Project (Tamil Nadu)/K. Discovery Pub., New Delhi, 2005.
7. UNEP's Environmental Impact Assessment Training Resource Manual -Second Edition, 2002.

CLIMATE CHANGE AND WATER RESOURCES

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UNIT I EARTH'S CLIMATE SYSTEM.

Introduction -Climate in the Spotlight -The Spectrum of Scientific Opinion, -The Earth's Natural Greenhouse Effect - The Importance of Water - Greenhouse Gases-The Role of Carbon Dioxide, The Earth's Carbon Reservoirs, Carbon Cycling-Climate and Weather - The Earth's Climate Machine - Global Wind Systems -Trade Winds and the Hadley Cell,- The Highs and Lows of the Westerlies, -The Vital Importance of Monsoon Rains, Clouds, Storms and Climate -Cloud Formation and Climate,-Hurricanes and Global warming - Global Ocean Circulation - El Niño and its Effects,

UNIT II OBSERVED AND PROJECTED CHANGES IN CLIMATE AS THEY RELATE TO HYDROLOGY

Precipitation (including extremes) - water vapour - Snow and land ice - Sea level – Evapotranspiration - Soil moisture - Runoff and river discharge - Patterns of large-scale variability - Influences and feedbacks of hydrological changes on climate - Land surface effects - Feedbacks through changes in ocean circulation - Emissions and sinks affected by hydrological processes - Projected changes in climate - Patterns of large-scale variability.

UNIT III IMPACTS AND RESPONSES

Observed climate change impacts - effects due to changes in the cryosphere - Future changes in water availability and demand due to climate change - Climate-related drivers of freshwater systems in the future - Impacts of climate change on water stress in the future - Impacts of climate change on costs and other socio-economic aspects of freshwater - Freshwater areas and sectors highly vulnerable to climate change - Uncertainties in the projected impacts of climate change on freshwater systems.

UNIT IV CLIMATE CHANGE ADAPTATION

Water-related adaptation to climate change in the fields of Ecosystems and biodiversity, - Agriculture and food security, land use and forestry, Human health, water supply and sanitation, infrastructure and Economy (insurance, tourism, industry and transportation) - Adaptation, vulnerability and sustainable development

UNIT V CLIMATE CHANGE MITIGATION MEASURES

Sector-specific mitigation - Carbon dioxide capture and storage (CCS) , Bio-energy crops, Biomass electricity, Hydropower, Geothermal energy, Energy use in buildings, Land-use change and management, Cropland management, Afforestation and Reforestation, - Effects of water management policies and measures on GHG emissions and mitigation - Potential water resource conflicts between adaptation and mitigation - Implications for policy and sustainable development.

REFERENCES:

1. Jan C. van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003.
2. IPCC fourth assessment report - The AR4 synthesis report, 2007
3. IPCC fourth assessment report –Working Group I Report, “ The physical Science Basis”, 2007

4. IPCC fourth assessment report - Working Group II Report, " Impacts, Adaptation and Vulnerability", 2007
5. IPCC fourth assessment report – Working Group III Report" Mitigation of Climate change", 2007
6. Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 'Climate Change and Water'. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.

