

	large data sets and generate programs. Plot global ocean /atmosphere data for specific spatial and temporal ranges.	
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Programme: M.Sc. (Marine Sciences)

Course Code: MSC 263

Title of the Course: Law of the Sea and Coastal Regulation Zone

Number of Credits: 02

Effective from AY: June 2018-19

Prerequisites for the course	Students who have undergone courses of semester I of Marine Sciences.	
Objective	This course introduces the law of the Sea and the concept of coastal regulation zone.	
Content	Law of the Sea – Territorial Sea – Contiguous zone – Straits used for international navigation – Archipelagic states – Exclusive economic zone – Continental shelf – High seas – Regime of islands – enclosed or semi-enclosed seas – Right of access of land-locked states – Protection and preservation of marine environment – Scientific and technical assistance – international rules and national legislation to prevent, reduce and control pollution of the marine environment.	12 hours
	Coastal Regulation Zone – Demarcation – Prohibited activities – Regulation of permissible activities – Procedure for monitoring and enforcement – Classification of Coastal Regulation Zone – Category I (CRZ-I) – Category II (CRZ-II) – Category III (CRZ-III) – Category IV (CRZ-IV) – Norms for regulation of activities – CRZ-I – CRZ-II – CRZ-III – CRZ-IV – Guidelines for development in the designated areas of CRZ-III – Permitted petroleum products for storage in CRZ.	12 hours
Pedagogy	Lectures / Assignments / Seminars / Discussion	
References / Readings	<ol style="list-style-type: none"> 1. United Nations Convention on the Law of the Sea 1982 A Commentary, 2011 volume 7, Nordquist M. N., Martinus Nijhoff Publishers. 2. United Nations Convention on the Law of the Sea, 2009, United Nations, Nova Science Publishers, Inc., New York. 3. Coastal Regulation Zone 2011 and Island Protection Zone 2011 notifications issued 6.1.2011, Ministry of Environment and Forests. 4. Coastal Regulation Zone notification 1991 under E(P)A, 1986 – 19.2.91 5. Coastal Regulation Zone and Island Protection Zone notifications 2011, ICZM project, Ministry of Environment, Forests and Climate change, July 11, 2016. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Understanding of the laws applicable for navigation in sea. 2. Knowledge of international and national legislation to control marine pollution. 3. Understanding coastal regulation zone to prevent the deterioration of coast. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 264 **Title of the Course:** Remote sensing and its applications

Number of Credits: 04

Effective from AY: June, 2018-19

Prerequisites for the course:	Students undergoing course in any branch of Marine Sciences.
Objective:	All the coastal process is transient in nature. They are of either diurnal/weekly time scale. To deal with such variability the requirement is a method that would provide a synoptic coverage of the coastal and offshore regions. This is possible only by means of Remote sensing. Hence this emerging technology has been introduced as a course.

Content:	Principles of Electromagnetic radiation– Energy matter interactions — Rayleigh scattering – Mie scattering – Non selective scattering - Radiative transfer in the atmosphere – Stefan’s and Wien’s displacement laws –Zenith and azimuth angles.	12 hours
	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.	12 hours
	Sun photometry - Beer-lambert’s law - spectral variation of aerosol optical thickness - atmospheric correction - interpretation of ocean colour - spectral response of water as a function of organic and inorganic constituents - Analysis of suspended minerals, chlorophyll <i>a</i> and dissolved organic matter through OCM/MODIS data.	12 hours
	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 – MSS, GOES, AVHRR, CZCS, SeaWiFS, IKONOS, MODIS, OCM I and OCM - II, LISS -I, LISS-II, WIFS and PAN – Fundamentals of digital image processing – Image rectification – Image enhancement – linear stretching – supervised and unsupervised classification - Introduction to Geographic Information system.	12 hours
Pedagogy:	Being a new and an emerging field, it is necessary to have class room contact hours. Hence, it is a class room taught course. In addition, to get acquainted with the course, seminar topics on the applications of remote sensing are given to the students at the beginning.	
References/ Readings	<ol style="list-style-type: none"> 1. Physical principles of remote sensing, 1990 – Rees, W.G., Cambridge Univ. Press, U.K. 2. Remote sensing optics and optical systems, 1980 – Slater, P.N., Addison Wesley Publ. Co. 3. Remote sensing and image interpretation (2nd edn), 1987 – Lillesand, T.M. and Kiefer, R.W., John Wiley and sons. 4. Remote sensing: Principles and interpretations (2nd edn), 1987 – Floyd and F. Sabnis Jr. W.H. Freeman and Co., New York. 5. Theory and application of optical remote sensing, 1989 – Asrar G., John Wiley & Sons. 6. Introduction to satellite oceanography, 1985 – Maul, G.A., Martinus Nijhoff Publ. 7. Advanced remote sensing from theory to applications (vol.1, 2 & 3), 1981 – Chlamys, F.T., Addison wisley Publ. Co. Inc., Canada. 8. Oceanography from space, 1987- Gover, J.A.R., Plenum Press, New York. 9. Remote sensing of atmospheres and oceans, 1980 - Deepak A., Academic press. 10. Satellite oceanography, 1985 - Robinson, I.S., John Wiley & Sons 	
Learning Outcomes	Since the country is in advanced stage in the field of space Technology, the students opting for this course will be trained Manpower to carry forward Nation’s need for human resources in the field of Remote sensing.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 265

Title of the Course: Remote Sensing and its applications Practical

Number of Credits: 02

Effective from AY: June, 2018-19

Prerequisites for the course:	Students undergoing course in any branch of Marine Sciences.
Objective:	This course is the practical component of the theory students learn. This involves satellite data processing for various applications of Ocean/earth/ atmosphere. In this course, students will be exposed to different satellite data, various corrections to be applied and finally image processing for a finished geophysical product.