

M. Sc. Oceanography Syllabus Semester I and Semester II
Credit Based and Grading System
To be implemented from the Academic year 2017-2018

SEMESTER I - THEORY

Course Code	Unit	Topic Headings	Credits	L/Week
PSOCN101	I	Fundamentals of Oceanography-I	4	1
	II	Sub domains of Oceanography-I		1
	III	Oceanographic Topography-I		1
	IV	Techniques & Technology in Oceanography-I		1

Course Code	Unit	Topic Headings	Credits	L/Week
PSOCN102	I	Fundamentals of Physical Oceanography-I	4	1
	II	Oceanographic Climatology-I		1
	III	Dynamical Oceanography-I		1
	IV	Oceanographic Meteorology-I		1

Course Code	Unit	Topic Headings	Credits	L/Week
PSOCN103	I	Fundamentals of Chemical Oceanography-I	4	1
	II	Chemical Composition of Oceans-I		1
	III	Natural Chemical Resources in Oceans-I		1
	IV	Oceanic Chemical Pollution-I		1

Course Code	Unit	Topic Headings	Credits	L/Week
PSOCN104	I	Fundamentals of Biological Oceanography-I	4	1
	II	Oceanic Non-Chordates-I		1
	III	Oceanic Chordates-I		1
	IV	Anthropogenic Oceanography-I		1

PRACTICALS

PSOCNP101	Tools & Techniques in Oceanography-I	2	1
PSOCNP102	Oceanic Dynamics-I	2	1
PSOCNP103	Chemical Oceanography-I	2	1
PSOCNP104	Organisms in Oceans-I	2	1

SEMESTER II - THEORY

Course Code	Unit	Topic Headings	Credits	L/Week
PSOCN201	I	Advances in Oceanography	4	1
	II	Sub domains of Oceanography-II		1
	III	Oceanographic Topography-II		1
	IV	Techniques & Technology in Oceanography-II		1

Course Code	Unit	Topic Headings	Credits	L/Week
PSOCN202	I	Advances in Physical Oceanography	4	1
	II	Oceanographic Climatology-II		1
	III	Dynamical Oceanography-II		1
	IV	Oceanographic Meteorology-II		1

Course Code	Unit	Topic Headings	Credits	L/Week
PSOCN203	I	Advances in Chemical Oceanography	4	1
	II	Chemical Composition of Oceans-II		1
	III	Natural Chemical Resources in Oceans-II		1
	IV	Oceanic Chemical Pollution-II		1

Course Code	Unit	Topic Headings	Credits	L/Week
PSOCN204	I	Advance in Biological Oceanography	4	1
	II	Oceanic Non-Chordates-II		1
	III	Oceanic Chordates-II		1
	IV	Anthropogenic Oceanography-II		1

PRACTICALS

PSOCNP201	Tools & Techniques in Oceanography-II	2	1
PSOCNP202	Oceanic Dynamics-II	2	1
PSOCNP203	Chemical Oceanography-II	2	1
PSOCNP104	Organisms in Oceans-II	2	1

M. Sc. Oceanography Syllabus

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SEMESTER I – THEORY

PSOCN 101 – Basics of Oceanography **60L**

Unit I- Fundamentals of Oceanography-I **15L**

- 1.1 Definition, history and facts about Oceanography: Biographies of ancient Oceanographers and their contribution; importance of study of Oceans and its relevance to current science & technology
- 1.2 Various Oceans on Earth, their peculiarities pertaining to geographical, climatic & other aspects
- 1.3 Concepts of Oceanography, Marine Sciences, Meteorology, Climatology & other relevant topics and their interrelationships
- 1.4 Scope of Oceanography in
 - 1.4.1 Academics
 - 1.4.2 Science & Technology
 - 1.4.3 Commercial ventures
 - 1.4.4 Hobbies & Skills

Unit II- Sub Domains of Oceanography-I **15L**

- 2.1 Various types, faculties & branches of Oceanography
- 2.2 Principles of Physical, Chemical & Biological Oceanography
- 2.3 Need & significance to study each sub domain

