ALAGAPPA UNIVERSITY

(A State University Established in 1985)

Karaikudi - 630003. Tamil Nadu, India

2017 Accredited with A+ Grade by NAAC (CGPA : 3.64)

2018 MHRD Govt. of India UGC Category - I Granted Autonomy

2018 MHRD Swachh Campus Rank : 4

2021 nirf National Institutional Ranking Framework Rank : 33

2021 QS University Rankings Asia Rank : 199

FACULTY OF SCIENCE

DEPARTMENT OF OCEANOGRAPHY AND COASTAL AREA STUDIES

M.SC., OCEANOGRAPHY AND COASTAL AREA STUDIES

REGULATIONS AND SYLLABUS

(For the candidates admitted from the Academic Year 2022 - 2023)

DEPARTMENT OF OCEANOGRAPHYANDCOASTALAREASTUDIES

M.Sc., Oceanography and Coastal Area Studies

REGULATIONS AND SYLLABUS

[For the candidates admitted from the Academic Year 2022– 2023 onwards]

ALAGAPPAUNIVERSITY

(A State University Accredited with "A+" grade by NAAC (CGPA:3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC)

Karaikudi-630003, Tamil Nadu.

The Panel of Members-Broad Based Board of Studies

Chairperson: Name:Dr.C.Stella,Designation:ProfessorandHeadDepartmentOceanographyandCostalAreaStudies,AlagappaUniversity,Karaikudi,TeachingExperience:24,ResearchExperience:27,Areaof Research: Biodiversity, Ecology-EIA and Mollusc an Taxonomy &Biology	
Foreign Expert: Name: ParticioRDelosRios-Escalante, Designation: Assistant Professor, Department: Faculty of Natural Resources, University: Catolica De Temuco, Chile, Teaching Experience:20,ResearchExperience:22, Area of Research: Systematics and Ecology.	
Indian Expert: Name: Dr. M. Kalaiselvam, Designation: Director Department: CAS in Marine Biology, Faculty of Marine Sciences, University: Annamalai University, Teaching Experience: 20Years, Research Experience:28, Area of Research: Marine Microbiology (Marine Mycology).	
Indian Expert: Name: Dr.C.Raghunathan, Designation: Joint Director, Institution: Zoological Survey of India, Research Experience: 28, Area of Research: Marine Biology, Zoology and Ecology.	
Industry Expert: Name: Dr.S.SancheHullas, Designation: Aquaculture Consultant Company name and address: Avanti feeds Ltd, Kovur- 534350 West Godavari District, Andhra Pradesh.Experience:21Area :Aquaculture	
Members (All Department faculty)	
Name: Dr.V.Sugumar, Designation: Assistant Professor Department Oceanography and Costal Area Studies, Alagappa University, Karaikudi, Teaching Experience:14Years, Research Experience:14Years, Area of Research: Crustacean Biology &Marine Biomaterials	
Name:Dr.S.Paramasivam,Designation:AssistantProfessorDepartmentOceanographyandCostalAreaStudies,AlagappaUniversity,Karaikudi,Teaching Experience: 14Years, Research Experience: 14Years, Area of Research: Marine Microbiology / Seafood Safety	
Alumnus/Alumna:Name:Dr.V.YogananthanCurrentposition:AssistantProfessor, Type of Profession: Teaching and Research: 10 Yrs, Professionaladdress:DepartmentofMarineSciences:BharathidasanUniversity,Tiruchirappalli–24	

ALAGAPPA UNIVERSITY
DEPARTMENT OF OCEANOGRAPHYAND COASTAL AREA STUDIES
Karaikudi- 630003, TamilNadu.

REGULATIONS AND SYLLABUS- (CBCS- University Department)
[For the candidates admitted from the Academic Year 2022 – 2023 onwards]

Name of the Department **:** Oceanography and Coastal Area Studies
Name of the Programme **:** Oceanography and Coastal Area Studies
Duration of the Programme **:** Full Time (Two Years)

Choice-Based Credit System

A choice-Based Credit System is a flexible system of learning. This system allows students to gain knowledge at their own tempo. Students shall decide on electives from a wide range of elective courses offered by the University Departments in consultation with the Department committee. Students undergo additional courses and acquire more than the required number of credits.They can also adopt an inter-disciplinary and intra-disciplinary approach to learning, and make the best use of the expertise of available faculty.

Programme

"Programme" means a course of study leading to the award of a degree in a discipline.

Courses

'Course' is a component (a paper) of a programme. Each course offered by the Department is identified by aunique course code. A course contains lectures/ tutorials/ laboratory /seminar/ project / practical training/report writing /Viva-voce, etc or a combination of these, to meet effectively the teaching and learning needs.

Credits

The term "Credit" refers to the weightage given to a course, usually in relation to the instructional hours assigned to it. Normally in each of the courses credits will be assigned on the basis of the number of lectures/tutorial/laboratory and other forms of learning required to complete the course contents in a 15-week schedule. One credit is equal to one hour of lectureperweek.Forlaboratory/fieldworkonecreditisequaltotwohours.

Semesters

An Academic year is divided into two **Semesters.** In each semester, courses are offered in 15teaching weeks and the remaining 5 weeks are to be utilized for conduct of examination andevaluationpurposes.Eachweekhas30workinghoursspreadover5daysa week.

Medium of Instruction:

English

Departmental committee

The Departmental Committee consists of the faculty of the Department. The Departmental Committee shall be responsible for admission to all the programmes offered by the Department including the conduct of entrance tests, verification of records, admission, and evaluation. The Departmental Committee determines the deliberation of courses and specifies the allocation of credits semester-wise and course-wise. For each course, it will also identify the number of credits for lectures, tutorials, practical's, seminars etc. The courses (Core/Discipline Specific Elective/Non-Major Elective) are designed by teachers and approved by the Departmental Committees. Courses

approved by the Departmental Committees shall be approved by the Board of Studies/Broad Based Board of Studies. A teacher offering a course will also be responsible for maintaining attendance and performance sheets (CIA -I, CIA-II, assignments and seminar) of all the students registered for the course. The Non-major elective programme, MOOCs coordinator and Internship Mentor are responsible for submitting the performance sheet to the Head of the department. The Head of the Department consolidates all such performance sheets of courses pertaining to the programmes offered by the department. Then forward the same to be Controller of Examinations.

Programme Educational Objectives- (PEO)

PEO-1	Equip students with a thorough understanding of the basic principles of oceanography, including physical, chemical, biological, and geological aspects of marine environments.
PEO-2	Develop an in-depth comprehension of coastal processes and dynamics, including shoreline erosion, sediment transport, and the impact of human activities on coastal areas.
PEO-3	Foster a detailed understanding of marine ecosystems, biodiversity, and the ecological interactions within various marine habitats, including coral reefs, estuaries, and deep-sea environments.
PEO-4	Train students in modern oceanographic research techniques and tools, such as remote sensing, GIS applications, and oceanographic instrumentation
PEO-5	Provide skills for assessing the environmental impact of natural events and human activities on marine and coastal ecosystems, including pollution, climate change, and habitat destruction
PEO-6	Develop knowledge of marine and coastal policy, management strategies, and conservation practices to sustainably manage marine resources and coastal zones.
PEO-7	Enhance practical skills through fieldwork, including data collection, sample analysis, and interpretation of results to study marine and coastal environments.
PEO-8	Promote critical thinking and problem-solving skills by analyzing complex oceanographic and coastal issues, proposing solutions, and evaluating their feasibility.
PEO-9	Encourage an interdisciplinary approach to understanding the ocean and coastal areas by integrating concepts from biology, chemistry, physics, geology, and environmental science.
PEO-10	Strengthen students' ability to communicate scientific findings effectively to diverse audiences, including peers, policymakers, and the public, and to work collaboratively in multidisciplinary teams

Programme Specific Objectives-(PSO)

PSO-1	Equip students with detailed knowledge of coastal processes, including sediment dynamics, erosion, deposition, and the influence of human activities on coastal morphology and ecosystems.
PSO-2	Develop the ability to analyze and interpret the structure, function, and dynamics of marine ecosystems, emphasizing ecological interactions and the impact of environmental changes on marine biodiversity
PSO-3	Train students in advanced oceanographic methods and technologies, such as remote sensing, GIS, and in-situ measurements, for studying oceanic and coastal phenomena.

PSO-4	Foster expertise in the application of marine and coastal policies, management practices, and conservation strategies to ensure the sustainable use and protection of marine resources and coastal zones
PSO-5	Enhance students' research skills and their ability to critically evaluate scientific data, formulate research questions, and develop solutions to complex marine and coastal challenges through interdisciplinary approaches.

Programme Outcome-(PO)

PO-1	Students will demonstrate a comprehensive understanding of the fundamental principles of oceanography, including physical, chemical, biological, and geological aspects.
PO-2	Students will be able to analyze and interpret coastal processes, such as sediment transport, erosion, and deposition, and understand the impact of human activities on coastal environments.
PO-3	Students will be proficient in using modern oceanographic tools and techniques, including remote sensing, Geographic Information Systems (GIS), and oceanographic instrumentation, for data collection and analysis
PO-4	Students will be capable of conducting environmental impact assessments to evaluate the effects of natural events and human activities on marine and coastal ecosystems.
PO-5	Students will possess a deep understanding of marine ecosystems, including species diversity, ecological interactions, and the impact of environmental changes on marine habitats.
PO-6	Students will be knowledgeable about marine and coastal policies, laws, and management strategies, and able to apply this knowledge to promote sustainable development and conservation efforts
PO-7	Students will have the ability to design and conduct independent research projects, analyze scientific data, and effectively communicate their findings through written and oral presentations
PO-8	Students will be able to integrate concepts from various scientific disciplines (biology, chemistry, physics, geology, and environmental science) to solve complex oceanographic and coastal issues
PO-9	Students will be experienced in conducting fieldwork in marine and coastal environments, including data collection, sample processing, and in-situ measurements
PO-10	Students will demonstrate strong critical thinking and problem-solving skills, enabling them to tackle complex challenges in oceanography and coastal area management and propose effective solutions

Programme Specific Outcome-(PSO)

PSO-1	Graduates will possess a thorough understanding of the physical, chemical, biological, and geological processes that govern marine and coastal environments.
PSO-2	Graduates will be skilled in utilizing modern oceanographic and coastal research techniques, including remote sensing, GIS, and various field and laboratory instruments, to collect and analyze environmental data
PSO-3	Graduates will be capable of assessing the environmental impacts of natural and anthropogenic activities on marine and coastal ecosystems and will be knowledgeable about conservation strategies and sustainable management practices.

