INTRODUCTION TO OCEANOGRAPHY – MR240
SPRING 2017

Instructor: Allain Bourgoin
Office: Math/Science Office **Tel.:** 320-2480 ext.: 222
Office hours: Monday, Wednesday, Friday from 12:00 to 13:30 (or by appointment)
Lecture schedule: Monday, Wednesday, Friday at 3:10 to 4:05 pm **Room:** A-101
Laboratory: Tuesday (Tu) from 11:00 to 1:55 pm --- Mandatory

Prerequisite: ESL 089 (Reading V)

Course description: This course will highlight various disciplines of oceanography including sections covering the history of oceanography, the geological, chemical, physical and biological oceanography, and the use of some ocean resources. Through laboratory and field exercises, students will be introduced to common equipment used in oceanography and learn how to collect and analyze oceanographic data and how to submit a report respecting the scientific format.

INSTITUTIONAL STUDENT LEARNING OUTCOMES:
(Ref: http://www.comfsm.fm/catalog/2016-2017/Catalog%202016-2017UPDATED8.pdf -- page 19)
COM-FSM graduates will demonstrate:

1. **Effective oral communication:** capacity to deliver prepared, purposeful presentations designed to increase knowledge, to foster understanding, or to promote change in the listeners' attitudes, values, beliefs, or behaviors.
2. **Effective written communication:** development and expression of ideas in writing through work in many genres and styles, utilizing different writing technologies, and mixing texts, data, and images through iterative experiences across the curriculum.
3. **Critical thinking:** a habit of mind characterized by the comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating an opinion or conclusion.
4. **Problem solving:** capacity to design, evaluate, and implement a strategy to answer an open-ended question or achieve a desired goal.
5. **Intercultural knowledge and competence:** a set of cognitive, affective, and behavioral skills and characteristics that support effective and appropriate interaction in a variety of cultural contexts.
6. **Information literacy:** the ability to know when there is a need for information, to be able to identify, locate, evaluate, and effectively and responsibly use and share that information for the problem at hand.
7. **Foundations and skills for life-long learning:** purposeful learning activity, undertaken on an ongoing basis with the aim of improving knowledge, skills, and competence.
8. **Quantitative Reasoning:** ability to reason and solve quantitative problems from a wide array of authentic contexts and everyday life situations; comprehends and can create sophisticated arguments supported by quantitative evidence and can clearly communicate those arguments in a variety of formats.

MARINE SCIENCE PROGRAM STUDENT LEARNING OUTCOMES (PSLO):
Upon completion of the COM-FSM Marine Sciences requirements, students will be able to:

1. Demonstrate fundamental knowledge of geological, geomorphological, physical, chemical, and biological oceanography.
2. Apply fundamental knowledge of marine sciences towards identifying and critically analyzing, and outlining potential solutions for local, regional and global problems relating to marine systems.
3. Apply the scientific process to formulate hypotheses, design experiments, and collect and analyze data from which valid scientific conclusions are drawn.
4. Communicate effectively, in written and oral forms, utilizing the language and concepts of marine science.

COURSE STUDENT LEARNING OUTCOMES (CSLO) AND STUDENTLEARNING OUTCOMES (SLO):
With 60% mastery – Students will be able to achieve the following learning outcomes:

CSLO 1. *The student will be able to list some general facts that permit to consider that "Earth is an Ocean World".*
The student will be able to…

- **SLO 1.1** … to identify the major ocean basins and report on basic ocean statistical facts

CSLO 2. *The student will be able to identify major historical events showing how the science of oceanography has evolved over time.*
The student will be able to…

- **SLO 2.1** … to enumerate the work of early mariners and list major explorers who contributed to the advances in early ocean studies.
- **SLO 2.2** … to associate the rise of modern oceanography that began in the early 20th century with the change in technology

CSLO 3. *The student will be able to describe the theory of plate tectonics and demonstrate how it relates to the distribution and origin of sea floor morphological features and its overlying sediment depositions. (Geological oceanography)*

The student will be able to…

- **SLO 3.1** …to list the three density stratified layers of the Earth and compare/contrast between the continental crust and the oceanic crust
- **SLO 3.2** … to enumerate the arguments that Wegener used to defend the theory of continental drift
- **SLO 3.3** … to associate the theories of seafloor spreading to plate tectonics by listing and describing the supportive evidences confirming these theories
- **SLO 3.4** … to review plate tectonics in terms of its effect on ocean margins and basins by summarizing in a table format the characteristics of plate boundaries
- **SLO 3.5** … to draw the profile of the ocean basins with its distinct continental margin and deep-ocean basin and label its respective seafloor components
- **SLO 3.6** … to classify the sediment by particle size, source/origin, and state their respective degree of importance, their distribution over the seafloor bed, along with the influence of the CCD on sediment distribution
- **SLO 3.7** … to furnish statistics on the present economic importance of marine minerals and fossil fuels and their potential future exploitation outcomes.