Unit III- Oceanographic Topography-I **15L**

3.1 Definition and basics of topography in general and, oceanic, in particular

3.2 Topographic differences among various oceans on Earth

3.2.1 Zonation and its significance in Oceanography

Unit VI- Techniques & Technology in Oceanography-I **15L**

4.1 Ancient Techniques

4.1.1 Pre-historic Techniques

4.1.2 Historic Techniques

4.2 Application of the techniques in the study of oceans

4.3 Overview of technologies in Oceanography

PSOCN 102 – Physical Oceanography I **60L**

Unit I- Fundamentals of Physical Oceanography I **15L**

1.1 Basics of Physical Oceanography

1.1.1 Physical conditions in oceans

1.1.2 Physical properties of oceans

1.1.3 Physical activities in oceans

1.2 Interrelations between physical conditions, properties & activities in different oceans and the role in deciding the uniqueness of each ocean

1.3 Current status of Physical Oceanography in the World

Unit II- Oceanographic Climatology I**15L**

- 2.1 Interactivities among physical factors of oceans, climates thereof, palaeoenvironment and its role in physical oceanography
- 2.2 Effects of geographic changes in oceans on other physical aspects of each ocean on Earth
- 2.3 Climate change & anthropogenic activities in oceans

Unit III- Dynamical Oceanography I**15L**

- 3.1 Properties of Oceanic water
- 3.2 Fluid dynamics of rotating sphere and its correlation with oceans
- 3.3 Mixing, turbulence on surface layer
- 3.4 Tides & waves
- 3.5 Air-ocean interaction: Al Nino effect

Unit IV- Oceanographic Meteorology I**15L**

- 4.1 Collecting meteorological data in oceans; interpreting the data & metadata and its utility in study of oceans and the overall earth climate
- 4.2 Study of various aspects of meteorology for devising various models in climate prediction
- 4.3 Anthropogenic activities study for better & practical analysis of the data & metadata generated in meteorological studies of oceans

PSOCN 103 – Chemical Oceanography I

60L

Unit I- Fundamentals of Chemical Oceanography I

15L

- 1.1 Basic Principles of Chemical Oceanography with overview of the chemical composition oceans
- 1.2 Chemical composition of each ocean with reference to the physical & physico-chemical characteristics and biotic environment
- 1.3 Natural resources- gaseous, liquefied and solid chemical parameters
 - 1.3.1 Available resources
 - 1.3.2 Exploited resources
 - 1.3.3 Unexploited resources and ancient & earlier techniques to excavate these chemical wealth

Unit II- Chemical Composition of Oceans I

15L

- 2.1 Detailed overview of chemicals known to date in the oceans
- 2.2 Chemical processes in each ocean characterizing physical, geochemical, geographical, biochemical & biological environments
- 2.3 Salinity, chlorinity, pH and other parameters in oceans

Unit III- Natural Resources I

15L

- 3.1 Detailed account of all the known natural resources in oceans
- 3.1.1 Dissolved gases and their chemical interactions leading to many geographical perturbations in oceans
- 3.1.2 Dissolved liquids that make the ocean unique and its significance at physical, geographical & biological nature of an individual ocean
- 3.1.3 Solid deposits, precipitates and suspensions in each ocean
- 3.2 Techniques deployed to unearth the chemical parameters in oceans
- 3.3 Account of known but unexploited oceanic reserves

Unit IV- Oceanic Pollution I

15L

- 4.1 Etiology of marine & oceanic pollution
- 4.2 Possible natural disturbances causing pollution in oceans with detailed account in each ocean in particular
- 4.3 Anthropogenic activities resulting in oceanic pollution
- 4.4 Oceanic pollutants and their characteristics for human benefits
- 4.5 Known remedial measures for pollution at sea & oceanic level

PSOCN 104 – Biological Oceanography I **60L**

Unit I- Fundamentals of Biological Oceanography I **15L**

- 1.1 Origin of life in water- various theories of inorganic & organic evolution
- 1.2 Biological associations that lead to stabilize the oceanic environment- mutualism, commensalism, parasitism; intra-specific interactions
- 1.3 Overview of the biota in individual oceans and its impact on physical, chemical & geographical environments

Unit II- Oceanic Non-chordates I **15L**

- 2.1 Phylogeny Systematics of non-chordates and assorted topics- I
Principles of systematic, importance of taxonomic studies in Biology, use of morphometric studies, Osteological studies, use of homologous organs
- 2.2 Taxonomic keys: Different kinds of taxonomic keys, their merits and demerits
- 2.3 Phylogeny, salient features, classification up to classes (wherever applicable) of the non-chordate phyla found in oceans & seas