PSO-4	Graduates will be adept at conducting scientific research, including designing experiments, collecting and interpreting data, and presenting findings effectively through scientific reports and presentations
PSO-5	Graduates will be able to apply an interdisciplinary approach to solve complex problems in oceanography and coastal area management, integrating knowledge from various scientific disciplines to develop holistic solutions

Eligibility for admission:

The Eligibility criteria for M.Sc.Oceanography and Coastal Area Studies, B.Sc.,in Zoology/ Botany/ Chemistry/ FisheryScience/ EarthScience/ Physics/ Agriculture/ Microbiology/ Biotechnology/Geology/Aquaculture/Marine Biology/Applied sciences or equivalent thereof in the related disciplines at least 55%marks for SC/ST45%marks.

Minimum Duration of programme

The programme is for a period of two years. Each year shall consist of two semesters viz. Odd and Even semesters. Odd semesters shall be from June / July to October / November and even semesters shall be from November / December to April / May. Each semester there shall be 90 working days consisting of 6 teaching hours per working day (5days/week).

Components

A PG programme consists of a number of courses. The term "course" is applied to indicate a logical part of the subject matter of the programme and is invariably equivalent to the subject matter of a"paper" in the conventional sense. The following are the various categories of the courses suggested for the PG programmes:

A. Core courses (CC)- "Core Papers" means "the core courses" related to the programme concerned including practical and project work offered under the programme and shall cover core competency,criticalthinking,analyticalreasoning,andresearchskill.

B. Discipline-Specific Electives (DSE) means the courses offered under the programme related to the major but are to be selected by the students, shall cover additional academic knowledge, critical thinking, and analytical reasoning.

C. Non-Major Electives(NME)-Exposure beyond the discipline

- Students have to undergo a total of two Non Major Elective courses with 2 credits offered by other departments (one in II Semester another in III Semester).
- A uniform time frame of 3 hours on a common day (Tuesday) shall be allocated for the Non-Major Electives.
- NonMajorElectivecoursesofferedbythedepartmentspertainingtoasemestershouldbe announced before the end of previous semester.
- Registration process: Students have to register for the Non-Major Elective course within 15 days from the commencement of the semester either in the department or NME portal(University Website).

D. Self Learning Courses from MOOCs platforms.

- MOOCs shall be on voluntary for the students.
- Studentshavetoundergoatotalof2 Self Learning Courses(MOOCs)one in II semester and another in III semester.
- The actual credits earned through MOOCs shall be transferred to the credit plan of programmes as extra credits. Other wise 2 credits/course be given if the Self Learning Course (MOOCs)is without credit.

- While selecting the MOOCs, preference shall be given to the course related to employability skills.

E. Projects/Dissertation/Internships(MaximumMarks:200**)**

The student shall undertake the dissertation work during the fourth semester.

Project/ Dissertation

ThecandidateshallundergoProject/DissertationWorkduringthefinalsemester.Thecandidate should prepare a scheme of work for the dissertation/project and should get approval from the guide. The candidate, after completing the dissertation /project work, shall be allowed to submit it to the university departments at the end of the final semester. If the candidate is desirous of availing the facility from other departments/universities/laboratories/organizations they will be permitted only after getting approval from the guide and HOD. In such a case, the candidate shall acknowledge the same in their dissertation/project work.

- **Format to be followed for dissertation/project report**

The format/certificate for thesis to be followed by the student are given below

- Title page
- Certificate
- Acknowledgment
- Content as follows:

Chapter No	Title	Page number
1	Introduction	
2	Aim and objectives	
3	Materials and methods	
4	Result	
5	Discussion	
6	Summary	
7	References	

- **Format of the title page**

Title of Dissertation/Project work

Dissertation/Project submitted in partial fulfillment of the requirement for the degree of Master of Science to the Alagappa University, Karaikudi-630003.

By

(Student Name)(Register Number)Universit y Logo

Department of----------

Alagappa University

(A StateUniversityAccreditedwith"A+"gradebyNAAC(CGPA:3.64)intheThirdCycle and Graded as Category-I University by MHRD-UGC, 2019: QS ASIA Rank-216,QSBRICSRank-104,QSIndiaRank-20)

Karaikudi – 630003

(Year)

- **Format of certificates**

Certificate-Guide

This is to certify that the **Dissertation/Project** entitled"----------" submitted to Alagappa University, Karaikudi-630 003 in partial fulfilment for the degree of Master of Science in----------byMr/Mis----------(RegNo ----------) under my supervision. This is based on the results of studies carried out by him/her in the Department of----------, Alagappa University, Karaikudi-630003. This dissertation / Project or any part of this work has not been submitted elsewhere for any other degree, diploma, fellowship, or any other similar titles or record of any University or Institution.

Place: Karaikudi Research Supervisor

Date:_____

Head of the Department

Certificate-(HOD)

This into certify that the thesis entitled**" ----------"** Submitted by Mr/Mis----------(RegNo ----------)to the Alagappa University, in Partial fulfillment for the award of the degree of Master of--------in ---------- is a bonafide Record of research work done under the supervision of Dr---------- , Assistant Professor, Department of----------,Alagappa University. This is to further certify that the thesis or any part thereof has not formed the basis of the award to the student of any degree, diploma, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi (_____)

Date:_____

Declaration(student)

I hereby declare that the dissertation entitled**" ----------"** Submitted to the Alagappa University for the award of the degree of Master of--------in----------has been carried out by me under the guidance of Dr----------, Assistant Professor, Department of----------,AlagappaUniversity,Karaikudi–630003. This is my original and independent work and has not previously formed the basis of the award of any degree, diploma, associateship, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi **(----------)**

Date:_____

Internship

The students who have opted for an Internship must undergo industrial training in thereputed organizations to accrue industrial knowledge in the final semester. The student has tofind industry related to their discipline (Public limited/Private Limited/owner/NGOs etc.,) inconsultationwiththefacultyincharge/Mentorandgetapprovalfromtheheadofthedepartmentand DepartmentalCommittee beforegoingforaninternship.

- **Format to be followed for Internship report**

The format /certificate for internshipreportto befollowed by thestudent aregivenbelow

- Titlepage -**Formatofthetitlepage**

Titleofinternshipreport

Internship reportsubmittedinpartialfulfilment ofthe requirementfortheMasterofdegreeintotheAlagappaUniversity,Karaikudi-630003.

By

(StudentName)

(Register Number)

UniversityLogo

Departmentof----------

Alagappa University

(A StateUniversityAccreditedwith"A+"gradebyNAAC(CGPA:3.64)intheThirdCycle and Graded as Category-I University by MHRD-UGC, 2019: QS ASIA Rank-216,QSBRICSRank-104,QSIndiaRank-20)

Karaikudi – 630003

(Year)

- Certificate-(**Format of certificate–faculty in-charge)**

This is to certify that the report entitled"---------- " submitted to Alagappa University, Karaikudi-630 003 in partial fulfilment for the Master of Science in----------by Mr/Mis----------(RegNo----------) under my supervision. This is based on the work carried out by him/her in the organization M/S --.This Internship report or any part of this work has not been submitted elsewhere for any other degree, diploma, fellowship, or anyother similar record of any University or Institution.

Place: ResearchSupervisor

Date:_____

Certificate–**(Format of Head of the Deparment)**

This is to certify that the Internship report entitled**"----------"** Submitted byMr/Miss**.----------(RegNo----------)**to the Alagappa University, in Partial fulfillment for the award of the Master of Science in **-------** is a bonafide record of Internship report done under the supervision of ----------,Assistant Professor, Department of----------,AlagappaUniversityandtheworkcarriedoutbyhim/herintheorganization M/S ----------. This is to further certify that the thesis or any partthereofhasnotformedthebasisoftheawardtothestudentofanydegree,diploma, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi Head of the Department
Date:_____

- Certificate-(**Format of certificate – Company supervisor or Head of the Organization)**

ThisistocertifythattheInternshipreportentitled"---------- ----" submitted to Alagappa University, Karaikudi-630 003 in partial fulfilmentfor the MasterofSciencein----------byMr/Miss----------(RegNo:----------) under my supervision. This is based on the work carried out by him/her in our organization M/S---------- ---------- for the period of three months or------. This Internship report or any part of this work has not been submitted elsewhere for any other degree, diploma, fellowship, or anyothersimilarrecordofanyUniversityorInstitution.

Place:
Date:_____

Declaration(student)

I hereby declare that the Internship Report entitled**"----------"** submitted to the Alagappa University for the award of the **Master of Science in ----------**has been carried out by me under the supervision of ---------- ,Assistant Professor, Department of---------- ,Alagappa University, Karaikudi–630003.Thisismyoriginaland independent work carried out by me in the organization M/S ---------- for the period of three months or ------- and has not previously formed the basis of the award of any degree, diploma, associateship, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi (Student Name)
Date:_____

- Acknowledgment
- Content as follows:

ChapterNo	Title	Page number
1	Introduction	
2	Aim and objectives	
3	Organisation profile/details	
4	Methods/Work	
5	Observation and knowledge gained	
6	Summary and outcome of the Internship study	
7	References	

- **No. of copies of the dissertation/project report/internship report**

  The candidate should prepare three copies of the dissertation/project/report and submit the same for the evaluation of examiners. After evaluation, one copy will be retained in the department library, one copy will be retained by the guide and the student shall hold one copy.

Teaching methods: Chalk and Talk, Powerpoint, Online

Attendance

Students must have earned75% of attendance in each course for appearing for the examination. Students who have earned 74% to 70% of attendance need to apply for condonation in the prescribed form with the prescribed fee. Students who have earned 69% to 60% of attendance need to apply for condonation in the prescribed form with the prescribed fee along with the Medical Certificate. Students who have below 60% of attendance are not eligible to appear for the End Semester Examination (ESE). They shall re-do the semester(s) after completion of the programme.

Examination

The examinations shall be conducted separately for theory and practical's to assess (remembering, understanding, applying, analysing, evaluating, and creating) the knowledge required during the study. There shall be two systems of examinations viz., internal and external examinations. The internal examinations shall be conducted as Continuous Internal Assessment tests I and II(CIA Test I & II).

F. Internal Assessment

The internal assessment shall comprise a maximum of 25 marks for each subject. The following procedure shall be followed for awarding internal marks.

Theory-25marks

Sr.No	Content	Marks
1	Average marks of two CIA test	15
2	Seminar/group discussion/quiz	5
3	Assignment/field trip report/case study report	5
	Total	25

Practical -25Marks

1	Major Experiment	10marks
2	Minor Experiment	5marks
3	Spotter(2x5/4x4)or any other mode	10marks
	Total	25 Marks

Project/Dissertation/internship-50Marks(assessbyGuide/incharge/HOD/supervisor)

1	Two presentations (mid-term)	30Marks
2	Progress report	20 Marks
	Total	50 Marks

G. External Examination

- There shall be examinations at the end of each semester, for odd semesters in the month of October/November; for even semesters in April/May.
- A candidate who does not pass the examination in any course(s) may be permitted to appear in such failed course(s) in the subsequent examinations to be held in October /November or April / May. However, candidates who have arrears in Practical shall be permitted to take their arrear Practical examination only along with Regular Practical examination in the respective semester.
- A candidate should get registered for the first semester examination. If registration is not possible owing to shortage of attendance beyond condonation limit / regulation prescribed OR belated joining OR on medical grounds, the candidates are permitted to move to the next semester. Such candidates shall re-do the missed semester after completion of the programme.
- For the Project Report/Dissertation Work / internship the maximum marks will be100 marks for project report evaluation and for the Viva-Voce it is 50 marks (if in some programmes, if the project is equivalent to more than one course, the project marks would be in proportion to the number of equivalent courses).
- Viva-Voce: Each candidate shall be required to appear for Viva-Voce Examination (in defense of the Dissertation Work/Project/internship).