CSLO 4*. The student will be able to relate the structure of the water molecule to the chemical and physical properties of the ocean. (Chemical oceanography)*

The student will be able to…

- **SLO 4.1** … to describe the properties of the water molecule and how its high heat capacity regulates the world climates.
- **SLO 4.2** … to define the principle of constant proportions (Dittmar principle) and its link in measuring the total seawater salinity via the chlorinity
- **SLO 4.3** … to name the three major dissolved gases in seawater; sketch and comment the profiles of both the oxygen and carbon dioxide concentration levels with depth in an open ocean environment.
- **SLO 4.4** … to explain the effect of the temperature and salinity in defining the density of given seawater mass; then, name the three major density stratified zones of the ocean basins.

CSLO 5. *The student will be able to illustrate the interaction between the oceanic and the atmospheric circulation patterns and explain how it affects the climate patterns of the Earth. (Physical oceanography)*

The student will be able to…

- **SLO 5.1** … to sketch the global atmospheric circulation cells or weather patterns; their associated wind regimes; and the corresponding convergence and divergent zones.
- **SLO 5.2** … to sketch a model of a geostrophic gyre with its associated wind regimes; identify and describe the associated oceanic currents within the gyre.
- **SLO 5.3** … to differentiate upwellings from downwellings; to relate the importance of upwellings in terms of primary productivity, marine life support, and economic interest for major world fisheries.
- **SLO 5.4** … to describe the thermohaline circulation, the major associated water masses, and the potential affect of climate change on the global converyer belt system.

CSLO 6*. The student will be able to describe the factors that generate tides and define the various tidal patterns. (Physical oceanography)*

The student will be able to…

- **SLO 6.1** … to define the term "tides"; differentiate between the Spring and Neap tides; compare/contrast diurnal, semidiurnal, and mixed tides; define a tidal range; differentiate between the flood, ebb currents, and slack water; and define tidal bores, surge wave, and tsunami (tidal wave).

CSLO 7*. The student will be able to state the factors that influence the primary productivity in the oceans and illustrate how it affects the biomass of living forms in the ocean realm. (Biological oceanography)*

The student will be able to…

- **SLO 7.1** … to classify the marine environment according to light penetration; according to location; and according to behavior.
- **SLO 7.2** … to describe the flow of energy and materials in an ocean ecosystem by sketching a pyramid of energy; by giving examples of such pyramids; and by describing where the richest fishing grounds are found and why this is so.

CSLO 8*. The student will be able to apply the scientific method to comprehend, interpret, analyze, and evaluate oceanographic concepts.*

The student will be able to…

- **SLO 8.1** … to illustrate through various examples covered during the lectures on how scientists apply the scientific method to identify, engage, and solve problems that arise in oceanography

Course Content:

AN OCEAN WORLD
1. Ocean basins and basic statistical facts on the oceans

A HISTORY OF MARINE SCIENCE
1. Early mariners, the age of discovery, and expeditions during the 18e & 19e century
2. Modern Oceanography (the 20e century)

EARTH STRUCTURE AND PLATE TECTONICS
1. A Layered Earth
2. Towards an Understanding of Earth
3. Plate Tectonics: A Closer Look
4. The Confirmation of Plate Tectonics
5. Problems and Implications

CONTINENTAL MARGINS AND OCEAN BASINS
1. The Topography of Ocean Floor
2. Continental Margins
3. Deep-Ocean Basins

SEDIMENTS
1. What Sediments Look Like
2. Classifying Sediments by Particle Size
3. Classifying Sediments by Source (Origin)
4. The Distribution of Marine Sediments
5. The Sediments of Continental Margins
6. The Sediments of Deep-Ocean Basins
7. The Economic Importance of Marine Sediments

SEAWATER CHEMISTRY
1. The Water Molecule
2. The Dissolving Power of Water
3. Seawater
4. Dissolved Gases

OCEAN PHYSICS
1. Water and Heat
2. Global Thermostatic Effects
3. Temperature, Salinity, and Water Density
4. An Overview of the Ocean Surface Conditions

ATMOSPHERIC CIRCULATION AND WEATHER
1. Composition and Properties of the Atmosphere
2. Weather and Climate
3. Wind Patterns

OCEAN CIRCULATION
1. The Forces That Drive Currents
2. Surface Currents
3. Wind-Induced Vertical Circulation
4. Thermohaline Circulation

LIFE IN THE OCEAN
1. The Organization of Communities
2. Classification of the Marine Environment
3. The Flow of Energy and Materials
4. Marine Productivity

Required textbook:

Garrison, T. and R. Ellis. 2016. Oceanography: An Invitation to Marine Science. 9th ed. National Geographic Learning. Cengage Learning, Boston, MA. (USA)

Required Course Materials: None

Other References:

Pinet P.R. 2003. Invitation to Oceanography. 3nd ed. Jones and Bartlett Publishers, Sudbury MA (USA). 555pp.