Unit III- Oceanic Chordates I **15L**

- 3.1 Phylogeny of Oceanic chordates
- 3.2 Systematics & taxonomy of Oceanic chordates
- 3.3 Economic significance of chordates pertaining to physical & chemical parameters and their associations with each other and human interactions

Unit IV- Anthropogenic Oceanography I

15L

- 4.1 Human evolution with respect to oceanography
- 4.2 Oceanographic processes and human development
- 4.3 Anthropogenic factors having direct correlation with oceanography

PSOCNP 101: Pracicals based on PSOCN 101

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SEMESTER II – THEORY

PSOCN 201 – Advances in Oceanography

60L

Unit I- Advances in Oceanography

15L

- 1.1 Fundamental research in Oceanography; biographies of the researchers that laid foundation to recent advances in the field

- 1.2 Basic advances with respect to the geography, physical & chemical characteristics of each ocean

- 1.3 Recent advances pertaining to meteorology, climatology and oceanography

- 1.4 Advances in Oceanography in
 - 1.4.1 Academics
 - 1.4.2 Science & Technology
 - 1.4.3 Industries

Unit II- Sub Domains of Oceanography-II

15L

- 2.1 Recent knowledge of various types, faculties & branches of Oceanography

- 2.2 Advances in Physical, Chemical & Biological Oceanography

- 2.3 Need & significance of the advances in the study of each sub domain

Unit III- Oceanographic Topography-II **15L**

- 3.1 Oceans, Seas and other water bodies in saline environments
- 3.2 Topological studies with respect to advances in computational geography
- 3.2.1 Zonation and its significance in Oceanography using various modern techniques and applying different computational models

Unit VI- Techniques & Technology in Oceanography-I **15L**

- 4.1 Recent Techniques in Oceanography
 - 4.1.1 Modern Techniques
 - 4.1.2 Ultra modern Techniques
- 4.2 Recent Application of the techniques in the study of oceans
- 4.3 Overview of modern technologies in Oceanography

PSOCN 202 – Physical Oceanography II **60L**

Unit I- Advances in Physical Oceanography **15L**

- 1.1 Basic advances in Physical Oceanography
 - 1.1.1 Physical conditions in oceans
 - 1.1.2 Physical properties of oceans studied using recent advances in computational sciences
 - 1.1.3 Physical activities in oceans in view of the advent of science & technology
- 1.2 Interrelations between physical conditions, properties & activities in different oceans and the role in deciding the uniqueness of each ocean using satellite imaging
- 1.3 Future of Physical Oceanography in the World

Unit II- Oceanographic Climatology II **15L**

- 2.1 Observational techniques using modern technology
- 2.2 Effects of geographic changes in oceans on agricultural modeling
- 2.3 Climate change and weather predictions using satellite imaging of oceans

Unit III- Dynamical Oceanography II **15L**

- 3.1 Properties of Oceanic water in light of advanced technology
- 3.2 Fluid dynamics of rotating sphere and its correlation with oceans
- 3.3 Mixing, turbulence on surface layer: modern interpretations
- 3.4 Impact of tides & waves in view of the recent developments in oceans
- 3.5 Air-ocean interaction: beyond Al Nino effect

Unit IV- Oceanographic Meteorology II **15L**

- 4.1 Collecting meteorological data in oceans; interpreting the data & metadata and its utility in study of oceans and the overall earth climate
- 4.2 Study of various aspects of meteorology for devising various models in climate prediction
- 4.3 Anthropogenic activities study for better & practical analysis of the data & metadata generated in meteorological studies of oceans

PSOCN 203 – Chemical Oceanography II

60L

Unit I- Advance in Chemical Oceanography

15L

- 1.1 Chemical Oceanography with overview of the chemical composition oceans analysed with modern technologies in Electrochemistry & other advanced techniques
- 1.2 Chemical composition of each ocean with reference to the physical & physico-chemical characteristics and biotic environment at the molecular level using applications of recent advances *viz* Nanotechnology
- 1.3 Natural resources- gaseous, liquefied and solid chemical parameters
 - 1.3.1 Additional resources, which were unfathomed till recent times
 - 1.3.2 Exploited resources earthed using modern excavation techniques
 - 1.3.3 Unexploited resources and recent & modern techniques to excavate these chemical wealth