H. Scheme of External Examination(Question Paper Pattern)

Theory-Maximum75Marks

Section A	10 questions. All questions carry equal marks. (Objective type questions)	10x 1 = 10 Marks	10 questions –2 each From every unit
Section B	5questions Either /or type like1.a (or) b. All questions carry equal marks	5x5=25	5 questions – 1 each from every unit
Section C	5questions Either /or type like1.a(or)b. All questions carry equal marks	5x8=40	5 questions – 1 each from every unit

Practical–Maximum 75Marks

Section A	Major experiment	15 Marks
Section B	Minor experiment	10 Marks
Section C	Experimental setup	5 Marks
Section D	Spotters(5x5marks)	25 Marks
Section E	Record note	10 Marks
Section F	Vivovoce	10 Marks

Dissertation/Project report/Internship report Scheme of evaluation

Dissertation/Project report/Internship report	100 Marks
Vivo voce	50 Marks

Results

Theresultsofalltheexaminationswillbepublishedthroughtheir Departmentwherethestudentunderwentthecourse as well as through University Website

Passing minimum

- A candidate shall be declared to have passed in each course if he/she secures not less than 40%marks in the End Semester Examinations and 40% marks in the Internal Assessment and not less than 50% in the aggregate, taking Continuous assessment and End Semester Examinations marks together.
- The candidates not obtained 50% in the Internal Assessment are permitted to improve their Internal Assessment marks in the subsequent semesters (2 chances will be given) by writing the CIA tests and by submitting assignments.
- Candidates, who have secured the pass marks in the End-Semester Examination and in the CIA but failed to secure the aggregate minimum pass mark (E.S.E + C I.A), are permitted toimprovetheirInternalAssessmentmarkinthefollowingsemesterand/orinUniversityexaminations.

- AcandidateshallbedeclaredtohavepassedintheProject/Dissertation/Internshipifhe/she gets not less than 40% in each of the Project / Dissertation / Internship Report and Viva-Voce and not less than 50%intheaggregateofboththemarks for Project Report and Viva-Voce.
- A candidate who gets less than 50% in the Project / Dissertation / Internship Report must resubmit the thesis. Such candidates need to take again the Viva-Voce on the resubmitted Project report.

Grading of the Courses

The following table gives the marks, Grade points, Letter Grades and classifications meant to indicate the overall academic performance of the candidate.
Conversion of Marks to Grade Points and Letter Grade (Performance in Paper/Course)

RANGE OF MARKS	GRADEPOINTS	LETTERGRADE	DESCRIPTION
90-100	**9.0–10.0**	**O**	**Outstanding**
80-89	**8.0–8.9**	**D+**	**Excellent**
75-79	**7.5–7.9**	**D**	**Distinction**
70-74	**7.0–7.4**	**A+**	**Very Good**
60-69	**6.0–6.9**	**A**	**Good**
50-59	**5.0–5.9**	**B**	**Average**
00-49	**0.0**	**U**	**Re-appear**
ABSENT	**0.0**	**AAA**	**ABSENT**

a. Successful candidates passing the examinations and earning GPA between 9.0 and 10.0 and marks from 90–100 shall be declared to have Outstanding (O).
b. Successful candidates passing the examinations and earning GPA between 8.0 and 8.9 and marks from 80-89 shall be declared to have Excellent (D+).
c. Successful candidates passing the examinations and earning GPA between 7.5–7.9 and marks from 75-79 shall be declared to have Distinction (D).
d. Successful candidates passing the examinations and earning GPA between 7.0–7.4 and marks from70-74 shall be declared to have Very Good (A+).
e. Successful candidates passing the examinations and earning GPA between 6.0–6.9 and marks from 60-69 shall be declared to have Good (A).
f. SuccessfulcandidatespassingtheexaminationsandearningGPAbetween5.0–5.9andmarksfrom50-59shallbe declared to have Average (B).
g. CandidatesearningGPAbetween0.0andmarksfrom00-49shallbedeclaredtohaveRe-appear(U).
h. Absence from an examinationshallnot betakenasanattempt.

From the second semester onwards the total performance within a semester and continuous performance starting from the first semester are indicated respectively **by Grade Point Average (GPA)and Cumulative Grade Point Average (CGPA).** These two are calculated by the following formulate

GRADE POINT AVERAGE(GPA)=□iCiGi/□iCi

GPA=Sum of the multiplication of Grade Points by the credits of the courses

Sum of the credits of the courses in a Semester

Classification of the final result

CGPA	Grade	Classification of Final Result
9.5–10.0 9.0 andabovebutbelow 9.5	**O+** **O**	First Class–Exemplary*
8.5 and abovebut below 9.0 8.0 and abovebut below 8.5 7.5 and abovebut below 8.0	**D++** **D+** **D**	FirstClasswith Distinction*
7.0 and abovebut below 7.5 6.5 and abovebut below 7.0 6.0 and abovebut below 6.5	**A++** **A+** **A**	FirstClass
5.5 and abovebutbelow 6.0 5.0 and abovebut below 5.5	**B+** **B**	SecondClass
0.0 andabovebutbelow 5.0	**U**	Re-appear

The final result of the candidate shall be based only on the CGPA earned by the candidate.

a) Successful candidates passing the examinations and earning CGPA between 9.5 and 10.0 shall begivenLetterGrade(O+),thosewhoearnedCGPAbetween9.0and9.4shallbegivenLetterGrade (O) and declared to have First Class–Exemplary*.

b) Successful candidates passing the examinations and earning CGPA between 7.5 and 7.9 shall be given Letter Grade (D), those who earned CGPA between 8.0 and 8.4 shall be given Letter Grade(D+), those who earned CGPA between 8.5 and 8.9 shall be given Letter Grade (D++) and declared to have First Class with Distinction*.

c) Successful candidates passing the examinations and earning CGPA between 6.0 and 6.4 shall be given Letter Grade (A), those who earned CGPA between 6.5 and 6.9 shall be given Letter Grade(A+), those who earned CGPA between 7.0 and 7.4 shall be given Letter Grade (A++) and declared to have First Class.

d) Successful candidates passing the examinations and earning CGPA between 5.0 and 5.4 shall be given Letter Grade (B), those who earned CGPA between 5.5 and 5.9 shall be given Letter Grade(B+)and declared to have passed in Second Class.

i) Candidates those who earned CGPA between 0.0 and 4.9 shall be given Letter Grade (U) and declared to have Re-appear.

e) Absence from an examination shall not be taken as an attempt.

CUMULATIVE GRADE POINTAVERAGE(CGPA)=□n□iCniGni/□n□iCni

CGPA = Sum of the multiplication of Grade Points by the credits of the entire Programme
Sum of the credits of the courses for the entire Programme

Where '**Ci**' is the Credit earned for Course i in any semester; '**Gi**' is the Grade Point obtained by the student for Course i and'n'refers to the semester in which such courses were credited.

CGPA(Cumulative Grade Point Average)=Average Grade Point of all the Courses passed starting from the first semester to the current semester.

Note:*ThecandidateswhohavepassedinthefirstappearanceandwithintheprescribedSemestersoft he PG Programme are alone eligible for this classification.

Maximum duration of the completion of the programme

The maximum period for completion of M.Sc.,Oceanography and Coastal Area Studies shall not exceed eight semesters continuing from the first semester.

Conferment of the Master's Degree

AcandidateshallbeeligiblefortheconfermentoftheDegreeonlyafterhe/shehasearnedtheminim umrequired credits for the Programme prescribed there for(i.e.90 credits). Programme).

Village Extension Programme

The Sivaganga and Ramnad districts are very backward districts where a majority of people Lives inpoverty.Theruralmassiseconomicallyandeducationallybackward.Thus the aim of the introduction of this Village Extension Programme is to extend out to reach environmental awareness, social activities, hygiene, and health to the rural people of this region. The students in their third semester have to visit any one of the adopted villages within the jurisdiction of Alagappa University and can arrange various programs to educate the rural mass in the following areas for three day based on the theme. 1.Environmental awareness 2.Hygiene and Health. A minimum of two faculty members can accompany the students and guide them.

DEPARTMENT OF OCEANOGRAPHY AND COASTAL AREA STUDIES
M. Sc OCEANOGRAPHY AND COASTAL AREA STUDIES
CREDIT STRUCTURE (2022-23 Onwards)

S. No	Paper Code	Courses	Title of the paper	T/P	Credits	Hours/ Week	Marks		
			I Semester				**I**	**E**	**Total**
1	461101	Core	Geological Oceanography	T	5	5	25	75	100
2	461102	Core	Physical Oceanography	T	5	5	25	75	100
3	461103	Core	Chemical Oceanography	T	4	4	25	75	100
4	461104	Core	Biological Oceanography	T	4	4	25	75	100
6	461105	Core	**Lab-I:** Geological Oceanography Physical Oceanography Chemical Oceanography Biological Oceanography	P	4	8	25	75	100
7		DSE*-1		T	3	3	25	75	100
			Library/Yoga/counseling/Fieldtrip			1			
					25	**30**	**150**	**450**	**600**
			II Semester						
8	461201	Core	Marine Ecology and Zoogeography	T	4	4	25	75	100
9	461202	Core	Marine Pollution, Environment and Health	T	4	4	25	75	100
10	461203	Core	Applications of Remote Sensing and GIS in Oceanography	T	4	4	25	75	100
11	461204	Core	Aquaculture	T	4	4	25	75	100
12	461205	Core	**Lab-II:** Marine Ecology and Zoogeography, Marine Pollution, Environment and Health, Applications of Remote Sensing and GIS in Oceanography, Aquaculture	P	4	8	25	75	100
13		DSE*2		T	3	3	25	75	100
14		NME	Non-Major Elective**	T	2	3	25	75	100
15		SLC	Self-learning course –MOOCs***		Extra credit				
					25	**30**	**175**	**525**	**700**
			III Semester						
15	461301	Core	Fish and fisheries	T	4	4	25	75	100
16	461302	Core	Post-Harvest Technology	T	4	4	25	75	100
17	461303	Core	Ocean Management	T	4	4	25	75	100
18	461304	Core	Research Methodology	T	4	4	25	75	100
19	461305	Core	**Lab-III:** Fish and fisheries, Post-Harvest Technology	P	4	8	25	75	100
20		DSE*3		T	3	3	25	75	100
21		NME	Non-Major Elective**	T	2	3	25	75	100
22		SLC	Self-learning course –MOOCs***		Extra credit				
					25	**30**	**175**	**525**	**700**
			IV Semester						
23	461999	Core	****Dissertation Work or Internship programme		15	30	50	150	200
					15	**30**	**50**	**150**	**200**
			Total		**90+**		**550**	**1650**	**2200**

DSE– Student Choice and it may be conducted by parallel sections.

