Programme: M. Sc. (Marine Sciences)
Course Code: MSO 266Title of the Course: Analytical Chemistry of Sea water and
Number of Credits: 04 **Instrumental Techniques**
Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.
Objective:	1. The course is aimed at understanding the collection sea water, sediment and biological samples by using different field equipments. 2. To adopt suitable techniques for preservation water, sediment and biological samples for their chemical analyses. 3. The course work is so designed to understand the errors generally occur in the analyses of samples by different techniques. 4. To study different techniques used for extraction of various inorganic chemicals (fresh water, salt, bromine, calcium, magnesium and potassium) and organic chemicals (Agar, Carrageenan and Alginic acid) and 5. To study instruments used (Spectrophotometer, spectrofluorimeter, and flame photometer, AAS, ICP, GC and HPLC) for analyses of different chemical constituents in sea water.

Content:	Sampling – Collection and preservation of water, sediment and biological samples. General Errors, Accuracy and Precision.Filtration and Storage - Criteria of an ideal filtering medium- Glass fiber, membrane and Nucleopore filters. Storage for analysis of water for major elements, nutrients, dissolved phosphate, total phosphorous, nitrogen compounds silicates, and trace metals. Chemical separation methods: Pre-concentration methods: Co-precipitation, Co-crystallization, ion exchange and solvent extraction methods, their principles and applications.	12 hours
	Fresh water recovery by various methods of desalination, Low temperature thermal desalination, Distillation, solar evaporation, Membrane process, scale formation and its prevention. Chemical recovery process- Chemistry of salt manufacture, Different grades of salt, washing of sea salt, salt for industries, up-gradation of sea salt, solar evaporation, forced evaporation of brine, Grainer process, Alberger process, Open pan evaporation and vacuum pan evaporation methods. Recovery of bromine from salt bittern, Dow process, Steaming out process for the manufacture of bromine. Recovery of magnesium, magnesium metal from sea water, Dow process and IG-MEL process for the production of magnesium. Recovery of potassium from sea water, Balard and Niccoli Processes for the production of potassium from sea water.	12 hours
	Extraction of Agar, Alginates and Carrageenan from seaweeds - their structures, production, uses and toxicology.Extraction of marine drugs: Chemical and Pharmacological Aspects- Prostaglandins, Steroids, Terpenes and Nitrogenous compounds, Antibiotic compounds from sponges, Cephalosporins and Fish and Shellfish toxins**.**	12 hours
	Chromatographic methods: Gas liquid and high performance liquid chromatograph Basic principles and application to marine samples**.**Spectroanalytical methods: Photometry and Spectrophotometry, Fluorimetry, Flame photometry, Atomic absorption spectrophotometry, Flameless AAS and Inductively coupled plasma emission spectrometry - Basic principles, instrumentation and applications in the analyses of marine samples.	12 hours
Pedagogy:	Lectures/ Tutorials/ assignments/self study.	
References/ Readings	1. A text book of qualitative Inorganic Analysis including Elementary Instrumental analysis, Vogel - 1978. The English Language book society. 2. Standard methods for the examination of water and waste water analysis (22nd edition), 2012. Rice, E.W and Bridgewater L. American Public health association, Washington DC. 3. Methods of seawater analysis, 1983 - Grosshoff, Verlag Chemie, Weinneim. 4. Manual for geochemical analysis of marine sediments and suspended particulate matter, 1992 - Loring and Rantala, Earth Science Review. 5. Chemical Oceanography, 1975 – Riley, J.P and Skirrow, G (eds.), Vol. 3, 1975. Academic Press, London. 6. Environmental Chemistry, 1995 - Anil Kumar De, Wiley Eastern Limited and New age international limited, New Delhi. 7. Marine drugs: chemical and Pharmaceutical aspects. In Chemical Oceanography - H.W. Young Y. Shimizu, In Chemical Oceanography, volume 4, Riley, J.P, and Chester, G (eds.). 8. Marine natural products, 1983 - Scheuer, P.J (ed), Chemical and Biological prospective, Academic Press, London. 9. Marine natural products, 1973 - Scheuer, P.J. Academic Press, London. 10. Quantitative analysis, 2001 - Day, R.A and Underwood, A. L .Prentice-Hall of India, New Delhi.	

	11. Instrumental methods of Chemical analysis, 4^{th} edition. 1981 - Ewing, G.W., Mc Graw Hill.	
Learning Outcomes	1. These studies would help for accurate measurement of chemical parameters by taking care of necessary precautionary steps during the chemical analyses. 2. Different techniques used for desalination of sea water and inorganic and organic chemicals were known. 3. Pharmacological actions of many drugs obtained from the sea are understood. 4. Instruments used for chemical analyses of sea water and their working principles are well known.	