Trujillo A.P. and H.V. Thurman. 2008. Essentials of Oceanography. 9th ed. Pearson/Prentice Hall. Upper Saddle River NJ (USA). 534pp.

Other references and reading assignments covering various oceanography issues will be given in class during the semester.

Instructional Cost: none

Method of instruction: The course will be taught by lectures extensively supported by PowerPoint presentations. Handouts will be furnished for each covered chapter. These handouts will be placed on WIKI. The students are asked to print the notes out and bring them to class. These notes will guide the students throughout the lectures and will be a useful tool to prepare the exams. The laboratory sessions will mainly focus on the study of the dynamics of an estuary. A field trip will be held to collect data. Then in successive laboratory sessions, the data will by compiled and analyzed and an extensive laboratory report synthesizing research findings will be submitted at the end of the semester.

Evaluation: Class quizzes and home assignments; 4 tests including the mid-term and final exams; semester report on the dynamics of an estuary (Laboratory session)

Grading:

Homework, quizzes…	15%
Exams	
Exam 1	15%
Exam 2 (Mid-Term)	15%
Exam 3	15%
Exam 4 (Final Exam)	15%
Laboratory *	25%

*NOTE: The laboratory is mandatory. A student that misses more than <u>two laboratory sessions</u> will automatically be withdrawn from the course and will receive a "F" as final grade.

Grading scale:

89.5-100%	A	59.5-69.4%	D
79.5-89.4%	B	below 59.5%	F
69.5-79.4%	C		

Class Attendance: The COM-FSM attendance policy is described on page 117 of the General Catalog 2016-2017 (http://www.comfsm.fm/catalog/2016-2017/Catalog%202016-2017UPDATED8.pdf):

"Regular and prompt class attendance is expected of all students. It shall be the student's responsibility to inform the instructor(s) of anticipated or unavoidable absences and to make up work missed as a result of absences. Mandatory attendance is at the discretion of the instructor provided that conditions for the attendance are included in the course syllabus and communicated to the students on the first day of class."

<u>My attendance policy is as follow</u>: ***Students who are absent for more than <u>six</u> classes, will automatically be dropped from the course. The total missed classes include unexcused and excused absences, such as sickness, funerals, and any other circumstances. LATE ARRIVALS COUNT AS AN ABSENCE.***

In order to reward the students who always show up on time and never miss class nor laboratory sessions, the following additional grades will be awarded in the following way.

0 absence	*3% added to the final grade*
1 absence	*2% added to the final grade*
2 absences	*1% added to the final grade*
3 absences or more	*no bonus*

Exams: All students are obligated to write each of the exams. If a student misses an exam, he or she will automatically receive a zero (0) for that specific exam unless the student was sick and furnished a written note signed by a medical expert as proof of sickness. In this case, the other three (3) tests will be re-weighed accordingly. **Please note that there are no "make-up tests".**

Assignments (Quizzes, homework…): Details of home assignments, quizzes will be given in class.
It is the responsibility of each student to assure that he or she completes and returns all assignments given by the professor. Due dates will be indicated for each assigned work. After this due date, the work will no longer be accepted and the student will automatically receive a zero (0) for the specific assignment not turned in. **All assignments are due at the beginning of the class/lab period. I will not accept any late assignments.**

Academic Honesty: *To ensure the integrity of the educational process and the institution, the College encourages academic honesty, and therefore does not condone cheating, plagiarism, or any related form of academic dishonesty which prevents an instructor from being able to assess accurately the performance of a student in any facet of learning. Students found guilty of academic dishonesty, cheating, plagiarism, and facilitating academic dishonesty will be liable to dismissal or suspension from the College.* . (p.115 of the General Catalog 2016-2017: (http://www.comfsm.fm/catalog/2016-2017/Catalog%202016-2017UPDATED8.pdf)

Graffiti and betel nut: Any student found scribbling on desks or chewing betel nut in classes will be liable to dismissal or suspension from the class. (see below for obligations relative to the Pohnpei State betel nut policy effective January 1, 2017)