**NME–Student have to select courses offered by other (Faculty) departments.

*** SLC-Voluntary basis

***Dissertation/internship report–Marks-Vivo-voce (50)+ thesis(100) +internal(50) =200 T-Theory , P-Practical

DISCIPLINE-SPECIFIC ELECTIVE PAPERS
DSE-PAPERS

S. No	Course Code	DISCIPLINE-SPECIFIC ELECTIVE PAPERS DSE-PAPERS	Credits	Hours
1	461501	Marine Biodiversity and Conservation	3	3
2	461502	Coastal Zone Management	3	3
3	461503	Marine Resources	3	3
4	461504	Coastal Disaster Management	3	3
5	461505	Marine Biofouling, Prevention and Management	3	3

I- SEMESTER					
Core	**Course Code: 461101**	**GEOLOGICAL OCEANOGRAPHY**	T	**Credits: 5**	**Hours: 5**

UNIT- I

Objective1	**This course offers basic knowledge about the earth and its processes.**

Introductory concepts in Earth Science – Origin of the universe and earth – earth's interior – crust, mantle and core – Geological time scale – division of geological time. Pangaea – continental drift and paleomagnetism, crustal movement plate tectonics, isostacy seafloor spreading. Emergent and submergent margins, convergent and divergent boundaries, changing sea level–Crustal deformation–folds, faults.

Outcome1	The students will study the topography, structure and geological processes of the ocean floor.	**K2**

UNIT-II

Objective 2	To study the pale oceanography of the past historical evidences and the changes of the oceans.

Products of Earthprocess-Materials of earth'scrust-igneousrock, metamorphic rock and sedimentary rock. Weathering and erosion–mechanical and chemical weathering, rates of weathering. Erosion by wind, water and glaciers.

Outcome 2	Students will gain knowledge about rocks and its origin process.	**K2/K3**

UNIT-III

Objective 3	To know the outline of Geological Oceanography and depth knowledge in physical geology of oceans.

Introduction and Concepts in Marine Geology - Introduction to marine geosciences –morphology of the near shore environment-beach, estuaries, continental shelf, Continental slope, rise, submarine canyons morphology and characteristics. Morphology of the ocean basins, ocean floor, abyssal plains, hills plateau, mid oceanic ridges. Sediment transport by waves and currents-long shore currents. General coastal geomorphology of India.

Outcome 3	Students will get awareness of marine physical geology and it's important.	**K2**

UNIT-IV

Objective 4	To provide basic knowledge of the major coastal deposits and landforms.

Depositional environment and features - Major coastal deposits and land forms –marine deltas, estuaries, spits and related features, beach ridges, barriers and sorgani creefs and atolls. Sedimentary structures-texture and their depositional significance. Physical properties of particles-size, mass properties-shape, sphericity and roundness, mineral stability and significance-Porosityandpermeability–Turbidites-Seafloorsediments, and geochronology-relativedating- absolute dating. Analysis of sediments -graphical representation and determination of depositional environment.

Outcome 4	Thelearnerswillexaminethemakeupoftheoceanbedrockandthenaturalprocessesofrockmovement.	**K3**

UNIT-V

Objective 5	To provide outline knowledge of the marine mineral resourses.

Marine mineral resources-Beachplacers,hydrocarbon resources ,manganese nodules, phosphotites, sulphur, dissolved salts, limestone deposits, evaporates - theirmechanismoforiginandglobaldistributionpattern.Methodsofdeep-seaexplorationofmineralresources-gravity,magneticandseismicmethods–principleand techniques.

Outcome 5	Students will study the exploration of minerals and its importance.	**K4**

Suggested Readings:

Benn, D.I., & Evans, D.J.A. (1998). *Glaciers and Glaciation*. London: Arnold.Blatt, H., & Tracy, R.J.(1996). *Petrology: Igneous, sedimentary, and metamorphic (2nd ed.).* New York: W.H. Freeman.Bolt,B.A.(1993). *Earthquakes(3rd ed.).*NewYork:W.H.Freeman.Carter,R.W.G.,&Woodroffe, C.D.(1994).*Coastalevolution.*CambridgeUniversityPress.

Chorley, R.J., Schumm, A.A., &Sugden, D. E. (1995). *Geomorphology.* New York: Methuen.Cox,A.,&Hart,R.B.,(1986).*Platetectonics: Howitworks.*PaloAlto,CA:Blackwell.

Craig, J.R., Vaughan, D.J., & Skinner, B.J. (1988). *Resources of the Earth*. Englewiid Cliffs, NJ:Prentice-Hall.

Davis, G.H.,& Reynolds, S.J. (1996). *Structural geology of rocks and regions.* New York: John WileyandSons.

Hardisty,J.(1990).*Beaches formandprocess.*NewYork:KarperCollins Academic.

Johnston, A.C., &Kanter, L.R. (1990). *Earthquakes in stable continental crust.*Scientific American,262(3):68-75.

Kearey, P., & Vine, F.J. (1990). *Global Tectonics.* Oxford: Blackwell Scientific.Sharma,P.V.(1986).*GeophysicalMethodsin Geology(2nd ed).*NewYork: Elsevier.

Sverdrup,H.U.,Johnson,M.,& Richard H.Fleming.(1942).*TheOceans,TheirPhysics,Chemistry,andGeneralBiology.*NewYork:Prentice-Hall.

Online resources

https://nap.nationalacademies.org/read/6024/chapter/3#6
https://opentextbc.ca/geology/chapter/5-3-the-products-of-weathering-and-erosion/
https://www.usgs.gov/faqs/what-marine-geology#:~:text=Marine%20Geology%20focuses%20on%20areas,areas%20and%20some%20large%20lakes.
https://commons.wvc.edu/rdawes/g101ocl/basics/depoenvirons.html
https://testbook.com/ias-preparation/marine-mineral-resources

Course Outcome VS Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S(3)	M(2)	S(3)	M(2)	S(3)	S(3)	M(2)	S(3)	M(2)	S(3)
CO2	M(2)	M(2)	S(3)	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)	M(2)
CO3	M(2)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	S(3)	M(2)
CO4	S(3)	M(2)	S(3)	M(2)	M(2)	S(3)	L(1)	S(3)	M(2)	M(2)
CO5	M(2)	M(2)	M(2)	M(2)	L(1)	M(2)	M(2)	M(2)	M(2)	L(1)
W.AV	**2.4**	**2.0**	**2.8**	**2.0**	**2.2**	**2.4**	**2.0**	**2.4**	**2.2**	**2.0**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome VS Programme Specific Outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	S(3)	M(2)	M(2)
CO2	M(2)	M(2)	M(2)	S(3)	S(3)
CO3	M(2)	M(2)	M(2)	M(2)	M(2)
CO4	S(3)	M(2)	M(2)	S(3)	M(2)
CO5	S(3)	M(2)	M(2)	S(3)	S(3)
W.AV	**2.6**	**2.2**	**2.2**	**2.6**	**2.4**

S–Strong(3),M-Medium(2),L-Low(1)

I–SEMESTER					
Core	**Course Code 461102**	**PHYSICAL OCEANOGRAPHY**	**T**	**Credits: 5**	**Hours: 5**

UNIT-I

Objective1	**The Objective of this course is to offer students about history of Oceanography.**

History of Oceanography: Classical Period - Contributions of the Greeks - The Golden Age of Discovery - Nineteenth century: The golden age of Oceanography - Development of oceanography in the Twentieth century - Ocean Exploration - Early scientific investigations - National Expeditions - Post War Oceanography - Modern Oceanography - Current and Future Oceanographic research.

Outcome1	**The Student will study the physical properties and dynamic processes of the oceans and study the interaction of the ocean with the atmosphere.**	**K2**

UNIT–II

Objective2	**To provide basic knowledge about the Ocean Currents - General character- Origin and types of Ocean currents**

Ocean Dynamics: Waves - Properties of Ocean waves - wave motions - waves in shallow waters - wave refraction - wave diffraction - standing waves - Other types of progressive waves. Breakers - Types of breakers. Tides - tidal characteristics - origin of tides. Tides in small and elongated basins - tidal currents - Power from the tides. Wind and Ocean Circulation - Surface ocean currents - Deep ocean circulation - water flow in semi-enclosed seaways. Ocean Currents - General character and Origin of Ocean currents - Types of Ocean currents.

Outcome2	**Students can able to understand not only how the ocean behaves at a given point of time, but also how the ocean changes and fluctuates.**	**K4**

UNIT–III

Objective3	**To provide basic knowledge about the physical properties of seawater, waves, tides, currents, estuaries, deltas, coastal lagoons, meteorology and clouds precipitation.**

Physical properties of seawater: Temperature of the Oceans: Sources of Heat - Surface temperature of the ocean water - Factors affecting the horizontal distribution of surface temperature of the oceans - Range of sea surface temperature. Pressure and their changes in the Sea. Salinity - Various sources of Oceanic salts - Factors causing variations in Salinity - Distribution of salinity - Partially or Wholly enclosed seas, Inland seas and Lakes, vertical distribution of salinity. Density of Ocean water - Horizontal and Vertical distribution of Density. Ice in the sea - Formation and Classification - Effect of Polar Ice on the Atmospheric Circulation. Practical Significance of T-S curve - water masses. Transmission of Sound – Absorption of radiation – Eddy conductivity – Diffusivity – viscosity.

Outcome3	**Students will study the climatic changes, global warming, and its impact.**	**K4**

UNIT–IV

Objective4	**To make the students to predict weather and climatic conditions of coastal regions and to comprehend the El Nino and La Nina effects.**

Meteorology: Fundamental Principles - Indian climatology with special reference to seasonal distribution. Climatic Zones of India. Clouds and their classification. Monsoons & Cyclones: Synoptic features associated with monsoon and tropical cyclones. General Circulation of the atmosphere. Satellite Meteorology: Polar orbiting and Geostationary satellites - visible and infrared radiometers - Multi-scanner radiometers. Identification of synoptic systems, fog and sandstorms, detection of cyclones, estimation of SST, cloud top temperatures, winds and rainfall - temperature and humidity soundings.

