

Name of the Programme: M. Sc. Marine Sciences

Course Code: MSC 621

Title of the Course: Remote Sensing and its Applications

Number of Credits: 03

Effective from AY: 2022-23

Prerequisites for the course:	Students who have undergone M.Sc. Part I.	
Objective:	To provide a basic understanding of remote sensing, and some applications in physical oceanography and auxiliary disciplines.	
Content:	Module I Principles of Electromagnetic radiation, energy and matter interactions – Rayleigh scattering – Mie scattering, Non selective scattering – radiative transfer in the atmosphere – Stefan’s law and Wien’s displacement law – Zenith and azimuth angles.	15 hrs.
	Module II Optical remote sensing – bio-optical properties of sea water – inherent and apparent optical properties – scattering – absorption-attenuation - diffuse attenuation – remote sensing reflectance – Case I and Case II waters – radiative transfer in the water column. Sun photometry – Beer-Lambert’s law – spectral variation of aerosol optical thickness – atmospheric correction – interpretation of ocean colour.	15 hrs.
	Module III Thermal infrared remote sensing – Thermal infrared properties – Atmospheric windows – Thermal radiation laws – Emissivity – sea surface temperature retrieval through IR sensors – Active and passive microwave remote sensing – Satellite altimetry of sea surface topography. Sensor characteristics of AVHRR, CZCS, SeaWiFS, MODIS, MSI, OCM-2 and FLEX – fundamentals of digital image processing – image rectification – image enhancement – linear stretching – supervised and unsupervised classification.	15 hrs.
Pedagogy:	Lectures/ Tutorials/ Assignments	

References/ Readings:	1.Rees, W. G. (1990). <i>Physical Principles of Remote Sensing</i>, (1990). U.K.: Cambridge University Press. 2.Sabins Jr., F. F. (1987). <i>Remote Sensing: Principles and Interpretations (Second Edition)</i>. New York, U.S.A.: W. H. Freeman. 3.Robinson, I. S. (1985). <i>Satellite Oceanography</i>. Somerset, N.J., U.S.A.: John Wiley & Sons. 4.Narayan, L. R. A. (1999). <i>Remote Sensing and its Applications</i>. Hyderabad: Universities Press. 5.Mukherjee, S. (2004). <i>Textbook of Environmental Remote Sensing</i>. Delhi – Chennai – Jaipur – Mumbai – Patna – Bangalore – Bhopal – Chandigarh – Coimbatore – Cuttack – Guwahati – Hubli – Hyderabad – Lucknow – Madurai – Nagpur – Pune – Raipur – Siliguri – Thiruvananthapuram – Visakhapatnam : Macmillan India Limited. ISBN: 1403 92235 7. 6.Emery, W., & Camps, A. (2017). <i>Introduction to Satellite Remote Sensing: Atmosphere, Ocean, land and Cryosphere Applications</i>. Amsterdam – Oxford – Cambridge, Massachusetts, U.S.A.: Elsevier. ISBN: 978-0-12-809254-5. 7.Janssen, L. L. F., & Bakker, W. H. (2000). <i>Principles of Remote Sensing: An Introductory Textbook</i>. International Institute for Aerospace Survey and Earth Sciences. 8.Joseph, G. (2005). <i>Fundamentals of Remote Sensing (Second Edition)</i>. Hyderabad: Universities Press.	
Course Outcomes:	1. An understanding of basics of remote sensing. 2. Applications of remote sensing to ocean science. 3. To understand basics of sensors used in remote sensing.	

Name of the Programme: M. Sc.Marine Sciences

Course Code: MSC 622

Title of the Course: Remote Sensing and its Applications Practical

Number of Credits: 01

Effective from AY: 2022-23

Prerequisites for the course:	Students who have undergone M.Sc. Part I.	
Objective:	Understanding of remote sensing and its applications in oceanography.	
Content:	1. Analysis of aerosol optical depth (A.O.D.) depth and estimation of atmospheric turbidity parameter and Angstrom exponent. (10 hrs, All references). 2. Chlorophyll-a concentration variability using satellite images (10 hrs, All references). 3. Application of satellite images to environmental issues. (10 hrs, All references).	30 hrs.
Pedagogy:	Practical/ tutorials/ assignments.	
References/Readings:	1.Rees, W. G. (1990). <i>Physical Principles of Remote Sensing</i> , (1990). U.K.: Cambridge University Press. 2.Sabins Jr., F. F. (1987). <i>Remote Sensing: Principles and Interpretations (Second Edition)</i> . New York, U.S.A.: W. H. Freeman. 3.Robinson, I. S. (1985). <i>Satellite Oceanography</i> . Somerset, N.J., U.S.A.: John Wiley & Sons. 4.Narayan, L. R. A. (1999). <i>Remote Sensing and its Applications</i> . Hyderabad: Universities Press. 5.Mukherjee, S. (2004). <i>Textbook of Environmental Remote Sensing</i> . Delhi – Chennai – Jaipur – Mumbai – Patna – Bangalore – Bhopal – Chandigarh – Coimbatore – Cuttack – Guwahati – Hubli – Hyderabad – Lucknow – Madurai – Nagpur – Pune – Raipur – Siliguri – Thiruvananthapuram – Visakhapatnam : Macmillan India Limited. ISBN: 1403 92235 6.Emery, W., & Camps, A. (2017). <i>Introduction to Satellite Remote Sensing: Atmosphere, Ocean, land and Cryosphere Applications</i> . Amsterdam – Oxford – Cambridge, Massachusetts, U.S.A.: Elsevier. ISBN: 978-0-12-809254-5. 7.Janssen, L. L. F., & Bakker, W. H. (2000). <i>Principles of Remote Sensing: An Introductory Textbook</i> . International Institute for Aerospace Survey and Earth Sciences. 8.Joseph, G. (2005). <i>Fundamentals of Remote Sensing (Second Edition)</i> . Hyderabad: Universities Press.	
Course Outcome:	1. Understanding of basic applications of remote sensing in oceanography.	