> Peilapalap, Pohnpei: September 16, 2016 - On Friday September 16, 2016 Governor Marcelo Peterson signed the historic BETEL NUT legislation that was unanimously and recently passed by the Pohnpei State Legislature.
> The historic legislation prohibits anyone to consume or chew betel nut in government offices, buildings, vehicles, boats, ships and other public gathering settings including Churches and traditional houses (Nahs). The bill also prohibits businesses to sell betel nut to minors under the age of 18. Furthermore, anyone who is in violation of this law will be fined, put in jail or both.
> The Governor stated that this legislation was long overdue and is necessary due to the increasing number of cancer related cases and deaths in the State of Pohnpei. He also mentioned that Pohnpei is still under a State of Emergency for Non Communicable Diseases (NCD) and therefore will require the State leadership, community leaders and local stakeholders to work together in reversing the crisis. Furthermore, the Governor tasked the State Department of Health Services and its partners to start with the education and work with relevant State Departments and agencies in enforcing the new Betel Nut law.
>
> The FSM National Cancer Control and Non Communicable Disease Program Manager, Mr. Xner Luther who represented the FSM Secretary of Health Magdalena Walter praised the Governor and the State Legislature for their leadership in tackling the NCD crisis and for setting the standard for Cancer related legislation.

Be on time in class: The official way to synchronize clocks on campus is to refer to:
http://www.timeanddate.com/worldclock/micronesia/kolonia
This is the official time based on atomic clocks in Boulder, Colorado. Synchronize your watch to that time and show up on time in class. If you are late, you might face a "locked door" and will not be able to assist class. **Do not forget that late arrivals count as "absences".**

Electronics: None of the students will be allowed to use electronics in class unless approved. This means that there will be NO USE OF Laptops, MP3s IPods, IPads, Iphones, Tablets etc. Equally, I will not tolerate that students have "earphones" tangling from their ears or around their necks. All these gadgets must be stored away before class starts.

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TENTATIVE COURSE SCHEDULE –SPRING 2017

Week 1 (Jan 9- Jan 13) (Jan 11- Last day add/drop)	• Syllabus (Monday, January 9) • An Ocean World; A History of Oceanography **Readings: Ch 1 &2; Lecture notes**
Week 2 (Jan 16 – Jan 20)	• Earth Structure and Plate Tectonics **Readings: Ch 3; Lecture notes**
Week 3 (Jan 23 – Jan 27)	• Continental Margins/Ocean Basins • Sediments **Readings: Ch 4 & 5; Lecture notes**
Week 4 (Jan 30 – Feb 3)	• Sediments (cont.) **Exam 1 (Wednesday, Feb 1)** **Readings: Ch 5; Lecture notes**
Week 5 (Feb 6 – Feb 10)	• Seawater Chemistry **Activity: Readings: Ch 6; Lecture notes**
Week 6 (Feb 13 – Feb 17)	• Ocean Physics **Readings: Ch 7; Lecture notes**
Week 7 (Feb 20 – Feb 24)	• Ocean Physics (cont.) **Readings: Ch 7; Lecture notes**
Week 8 (Feb 27 – Mar 3) (Feb 29-Mar 1 – mid-terms)	**Mid-term evaluation (Monday, Feb 27)** • Atmospheric circulation and weather **Readings: Ch 8; Lecture notes**
Week 9 (Mar 6 – Mar 10)	• Atmospheric circulation and weather (cont.) • Ocean circulation **Readings: Ch 8 & 9; Lecture notes**
Week 10 (Mar 13 – Mar 17) (March 17 – Last day to "W")	• Ocean circulation (cont.) **Readings: Ch 9; Lecture notes**
Week 11 (Mar 20 – Mar 24)	• Ocean circulation (cont.) **Readings: Ch 9; Lecture notes**
Week 12 (Mar 27– Mar 31) (March 30 – COM-FSM founding day) (March 31 -Holiday: cultural day)	• Ocean circulation (cont.) **Exam 3 (Wednesday, Mar 29)** **Readings: Ch 9; Lecture notes**
Week 13 (Apr 3 – Apr 7)	• Exam 3 - revision **Readings: Ch 11; Lecture notes**
Week 14 (Apr 10 – Apr 14) (Apr 12, 13, & 14: Easter Recess & Good Friday)	• Tsunami and Tides **Readings: Ch 11; Lecture notes**
Week 15 (Apr 17 – Apr 21)	• Life in the Oceans **Readings: Ch 13; Lecture notes**
Week 16 (Apr 24 – Apr 28)	• Life in the Ocean (cont) **Readings: Ch 13; Lecture notes**
Week 17 (May 1 – May 5) (May 2 – last day of instruction) (May 3, 4, & 5: final exams)	• Course revision (Mo May 1) • May 3, 4 & 5 – **Final Exams**
Week 18 (May 8 – May 12) (May 10 – Holiday (FSM Const. day) (May 11 – Graduation)	• May 11 – Graduation