Outcome4	**Students will gain knowledge in meteorological technologies.**	**K3**

UNIT–V		
Objective5	**To provide the basic knowledge of global warming and greenhouse effect.**	
Climate and Sea level change: Global warming - Greenhouse effect - Ozone deflection. El Nino and La Nina - Southern Oscillation - ENSO and its impact on Indian Monsoon. The Geiod - Eustasy and Isostasy - Regional and global effects of Sea level changes - Effect of sea level changes on shorelines and case studies.		
Outcome5	**Students will learn the effect of sea level changes on shorelines and case studies.**	**K4**

Suggested Readings:

Alan P. Trujillo. (2013). Essentials of Oceanography (11thed). Pearson. Bharatdwaj, K. (1993). Physical Geography-Oceanography. Discovery Publishing House.

Duxbury, A. C., Duxbury, A. B., & Sverdrup, K. A. (2000). An Introduction to The World's Oceans. UK: Wm. C. Brown Publishers.

Lal. D.S. (2010). Oceanography. Allahabad: ShardaPustakBhawan. Matthew Fontaine Maury. (1855). The Physical Geography of the Sea. Harper & Brothers.

Natarajan, M., &Balasubramanian, T. (2001). Oceanographic equipments. ENVIS Centre, CAS in Marine Biology, Annamalai University.

Paul. R. Pinet. (1992). Oceanography - An Introduction to the Planet Oceans. UK: West Publishing Company.

Paul. R. Pinet. (2000). Invitation to Oceanography (2nded). Sudbury, Massachusetts: Jones and Bartlett Publishers.

Robert. H. Stewart. (2008). Introduction to Physical Oceanography. Texas: Texas A & M University.

Roland Stull. (2015). Practical meteorology - An algebra-based survey of Atmospheric Sciences. Vancouver, Canada: The University of British Columbia.

Onlineresources

https://divediscover.whoi.edu/history-of-oceanography/
http://oceans.mit.edu/JohnMarshall/research/ocean-dynamics/
http://ecoursesonline.iasri.res.in/mod/page/view.php?id=86507
https://endurance22.org/science/meteorology-oceanography
https://rwu.pressbooks.pub/webboceanography/chapter/13-7-sea-level-change/

Course Outcome VS Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S(3)	S(3)	M(2)	M(2)	L(1)	M (2)	M(2)	M(2)	M(2)	L(1)
CO2	S (3)	S(3)	S(3)	M(2)	M (2)	L(1)	M(2)	S(3)	M(2)	M (2)
CO3	S(3)	S(3)	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)
CO4	S(3)	S(3)	S(3)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)
CO5	S(3)	S(3)	S(3)	S(3)	S(3)	S(3)	S(3)	S(3)	S(3)	S(3)
W.AV	**3**	**3**	**2.6**	**2.2**	**2**	**2.2**	**2.2**	**2.6**	**2.2**	**2.0**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome VS Programme Specific Outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	M(2)	M(2)	M(2)
CO2	S(3)	S(3)	M(2)	M(2)	S(3)
CO3	M(2)	M(2)	M(2)	S(3)	S(3)
CO4	S(3)	S(3)	S(3)	S(3)	S(3)
CO5	S(3)	S(3)	M(2)	M(2)	M(2)
W.AV	**2.8**	**2.8**	**2.2**	**2.4**	**2.6**

S–Strong(3),M-Medium(2),L-Low(1)

I-SEMESTER- Core					
Core	**Course Code: 461103**	**CHEMICALOCEANOGRAPHY**	**T**	**Credits: 4**	**Hours: 4**

UNIT-I

Objective1	To provide knowledge about historical development of chemical oceanography and ocean expeditions.	
Introduction: marine chemistry -historical development-International Indian Ocean Expedition(IIOE).		
Outcome1	**The Students learn the different development stages of chemical oceanography and oceanographic expedition.**	**K2**

UNIT – II

Objective2	**To prepare the students with strongknowledge ofnutrients and dissolved gases in marine environment.**	
Chemicalpropertiesofwaterandseawater-structureofwatermolecules.pH,salinity and chlorinity of seawater. Dissolved gases: Solubility of gases in seawater -Carbondioxide,Dissolvedoxygen- BODand COD- Air and sea gas exchange-N_2 -H_2S, Methane-Noble gases-Their origin-distribution and importance-Hydrothermalvents.		
Outcome2	**Students gain knowledge about molecular structure of seawater and its chemical parameters.**	**K4**

UNIT –III

Objective3	**To learn about the major and minor elements dynamics and its interaction with marine organisms.**	
Trace elements: Elements- Major and Minor elements in seawater-Oxidation-Reduction Potential of seawater-Ions and its composition. Trace element inputs fromestuarine waters. Cycling of major, minor and trace elements in coastal waters and their Interaction with marine organisms. Exploration of Manganesenodules		
Outcome3	**Students understand the major and minor elements and exploration of marine non living recourses.**	**K3**

UNIT –IV

Objective4	**To learn about the origin and seasonal variation of nutrients cycles.**	
Nutrients:Origin-Significance-Silicon,Nitrogen,PhosphorusandCarboncycle-Seasonalvariations.		
Outcome4	Students gain insights on nutrients cycle in ocean.	**K2**

UNIT - V

Objective5	**To provide the basic knowledge about dissolved organic maters including hydrocarbon distribution in ocean.**	
Organic matter: Dissolved and particulate organic matter-sources classification- compositionestimation-Distribution-Seasonalvariation.Petroleumhydrocarbon.		
Outcome5	**Students acquire fundamental knowledge of marine organic matter.**	**K4**

Suggested Readings:

DavidA.Ross. (1977).*IntroductiontoOceanography.*NewJersey: Prentice-Hall Inc.

GrantGross,M.(1993). *Oceanography:A viewoftheearth.*NewJersey:Prentice -HallInc.

McCormic, J.M., & J.V.Thiruvathakal.(1976).*Elementsof Oceanography.*Philadephis: W.B. SaunderrsCompany.

Pickard, G. L. (1975).*Disruptivephysicaloceanography.*PergamonPressLondon.

Riley, J. P., & G. Skirrow. (1975). *Chemical oceanography (Vol.1-8).* London: Academic press.Ross,D.A.(1970).*Introductionofoceanography.*London:PrenticeHallInc.

Strickland,J.D.H.,&T.R.Parsons.(1972).*Apracticalhandbookofseawateranalysis*.
Sverdrup,H.U.,Honeson,M.W.,&Fleming,R.H.(1959).*Theoceantheirphysics,chemistryandgeneralbiology*.
NewJersey:Prentice-HallInc.

Onlineresources

https://www.marinebio.org/oceans/ocean-chemistry/
https://www.britannica.com/science/seawater
https://www.britannica.com/science/chemical-element/Composition-of-seawater
http://ecoursesonline.iasri.res.in/mod/page/view.php?id=86524
https://www.britannica.com/science/seawater/Dissolved-organic-substances

Course Outcome VS Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S(3)	S(3)	M(2)	M(2)	L(1)	M (2)	M(2)	M(2)	M(2)	L(1)
CO2	M (2)	S(3)	M(2)	M(2)	M (2)	L(1)	M(2)	S(3)	M(2)	M (2)
CO3	S(3)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)
CO4	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)
CO5	L(3)	S(3)	S(3)	M(2)	M(2)	M(2)	L(1)	L(1)	L(1)	L(1)
W.AV	**2.6**	**2.6**	**2.2**	**2.0**	**1.8**	**2.0**	**1.8**	**2.2**	**1.8**	**1.6**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome VS Programme Specific Outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	M(2)	M(2)	M(2)
CO2	S(3)	S(3)	S(3)	M(2)	S(3)
CO3	M(2)	M(2)	M(2)	S(3)	S(3)
CO4	M(2)	M(2)	M(2)	M(2)	M(2)
CO5	M(2)	M(2)	M(2)	M(2)	M(2)
W.AV	**2.4**	**2.4**	**2.2**	**2.2**	**2.4**

S–Strong(3),M-Medium(2),L-Low(1)

I- SEMESTER					
Core	**Course Code: 461104**	**BIOLOGICAL OCEANOGRAPHY**	T	**Credits: 4**	**Hours: 4**

UNIT- I		
Objective 1	**The main objective of this course is to make the students aware of the major life forms in the ocean.**	
Plankton - classification based on size, mode of life and habitat. Phytoplankton and Zooplankton - methods of collection, estimation of standing crop-wet and dry weight estimation-plankton volume settling and displacement methods.		
Outcome 1	**Students will gain knowledge on major life forms in the sea.**	**K2**

UNIT-II		
Objective 2	**To study the phytoplankton and zooplankton and their interrelationship.**	
Adaptation of plankton - structural (weight, increase of surface area, flotation) physiological mechanisms. Phytoplankton and Zooplankton interrelationship - red tide phenomenon - causes and effects.		
Outcome 2	**They will study primary and secondary productivity.**	**K2/K3**

UNIT-III		
Objective 3	**To study Primary and secondary productions - methods of estimation of primary and secondary production.**	
Organic production - Primary and secondary productions methods of estimation of primary production. Factors affecting primary production - regional differences in (primary and secondary) production.		
Outcome 3	**Students will know primary and secondary productivity estimation.**	**K4**

UNIT-IV		
Objective 4	**To study marine plants such as seaweeds, seagrass and mangroves and its importance.**	
Seaweeds - Occurrence and distribution in India - economic importance. Life cycles of economic important seaweeds. Seagrasses - morphological and anatomical adaptations ecological role. Mangroves - distribution, adaptation, conservation and ecological role. Coral reef ecosystem.		
Outcome 4	**Students will gain knowledge on seaweed culture techniques.**	**K4**

UNIT-V		
Objective 5	**To study the conservation and management of coastal ecosystems.**	
Salt marsh and sand dune, mud flat vegetation - morphological, anatomical and physiological features, ecological role, uses, conservation and management.		
Outcome 5	**Students will learn about the conservation and management of coastal ecosystem.**	**K2**

Suggested Readings:

Chapman, V.J. (1978). Coastal vegetation. Oxford: Pergamon Press.

Naskar, K., & R. Mandal. (1999). Ecology and Biodiversity of Indian Mangroves (Vol. I & II). Daya Publishing House.

Nybakken, J. W. (2001). Marine Biology an Ecological. Approach (8thed). Addison Wesley Edu. Pub. Inc.

Parsons, T.R., M. Takahashi & B. Hargrave. (1977). Biological Oceanography Processes, (2nd ed.), Oxford.Pergamon Press.

Peter Mc Roy, C. & G. Helferich. (1977). Seagrass Ecosystems - A scientific Perspective. New York: Marcel Dekker Inc.
Sumich, J. L. (1999). Introduction to the Biology of Marine Life (7thed). The McGraw Hill Companies Inc.
Tomas.,& Carmelo, R. (1997). Identifying Marine Phytoplankton. Academic Press.