Unit II- Chemical Composition of Oceans II

15L

- 2.1 Detailed overview of chemicals in the oceans: known & beyond
- 2.2 Chemical processes in each ocean characterizing physical, geochemical, geographical, biochemical & biological environments unraveled to micro-level details studied with the help of computational models
- 2.3 Salinity, chlorinity, pH and other parameters in oceans: impact on biological world

Unit III- Natural Resources II

15L

- 3.1 Details of attempts made to fathom the unknown natural resources in oceans
 - 3.1.1 Dissolved gases and their chemical interactions leading to many geographical perturbations in oceans: modern perspectives
 - 3.1.2 Dissolved liquids that make the ocean unique and its significance at physical, geographical & biological nature of an individual ocean: laboratory techniques to implement in the field for detailed study of these chemicals
 - 3.1.3 Solid deposits, precipitates and suspensions in each ocean: study using modern techniques & technology like SONAR, USG *etc*
- 3.2 Modern & very recent Techniques deployed to unearth the chemical parameters in oceans
- 3.3 Account of unknown and unexploited oceanic reserves that would enrich human population in all respects

Unit IV- Oceanic Pollution I

15L

- 4.1 Effects of marine & oceanic pollution in view of modern advances in Chemistry
- 4.2 Natural disturbances causing pollution in oceans with detailed account in each ocean in particular using actual & virtual models
- 4.3 Carbon sequestration
- 4.4 Converting the ill-effects of pollutants for development of seas & oceans
- 4.5 Remedial measures for pollution at sea & oceanic level using various recent advances in Biochemistry and Nanobiotechnology

PSOCN 204 – Biological Oceanography II

60L

Unit I- Fundamentals of Biological Oceanography I

15L

1.1 Origin of life in water- modern theories of organic evolution

1.2 Biological associations that lead to disturb the oceanic environment- interspecific & intraspecific negative interactions

1.3 Overview of the biota in individual oceans and its impact on meteorological, dynamical & climatic changes

Unit II- Oceanic Non-chordates II

15L

2.1 Advanced methods to study the missing links in the phylogeny of non-chordates

2.2 Taxonomic studies using carbon dating and other modern techniques

2.3 Phylogeny, salient features, classification up to classes (wherever applicable) of the protochordate phyla found in oceans & seas

Unit III- Oceanic Chordates II

15L

3.1 Oceanic chordates: their role in maintaining the ecological balance

3.2 Oceanic chordates: Commercial value and various utilities to humans

3.3 Methods in excavating deep oceanic chordates and its role in future world economics

Unit IV- Anthropogenic Oceanography I

15L

- 4.1 Role of Human with recent developments in oceanography
- 4.2 Oceanographic processes and human development: Modern perspectives
- 4.3 Oceanography in future: computational and IT advancements in the field

PSOCNP 201: Pracicals based on PSOCN 201

PSOCNP 202: Pracicals based on PSOCN 202

PSOCNP 203: Pracicals based on PSOCN 203

PSOCNP 204: Pracicals based on PSOCN 204

Reference Books:

PSOCN 101 & 201

1. Fundamentals of Oceanography: Keith Sverdrup *et al*
2. Fundamentals of Oceanography: Alison Duxbury
3. Essentials of Oceanography: Alan Trujilo & Harold V. Thurman

PSOCN 102 & 202:

1. The Oceans and Climate: Bigg R. Grant
2. Mathematics. Climate and Environment: Diaz J. L., J. L. Lions
3. Modern Physical Climatology: Hartmann D. L.
4. Descriptive Physical Oceanography, an Introduction: Lynne D. Taley

PSOCN 103 & 203:

1. Chemical Oceanography: Frank J. Millero
2. Chemical Oceanography: J. P Riley, R. Chester
3. Chemical Oceanography: P. J. Wangersky
4. Chemical Oceanography and Marine Carbon Cycle: Rainer Amon

PSOCN 104 & 204:

1. Biological Oceanography: Charles Miller, Patricia Wheeler
2. Biological Oceanography an Introduction: Carol M. Lalli, Timothy R. Parsons
3. Biological Oceanography: Martin V. Angel
4. Achievements in Biological Oceanography: Richard T. Barber, Anna K. Hilting