MDM III–CEM313N: REMOTE SENSING AND GIS

Teaching Scheme: 3L, T-1 Total : 4Hr Total Credit: 4

Evaluation Scheme: 30MSE + 10ISA + 60ESE Total Marks: 100

Duration of ESE: 03 Hrs

COURSE DESCRIPTION

The course aims to introduce the students to the basic concepts and principles of remote sensing and also provide an exposure to GIS technology along with its practical applications in civil engineering projects.

COURSE OUTCOMES

Upon successful completion of this course the students will:

1. apply the principles of remote sensing and GIS and their applications in civil engineering and environmental monitoring.
2. analyze electromagnetic radiation interactions with the atmosphere, land, and water to interpret satellite imagery effectively.
3. apply GIS techniques for spatial data management, visualization, and decision-making in civil engineering projects.
4. use remote sensing data to assess natural resources, monitor environmental changes, and manage water resources.

Relevance of Program Outcomes (PO's) and strength of co-relation

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1		2		1	2							3		3
2	3			2	2							3		
3	3	1	3		3							2	2	3
4				1								2		2

1-Weakly Correlated 2-Moderately Correlated 3-Strongly Correlated

COURSE CONTENT

Remote Sensing [08Hrs]

Definition and Scope of Remote Sensing, Historical Development, Principles & Methods, Active and Passive Remote Sensing, Remote Sensing Platforms, Electromagnetic Spectrum, Blackbody Radiation – Planck's Law – Stefan; Boltzman Law, Satellite Classification Based on Orbit and Purpose, Different Remote Sensing Sensors

EMR Interactions and Remote Sensing Resolutions [08Hrs]

EMR Interaction with atmosphere – Scattering: Rayleigh, Mie, Non-selective and Raman Scattering, Back Scattering and Speckle, EMR interaction with water and ozone, Atmospheric windows and their significance, EMR Interaction with earth surface materials: Radiance, Irradiance, Absorbed & Transmitted energy, Reflectance: Specular & Diffuse Surfaces, Spectral Signatures and spectral signature curves, EMR Interaction with Soil, Resolution types in Remote Sensing: Spectral, Spatial, Radiometric, and Temporal

Remote Sensing Applications in Civil Engineering and Resource Management [08Hrs]

Characteristics and Enhancement of Digital Satellite images, Image Processing Techniques: Filtering, Classification (Supervised & unsupervised), image enhancement, Applications of Aerial Photographs and satellite imageries: merits & limitations, water resource management, watershed management, urban studies and planning, flood management, forestry and agriculture, disaster management and environmental monitoring

Geographic Information System [08Hrs]

Definition & Component of GIS: Hardware, software, and organizational context, Spatial and Non-spatial data, maps and projections: types, Data Input methods: Digitizer and scanner, editing and error correction, Raster and vector data structures: comparison, analysis techniques: Data retrieval, reclassification, overlay analysis, buffering, Data Output: Printers & Plotters

Data Interpretation and GIS Applications [08Hrs]

Visual Interpretation of Satellite Images: Elements of image Interpretation, Interpretation Keys, Characteristics of Digital Satellite Image, GIS & Remote Sensing Integration, Application of GIS: Urban Planning, Water resources management, watershed analysis, land use and land cover mapping, environmental monitoring and disaster risk management

Text Books:

1. Anji Reddy, "Remote Sensing and Geographical Information Systems", BS Publications 2001

Reference Books:

1. Anand P.H, "Principles of remote Sensing and Geographical Information Systems", Sri Venkateswara Publishers, 2003.
2. Lillesand T.M and Kiefer R.W. Remote sensing and Image, Interpretation, John Wiley and Sons, INC, New York, 1987.
3. Burrough P A, "Principle of GIS for land resource assessment", Oxford University, 1990

MDM IV – CEM366N: GREEN BUILDING AND ENERGY CONSERVATION

Teaching Scheme: 2L **Total : 2Hr** **Total Credit: 2**

Evaluation Scheme: 30MSE + 10ISA + 60ESE **Total Marks: 100**

Duration of ESE: 03 Hrs

COURSE DESCRIPTION

This course introduces the fundamental principles of Green Building and Energy Conservation, focusing on sustainable design, construction techniques, energy efficiency, and environmental impact reduction. It covers green building materials, energy conservation strategies, renewable energy integration, and rating systems such as IGBC, LEED, GRIHA, and BREEAM. The course emphasizes practical applications in civil engineering, including water conservation, waste management, and life cycle analysis for sustainable infrastructure development.