Online resources

https://www.britannica.com/science/plankton
https://www.sciencedirect.com/science/article/abs/pii/0304420377900263
https://www.degruyter.com/document/doi/10.1515/bot-2018-0056/html?lang=en
https://seawatersolutions.org/importance-of-coastal-vegetation/

Course Outcome VS Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S(3)	S(3)	M(2)	M(2)	S(3)	M (2)	M(2)	M(2)	M(2)	L(1)
CO2	S (2)	S(3)	S(3)	S(3)	M (2)	L(1)	M(2)	S(3)	M(2)	M (2)
CO3	S(3)	M(2)	S(3)	M(2)	S(3)	S(3)	S(3)	M(2)	M(2)	M(2)
CO4	M(2)	M(2)	L(1)	L(1)	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)
CO5	L(3)	S(3)	S(3)	M(2)	M(2)	M(2)	L(1)	M(2)	S(3)	M(2)
W.AV	**2.6**	**2.6**	**2.4**	**2.0**	**2.4**	**2.0**	**2.0**	**2.4**	**2.2**	**1.8**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome VS Programme Specific Outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	M(2)	M(2)	M(2)
CO2	M(2)	M(2)	M(2)	M(2)	M(2)
CO3	M(2)	M(2)	M(2)	S(3)	S(3)
CO4	M(2)	M(2)	S(3)	M(2)	M(2)
CO5	S(3)	M(2)	M(2)	S(3)	M(2)
W.AV	**2.4**	**2.2**	**2.2**	**2.4**	**2.2**

S–Strong(3),M-Medium(2),L-Low(1)

PRACTICALS–FIRST SEMESTER

Course Code: 461105	PRACTICAL Geological Oceanography Physical Oceanography Chemical Oceanography Biological Oceanography	P	Credits: 4	Hours:8

GEOLOGICALOCEANOGRAPHY

1. Observation of geomorphological changes of islands and coral reef environment.
2. Geological information system(GIS).
3. Identification of fossils: foraminifera and ostracods and their preservation methods.
4. Estimation of Sediment and classification.
5. Measurement of elevation in sea level.

PHYSICALOCEANOGRAPHY

1. Water sampling devices: Mayer's water sampler-Knudsen water sampler – universal watersampler-Nansenwatersampler-Horizontalwatersampler–Niskinwatersampler-Bacteriologicalwater sampler.
2. Lightmeasuringdevices:Secchidisc–Luxmeter–Turbiditymeter–underwaterPhotometer.
3. Temperature and pressure measuring devices: Towing surface thermometer – Six's maximumandminimumthermometer–Reversingthermometer-Bathythermograph–Thermohydrobarograph-Fortin'sbarometer.
4. Currentmeasuringdevices:Watt'scurrentmeter-Directreadingcurrentmeter.
5. Bottom sampling devices: Ekman's dredge - Peterson's grab – Van Veen's grab - Verticalgravity corer - Ooze sucker - Mud snapper - Box corer - Boomerang water sampler, grab andcorer.
6. Depth measuring devices–Echosounder, SidescanSonar.
7. WeatherInstruments:Thermometers,Barometers,HumiditySensors,WindSpeed,WindVane,RainGauge,HailPad,CampbellStokesRecorder,Hygrometer,Panevaporation,weatherpredictionchartsof thelocalregion.

CHEMICALOCEANOGRAPHY

1. Determination of Salinity
2. Total alkalinity
3. Dissolved oxygen
4. Biological oxygen demand
5. Chemical oxygen demand
6. Calcium and magnesium
7. Nitrite
8. Nitrate
9. Reactivesilicate
10. Total Phosphorous
11. Inorganic Phosphate
12. Ammonia
13. Total Nitrogen
14. Particulate organic matter
15. Total dissolved phosphorous

BIOLOGICALOCEANOGRAPHY

1. Identification of phytoplankton
2. Identification of zooplankton
3. Identification of seaweeds, sea grasses and mangrove plants.
4. Extraction and estimation of chlorophyll**,** primary productivity.
5. Identification of coastal invertebrate fauna.
6. Mounting of gastropodradulae.
7. Anatomy of crabs, shrimp, gastropodandbivalve.
8. Identification of minorphyla.

Course Outcome VS Programme Outcomes

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S(3)	M(2)	L(1)	M(2)	L(1)	M(2)	M(2)	M(2)	M(2)	L(1)
CO2	S(3)	M(2)	M(2)	L(1)	M(2)	L(1)	M(2)	M(2)	M(2)	M(2)
CO3	S(3)	M(2)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	L(1)	M(2)
CO4	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)
CO5	M(2)	S(3)	S(3)	S(3)	S(3)	S(3)	S(3)	M(2)	M(2)	S(3)
W.AV	**2.6**	**2.2**	**2**	**2.2**	**2**	**2.2**	**2.2**	**2.0**	**1.8**	**2.0**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M(2)	L(1)	M(2)	L(1)	M(2)
CO2	M(2)	M(2)	L(1)	M(2)	L(1)
CO3	L(1)	M(2)	S(3)	M(2)	M(2)
CO4	M(2)	M(2)	M(2)	M(2)	M(2)
CO5	M(2)	S(3)	S(3)	S(3)	S(3)
W.AV	**1.8**	**2.0**	**2.2**	**2**	**2.0**

S–Strong(3),M-Medium(2),L-Low(1)

II–Semester					
Core	**Course Code: 461201**	**MARINE ECOLOGY AND ZOOGEOGRAPHY**	**T**	**Credits: 4**	**Hours: 4**

Unit–I		
Objective1	**Tounderstandthedivisionsofmarineenvironmentandphysico-chemicalparametersandadaptationsoflivingorganisms.**	
Marine environment ecological factors: light–temperature–salinity-pressure. Classification of marine environment: pelagic environment, planktonic and nektonic adaptations, benthic environment intertidal, interstitial and deep-sea adaptation.		
Outcome1	**To understand the important of aquaculture**	**K2**
Unit II		
Objective2	**To study the structure and function of marine ecosystems.**	
Marine Ecosystem: Concept-Ecosystem Structure and Function-Functional attributes Food chain, Food–web, Ecological Pyramid, Energy Flow. Recycling of Nutrients. Evolution and management-system ecology and modeling.		
Outcome 2	**Gain the knowledge of intensive, extensive culture and open sea farming.**	**K3**
Unit III		
Objective 3	**To provide detailed information population growth.**	
Population Ecology - group attributes, population growth, density variations, concept of carrying capacity. Dispersal, prey-predator relationship-density dependent-density independent factors.		
Outcome3	**Students can analyse the various knowledge on different cultures and maintenance.**	**K3**
Unit IV		
Objective4	**To understand the structure, composition and adaptations of community ecology, study of animal associations.**	
Structure and composition, diversity and stability, concept of niche, succession, community wise adaptation, e.g. fouling and boring community. Animal association in marine environment-endoecism, inquilinism–phoresis-epizoism-mutualism- communalism – symbiosis-parasitism. Marine zoogeography with reference to Indian Arctic and Antarctic Oceans.		
Outcome4	**Learners acquire knowledge on hatchery managements.**	**K4**
Unit V		
Objective5	**To study the biodiversity assessment techniques (Quadrate and Line and Transect method)**	
Marine biodiversity: Definition and Importance, Biodiversity Assessment Techniques. Threats to Marine Biodiversity,Over-Exploitation,PhysicalAlteration,Pollution,AlienSpecies.Bio-Security.Marine bio resources		
Outcome5	**Students understand the feed management.**	**K4**

Suggested Readings:

Balakrishna Nair, N.,&Thampy, D. M. (1980). *A text Book of Marine Ecology.* New Delhi: TheMacmillanCo.of India Ltd.

BarnesR.S. K.(1999*).IntroductiontoMarineEcology.*BlackwellScience.

Bertness, M. D., Gaines, S. D., & Hay, M.K. (2000). *Marine Community Ecology.* Sinauer Associates.Crowder.(1991). *WilliamSeashoreLifeBetweentheTides.*DoverPublication.

Gage. J. D., & Tyler, P. A. (1991). *Deep Sea Biology.* Cambridge: Cambridge University Press.JefferyS. Levinton.(2000).*MarineEcology, BiodiversityandFunction*.OxfordUniversityPress.

Onlineresources

https://www.sciencelearn.org.nz/resources/141-environmental-conditions-affecting-the-sea
https://www.britannica.com/science/marine-ecosystem
https://www.marinebio.org/conservation/marine-ecology/
https://www.britannica.com/science/community-ecology/The-process-of-succession
https://www.marinebio.org/conservation/marine-conservation-biology/biodiversity/

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S(3)	S(3)	M(2)	M(2)	L(1)	M (2)	M(2)	M(2)	M(2)	L(1)
CO2	M (2)	S(3)	M(2)	M(2)	S(3)	L(1)	S(3)	S(3)	M(2)	M (2)
CO3	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)
CO4	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)
CO5	L(3)	L(1)	S(3)	M(2)	M(2)	M(2)	L(1)	M(2)	S(3)	M(2)
W.AV	**2.4**	**2.2**	**2.2**	**2.2**	**2.0**	**1.8**	**2.0**	**2.4**	**2.2**	**1.8**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	M(2)	M(2)	S(3)
CO2	M(2)	M(2)	S(3)	M(2)	M(2)
CO3	S(3)	S(3)	M(2)	S(3)	S(3)
CO4	M(2)	M(2)	S(3)	M(2)	M(2)
CO5	M(2)	M(2)	M(2)	M(2)	M(2)
W.AV	**2.4**	**2.4**	**2.4**	**2.2**	**2.4**

S–Strong(3),M-Medium(2),L-Low(1)

II–Semester					
Core	**Course Code: 461202**	**MARINE POLLUTION, ENVIRONMENT AND HEALTH**	**T**	**Credits: 4**	**Hours: 4**

UNIT–I		
Objective1	**To study major classes of pollutants in the marine environment.**	
Marine Pollution - Definition, categories of additions, Pollutant and its classification. Organic wastes - BOD, COD, and dilution factor, Fluctuations in DO - Consequences of organic discharges to estuaries with examples - their origin and transport to the oceans. Mechanism of dispersion of different pollutants-physical, chemical and biological Effect on marine organisms-bioaccumulation and biomagnifications.		
Outcome1	**To understand the important of aquaculture.**	**K2**

UNIT- II		
Objective2	**To make students aware of how to protect the ocean from marine pollution**	
Sewage Pollution- Definition, sources, nature and their treatment processes with reference to wastes from river run off, agricultural, paper, fertilizer, pulp and soap manufacturing industries. Thermal Pollution-The state of some ocean and seas in the world (pollution aspect)- The Pacific Ocean and Indian Ocean-Mediterranean Sea		
Outcome2	The students learn about treatment processes with reference to wastes from river run off, agricultural, paper, fertilizer, pulp and soap manufacturing industries. Thermal Pollution.	**K4**

UNIT -III		
Objective3	**To understand the sewage pollution and treatment process**	
Oil Pollution-Sources, major accidental spills, fate of spilled oil on the sea-consequences of oil spills and treatment of oil spills. Pesticide pollution - inputs, fate in the sea, factors affecting the bioaccumulation of pesticides - DDT the most wide spread molecule-Impact of pesticides on the Environment- Mode of poisoning of pesticides-Methods to minimize pesticide pollution.		
Outcome3	**Students can analyse the various knowledge on different cultures and maintenance.**	**K4**

UNIT- IV		
Objective4	**To study the heavy metal pollution and their effects of marine and coastal waters.**	
Heavy metal Pollution - Sources, Classification and effects of marine and coastal waters(Hg, Pb, Cd, Cu, Zn and Fe). Distribution- toxicity and disease -minamita, itaiitai, etc. and their toxic effect - eutrophication and ecological significance. The present status of coastal pollution in India and future strategies. Maximum permissible dose concept –dose limits, Disposal of radioactive wastes- beneficial aspects of radiation and food safety.		
Outcome4	**Learners acquire knowledge on hatchery managements.**	**K2**

UNIT- V		
Objective5	**To study the Global warming and Climate change, effect of marine and coastal waters.**	
Criteria for selection of indicator organism - Quantitation of pollution load, basic pre-requisites. Macro algae, crustaceans and mollusks as indicator organisms for monitoring of trace metal pollution - Red tides phenomena- distribution, types of poisoning, effects and methods to minimize redtides in the sea. Monitoring strategies of marine pollution –Mitigation. Global warming and Climate change-Role of international and national organizations and role of NGO.		
Outcome5	**Students understand the feed management**	**K3**

Suggested Readings:

AaradhanaSalpekar.(2018). *Marine,NuclearandThermalPollution.*JnanadaPrakashan.
AndresHugoArias.,&JorgeEduard.(2017).*MarinePollutionandClimateChange.*TaylorandFrancisGroup.
CarlJ.Sindermann.(1995).*OceanPollution:EffectsonLivingResourcesandHumans.*CRCMarineScience.
Clark, R. B.(1989). *Marine pollution.* Oxford, New York: Clarendon
Press.Coffield,R.L.(2019).*SavingOurOceans*.MoonlightMesaAssociates.
JudithS.Weis.(2015).*MarinePollution.*OxwardUniversity Press.
Mishra,P.(2007). *EnvironmentPollutionanditsControl.*SumitEnterprises.
RicardoBeiras.(2018).*MarinePollution:Sources,FateandEffectsofPollutantsinCoastalEcosystem.*
Elsevier.
Singh, P. (1995). *Environmental Pollution and Management.* Chugh Publications.Sinha,P.(1998).*MarinePollution.*AnmolPublicationsPvt.Ltd.

Onlineresources

https://www.texasdisposal.com/blog/ocean-pollution-causes-effects-and-prevention/
http://www.waterencyclopedia.com/Po-Re/Pollution-of-the-Ocean-by-Sewage-Nutrients-and-Chemicals.html
https://worldoceanreview.com/en/wor-1/pollution/oil/
https://www.intechopen.com/chapters/83381
https://www.un.org/en/climatechange/science/climate-issues/ocean-impacts

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S(3)	S(3)	M(2)	S(3)	M(2)	M (2)	M(2)	M(2)	M(2)	M(2)
CO2	M (2)	M(2)	S(2)	M(2)	S(3)	L(1)	S(3)	S(3)	M(2)	M (2)
CO3	M(2)	M(2)	L(1)	S(3)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)
CO4	L(1)	M(2)	M(2)	M(2)	M(2)	L(1)	M(2)	S(3)	M(2)	L(1)
CO5	L(3)	L(1)	S(3)	M(2)	M(2)	M(2)	L(1)	M(2)	M(2)	M(2)
W.AV	**2.2**	**2.0**	**2.0**	**2.4**	**2.2**	**1.6**	**2.0**	**2.4**	**2.2**	**1.8**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	M(2)	M(2)	S(3)
CO2	M(2)	M(2)	S(3)	M(2)	M(2)
CO3	M(2)	S(3)	M(2)	M(2)	M(2)
CO4	M(2)	S(3)	M(2)	M(2)	M(2)
CO5	M(2)	M(2)	M(2)	M(2)	M(2)
W.AV	**2.2**	**2.6**	**2.2**	**2.0**	**2.2**

S–Strong(3),M-Medium(2),L-Low(1)

III–SEMESTER					
Core	**Course Code: 461203**	**APPLICATIONS OF REMOTE SENSING & GIS IN OCEANOGRAPHY**	**T**	**Credits: 4**	**Hours: 4**

UNIT–I		
Objective1	**To gather knowledge of fundamentals of Electro-Magnetic Radiation (EMR) and interactions with Earth's surface and atmosphere.**	
Remote sensing Definition-Principles and Concepts-Electromagnetic spectrum Electromagnetic energy interaction in the Atmosphere: Absorption, Transmission and Scattering- Electromagnetic spectrum- Electromagnetic energy interaction in the Earth Surface: Vegetation, Soil and Water.		
Outcome1	**Students understand the of fundamentals of Remote sensing and Electromagnetic energy interaction with atmosphere and Earth Surface.**	**K2**

UNIT –II		
Objective2	**To acquire knowledge of Aerial photography and various Platforms , sensors of satellites**	
Define sensors and Platforms-Types of sensors (Active and Passive)-Types of Platforms (Airborne and Space borne)-Aerial camera-Basic principles of Photogrammetry- Aerial photography missions-Multispectral scanners		
Outcome2	**Students can gain the knowledge of Aerial photography and various Platforms and sensors of satellites**	**K3/K4**

UNIT –III		
Objective3	**To educate the Visual Image Interpretation of various thematic mapping and knowledge of Multispectral, Thermal, Hyper spectral and Microwave sensing.**	
Introduction of visual image interpretation- Land use, land cover, Geological, Soil and Wetland mapping-Applications of Agricultural, Forestry, Rangeland, Water resource and Urban planning-Principles of Landform identification and Evaluation-Multispectral, Thermal, Hyper spectral and Microwave sensing.		
Outcome3	**Students can explore the knowledge of Visual Image Interpretation of various thematic mapping and knowledge of Multispectral, Thermal, Hyperspectral and Microwave sensing.**	**K3**

UNIT– IV		
Objective4	**To learn the various Earth observation systems and Global Positioning System**	
Earth observation system (Low, medium, High and Imaging spectrometry systems) Lansatseries, SPOT, IRS, RESURS, ADEOS, JERS, SPIN, IKONOS, QuikBird, OrbView,EROS, NOAA, GOES, DMSP, Seasat, EOS and MODIS-Global Positioning System..		
Outcome4	**Students acquired the specifications of various Earth observation systems and Global Positioning System**	**K4**

UNIT– V		
Objective5	**To educate the Principles of Digital Image Processing and Geographic Information System**	
Basic principles & uses of GIS-Application of GIS in Geology and natural Resource management - Components of GIS-Raster and vector data – DEM -Digital Image Classification-Principle of image classification-image classification process (Supervised, Unsupervised)- Problems in image classification		
Outcome5	**Students get idea about of Digital Image Processing and Geographic Information System**	**K4**

Suggested Readings:

Ikeda, M., &Dobson, F. (1995). Oceanographic Applications of Remote Sensing: CRC Press.

Malczewski, J. (1999). GIS and Multicriteria Decision Analysis: John Wiley & Sons Inc.

Mueller, T., &Sassenrath, G. (2015). GIS Applications in Agriculture. CRC Press.

Richards, J., &Jia, X. (2006). Remote Sensing Digital Image Analysis (4th ed). Springer International Publishing.

Richards, J., and Jia, X. (1999). Remote Sensing Digital Image Analysis (3rd ed). Springer International Publishing.

Singh, S. (1992). Geomorphology and Remote Sensing in Environmental Management. Scientific Publishers.

Onlineresources

https://www.esri.com/en-us/industries/higher-education/imagery-remote-sensing-education
https://earthobservatory.nasa.gov/Library/RemoteSensing/
https://www.coursera.org/courses?query=remote%20sensing
https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2017WR022437
http://www.mimas.ac.uk/rs/
http://http2.brunel.ac.uk:8080/depts/geo/Contents.html
http://rsd.gsfc.nasa.gov/rsd/RemoteSensing.html
http://www.vtt.fi/aut/rs/virtual/
http://www.cast.uark.edu/jpgis/

Course Outcome VS Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L(1)	L(1)	L(1)	M(2)	L(1)	M(2)	L(1)	M(2)	L(1)	L(1)
CO2	L(1)	L(1)	M(2)	L(1)	L(1)	M(2)	L(1)	M(2)	L(1)	L(1)
CO3	M(1)	M(2)	L(1)	L(1)	M(2)	M(2)	M(2)	M(2)	M(2)	L(1)
CO4	M(1)	M(2)	M(2)	L(1)	M(2)	M(2)	M(2)	M(2)	M(2)	L(1)
CO5	L(1)	L(1)	L (1)	L(1)	M(2)	M(2)	M(2)	M(2)	M(2)	L(1)
W.AV	**1**	**1.6**	**1.2**	**1.2**	**1.6**	**2**	**1.6**	**2**	**1.6**	**1**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome VS Programme Specific Outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	M(2)	L(1)	L(1)
CO2	M(2)	M(2)	M(2)	M(2)	M(2)
CO3	M(2)	M(2)	M(2)	L(1)	M(2)
CO4	M(2)	L(1)	M(2)	S(3)	M(2)
CO5	M(2)	L(1)	M(2)	S(3)	M(2)
W.AV	**2**	**1.8**	**2**	**2**	**1.8**

S–Strong(3),M-Medium(2),L-Low(1)

II–SEMESTER					
Core	**Course Code: 461204**	**AQUACULTURE**	**T**	**Credits: 4**	**Hours: 4**

UNIT–I

Objective1	**To learn the Coastal aquaculture and its important.**	
Introduction: Importance of Coastal aquaculture-Natural Stock-Over fishing-Depletion -Present status-Potentialities and socio-economic problems of aquaculture.		
Outcome1	**To understand the important of aquaculture.**	**K2**

UNIT -II

Objective2	**To provide General information of pond design and construction.**	
Farm design and structure: Site selection-Technical consideration- Topography-Soil Characteristics - water supply- Pond type, Dyke -Inlet, outlet - Structures, type and Design of supply and drainage canals - Farm design, construction, operation and maintenance- Open sea forming: cages,pens - Raft - Raceways practices.		
Outcome2	**Gain the knowledge of intensive, extensive culture and open sea farming.**	**K4**

UNIT -III

Objective3	**To provide detailed information of Pond maintenance.**	
Farm Management: Pond management, nursery management-stocking, feeding schedules, water quality management-control of predators, parasites and disease management. Harvesting-Economics of farming. Seaweed culture-Types of culture-Economic importance of seaweeds		
Outcome3	**Students can analyse the various knowledge on different cultures and maintenance.**	**K4**

UNIT -IV

Objective4	**To learn the hatchery management and its important.**	
Hatchery Management: An over view of Crustaceans, Fin fishes and Molluscans culture: Present status-Hatchery production: Collection and maintenance of brood stock-induced breeding-mass production of seeds- Types and components of hatchery.		
Outcome4	**Learners acquire knowledge on hatchery managements.**	**K3**

UNIT -V

Objective5	**To educate the feed management of hatcheries and pond.**	
Feed Formulation - Fisheries extension - Principles and approaches- extension methods- Role of Fisheries extension -Fish Farmers - Development Agency-Brackish Water fish Farmers Development Agency (FFDA & BFFDA) and Non- Governmental Agencies in fisheries development.		
Outcome5	**Students understand the feed management.**	**K4**

Suggested Readings:

Boyd, C., & Tucker, C. (1998). *Pond Aquaculture: Water Quality Management.* Springer International Publishing.