COURSE OUTCOMES

Upon successful completion of this course the students will able to:

1. apply the principles of green building design and their role in sustainable development.
2. analyze energy conservation strategies and implement passive and active solutions in building design.
3. evaluate renewable energy sources for integration into green buildings and Perform life cycle assessment (LCA) and cost-benefit analysis for sustainable construction projects.
4. design water and waste management systems for efficient resource utilization.

Relevance of Program Outcomes (PO's) and strength of co-relation

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1		3	3		1	2							1	2
2						1	2					2		1
3	3		3	1	2		1					3	2	1
4	1	1	2		2							3	2	2

1- Weakly Correlated 2-Moderately Correlated 3-Strongly Correlated

COURSE CONTENT

Introduction to Green Building and Sustainability [04Hrs]

Concept of Green Building – Definition and Importance, Conventional vs Green Building, Sustainability: Environmental, Economical and Social Benefits, Carbon Footprint, and Climate Change Impact, Green Building Site Planning and Development: Site Selection criteria, urban heat island effect and mitigation strategies, sustainable landscaping and green roofs, Green Building Certifications and Rating Systems: LEED, IGBC, GRIHA, BREEAM – Process, Evaluation criteria and case studies

Energy Efficiency in Buildings [04Hrs]

Building Energy Demand and Consumption: Conventional vs green building, Energy Benchmarking, Passive Energy Conservation Techniques: Building Orientation, design considerations, natural ventilation, insulation and high performance building envelope, Active Energy Conservation Strategies: HVAC, building automation, smart grids, Net zero building: design strategies and case studies

Renewable Energy Integration in Green Buildings [04Hrs]

Solar Energy Utilization: PV systems, thermal applications (water heating, space heating/cooling), Wind and geothermal energy: Case Studies on small scale applications, Biomass and bioenergy, Energy storage and microgrid Solutions, Case Studies

Water and Waste Management in Green Buildings [06Hrs]

Water Conservation Strategies: RWH and Ground water recharging, water efficient plumbing fixtures and appliances, wastewater treatment and recycling, Sustainable urban drainage system: stormwater management, permeable pavements, Construction and demolition waste management: 4R, Strategies for zero waste

Life Cycle Assessment (LCA) and Future Trends in Green Building [06Hrs]

Life Cycle Assessment of Buildings: EIA for sustainable construction, embodied energy and carbon footprint analysis, Cost-Benefit Analysis of Green Building, Smart Cities and IoT enables green buildings, Future Trends: circular economy principles, net-zero and climate positive buildings, advances in green materials and technologies

Text Books:

1. **Kibert, C. J.** (2016). Sustainable Construction: Green Building Design and Delivery (4th Edition). Wiley
2. **Yudelson, J.** (2019). Green Building: Principles and Practices in Residential Construction. Cengage Learning.
3. HarharaIyer G, Green Building Fundamentals, Notion Press, (latest edition)
4. Dr. Adv. HarshulSavla, Green Building: Principles & Practices (latest edition)
5. Green Building Hand Book by Tomwoolley and Samkimings, 2009(latest edition)

Reference Books:

1. **Routledge Handbook of Sustainable Design** (2017) – Edited by Rachel Beth Egenhoefer.

2. **ASHRAE GreenGuide: The Design, Construction, and Operation of Sustainable Buildings** (5th Edition). ASHRAE.
3. Sam Kubba, “Hand book of Green building Design and construction”, Elsevier Architecture Press.
4. Abe Kruger and Carl Seville, “Green building: principals and practice in residential construction”, Cengage Learning.
5. IGBC Green New building rating system (Version 3.0), March 2015.
6. GRIHA Manual Volume-1: Introduction to National Rating System by Ministry of New and Renewable Energy, Government of India and the energy and resource institute, New Delhi.