Coche, A. G., & Muir, J. F. (1992). *Pond Construction.* Daya Publishing House.

Dash, M. C., &Patnaik, P. N. (1994). *Brackish Water Prawn Culture.* Palani Paramount Publications.

Gupta, S., Mohapatra, B., &Routray, P. (2008). *Textbook of Breeding and Hatchery Management of Carps.* Narendra Publishing House.

Kannupandi, T., Soundarapandiyan, P., &Anantharaman, P. (2002). *Hatchery manual for Penaeusmonodonfabricus*. ENVIS Centre, CAS in Marine Biology, Annamalai University.

Thomas, P. C., Rath, S.,&Mohapatra, K. D. (2013). *Breeding and Seed Production of Finfish and Shellfish.* Daya Publishing House.

Online resources

http://ecoursesonline.iasri.res.in/mod/page/view.php?id=45552
https://www.fishfarming.com/services/fish-farm-design-construction.html
https://www.slideshare.net/narasimhaharsha/nursery-pond-management-of-fishes
http://ecoursesonline.iasri.res.in/mod/page/view.php?id=86156
http://www.agritech.tnau.ac.in/expert_system/poultry/Incubation%20and%20Hatching.html
https://www.fao.org/3/n9317e/n9317e0l.htm

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M (2)	S (3)	M (2)	M (2)	M (2)	S (3)	M (2)	M (2)	M (2)	M (2)
CO2	S (3)	M (2)	S (3)	S (3)	M (2)	S (3)	M (2)	M (2)	M (2)	M (2)
CO3	L (1)	M (2)	M (2)	M (2)	M (2)	M (2)	M (2)	L (1)	L (1)	M (2)
CO4	M (2)	M (2)	L (1)	L (1)	M (2)	M (2)	L (1)	L (1)	L (1)	M (2)
CO5	L (1)	M (2)	L (1)	M (2)	M (2)	L (1)	M (1)	M (2)	M (2)	L (1)
W.AV	**1.8**	**2.2**	**1.8**	**2.0**	**2.0**	**2.2**	**1.6**	**1.6**	**1.6**	**1.8**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M (2)	M (2)	M (2)	S (3)	M (2)
CO2	S (3)	S (3)	M (2)	M (2)	M (2)
CO3	M (2)	M (2)	L (1)	M (2)	M (2)
CO4	M (2)	L (1)	L (1)	M (2)	L (1)
CO5	M (2)	L (1)	L (1)	L (1)	M (2)
W.AV	**2.2**	**1.8**	**1.4**	**2.0**	**1.8**

S–Strong(3),M-Medium(2),L-Low(1)

II-SEMESTER				
Core	**Course Code: 461205**	**MARINE ECOLOGY AND ZOOGEOGRAPHY MARINE POLLUTION, ENVIRONMENT AND HEALTH APPLICATION OF REMOTE SENSING & GIS IN OCEANOGRAPHY AQUACULTURE**	**Credit:4**	**Hours:8**

PRACTICAL–II

MARINE ECOLOGYANDZOOGEOGRAPHY

1. Rocky, sandy, muddy shore Fauna
2. Sea grass– Macrofauna &Meiofauna
3. Mangrove associated Macro fauna & Meiofauna
4. Biodiversity assessment of Population density in an Ecosystem
5. Field visit to Rock shore, sandy shore and Muddy shore
6. Visit to Marine National Park and Report Submission

MARINE POLLUTION, ENVIRONMENT AND HEALTH

1. BOD–TOC–TDS- TSS
2. Heavy Metal Analysis
3. Identification of phytoplankton and zooplankton
4. Identification of Pollution indicator organisms

APPLICATION OF REMOTE SENSING & GISIN OCEANOGRAPHY

1. Preparation of simple Vector map, Toposheet reading and GPS field survey.
2. VisualInterpretationofGeomorphicfeaturesfromtheSatelliteimageandAerial photographs.

AQUACULTURE

1. Identification of cultivable seaweeds, fin and shellfishes.
2. Soil and water quality determination and fish farm equipment
3. Technique of induced breeding and rearing techniques of finfish and crustaceans in hatcheries.
4. Observation and management practices of nursery and stocking ponds.
5. Fields visits toob serve finfish, shellfish, sea cucumber and seaweed culture technique and harvest methods.

III–SEMESTER					
Core	**Course Code: 461301**	**FISH AND FISHERIES**	**T**	**Credits: 4**	**Hours: 4**
UNIT–I					
Objective1	**To provide basic and advanced information on fishery resources in India and world**.				
Major fisheries resources of the world - global trends in production - Target and non-target fisheries resources of the Indian subcontinent and the EEZ. Distribution, composition, trends and dynamics of major exploited fishery resources in lagoons, estuaries, territorial waters, oceanic waters, deep sea oceanic islands. Sports, game and ornamental fisheries. Endangered and threatened species - in-situ and ex-situ conservation.					
Outcome1	**To understand the Indian major fishery resources.**				**K2**
UNIT –II					
Objective2	**To provide knowledge of General outline classification and reproductive biology of fishes.**				
Biology of economically important fish species - Food and feeding habits- methods of studying food and feeding habits - Reproductive biology - maturity stages, fecundity, ova diameter studies and breeding cycles - Length - weight relationships, Condition Factor, Gonado-Somatic Index, Age and growth studies. Catch per unit effort - Concept of Maximum Sustainable Yield and Maximum Economic Yield.					
Outcome2	**Students learn the classification, food and feeding and reproductive biology of fishes.**				**K3**
UNIT –III					
Objective3	**To educate National and international organizations involving the fisheries management.**				
Concepts and principles of fisheries management - Fisheries Acts and Legislations - Fisheries policies for inland, coastal and open ocean fisheries management - International fishery regulations and treaties - Input control measures - access control, size, type, number and power of boats, duration of fishing. Output control measures - Total Allowable Catch, Catch Quotas, Licensing, Technical control measures such as size limitations, closed fishing areas, closed seasons, size of nets and mesh size regulations, limited entry. UNCLOS, FAO Code of Conduct for Responsible Fisheries.					
Outcome3	**Students can able to discuss the fisheries management regulations acts.**				**K3**
UNIT– IV					
Objective4	**To learn the craft and gears and recent techniques in fishing activities.**				
Different types of craft and gear, their operation and their maintenance - Selectivity of fishing gears - by-catch reduction devices in trawls - turtle excluder devices - Use of modern techniques and equipment for fish finding and capturing.					
Outcome4	**Learners acquire knowledge of craft and gears recent techniques**				**K4**
UNIT– V					
Objective5	**To educate the importance of protected area.**				
Relevance of capture fisheries in food, nutrition, employment income and livelihood securities of fishers - Impact of dams, river linking, CRZ, Biodiversity Bill, protected/closed area, fishing bans, protected areas, mangroves, sanctuaries and parks on the fisher communities. Role of extension in fisheries - mechanisms and modes of extension and their impact on capture fisheries and fisher's livelihood - alternative livelihood options.					
Outcome5	**Students evaluate the protected area and Role of fisheries extension.**				**K4**

Suggested Readings:

- Bal, D.V., &Rao, K. V. (1990). *Marine Fishes of India (1sted).* Tata McGraw Hill.
- Chandra P. (2007). *Fishery Conservation, Management and Development.* SBS Publ.
- Dholakia, A. D. (2004). *Fisheries and Aquatic Resources of India, FAO, Technical Papers on Marine Fisheries.* Daya Publ. House.
- Hoar, W. S.,&Randall, D. J. (1971). *Fish Physiology (Vol.1-11).* New York: Academic Press.
- Kurian, C. V., & Sebastian, V. O. (1986). *Prawns and Prawn Fisheries of India.* Hindustan Publ.Corp.
- Margaret, E. Brown. (1957). *The Physiology of fishes (Vol.1& 2).* New York: Academic Press.
- Peter, B. M., &Joseph, J. C. Jr. (2000). *Fishes - An Introduction to Ichthyology (4thed).* Prentice Hall.
- Samuel, C. T. (1968). *Marine Fisheries in India.* Narendra Publ. House.
- Shanbhogue, S. L. (2000). *Marine Fisheries of India*. ICAR.
- Yadav, B. N. (1997). *Fish and Fisheries (2nded).* Daya Publ. House.

Onlineresources

https://www.fao.org/3/cc0461en/online/sofia/2022/status-of-fishery-resources.html
https://www.britannica.com/animal/fish/Annotated-classification
https://trackwellfims.com/fisheries-management-systems/
https://agriculturistmusa.com/fishing-technology/
https://vikaspedia.in/aspirational-districts/uttar-pradesh/sonbhadra/best-practices/biofloc-fish-farming-an-innovative-sustainable-livelihoods-practice

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S(3)	S(3)	L(1)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)	M(2)
CO2	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)
CO3	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	L(1)	S(3)	L(1)
CO4	M(2)	M(2)	M(2)	L(1)	M (2)	S(3)	M(2)	M(2)	L(1)	M (2)
CO5	L(1)	M(2)	M(2)	M(2)	M(2)	M(3)	(2)	M(2)	M(2)	L(1)
W.AV	**2.0**	**2.4**	**1.8**	**2.0**	**2.2**	**2.4**	**2.2**	**1.6**	**2.0**	**1.6**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	M(2)	M(2)	M(2)
CO2	M(2)	M(2)	S(3)	M(2)	M(2)
CO3	M(2)	M(2)	M(2)	L(1)	L (1)
CO4	L(1)	L(1)	L(1)	S(3)	M(2)
CO5	M(2)	L(1)	L(1)	M(2)	L(1)
W.AV	**2.0**	**1.8**	**1.8**	**2.0**	**1.6**

S–Strong(3),M-Medium(2),L-Low(1)

III – SEMESTER					
Core	**Course Code 461302**	**POST – HARVEST TECHNOLOGY**	T	**Credits: 4**	**Hours: 4**

UNIT -I		
Objective 1	**To study the handling and processing of fishes.**	
Handling and transportation - on board and on shore - manufacture, quality and uses of ice for handling, transportation and processing of fish - Refrigerated Sea water for fish preservation. Insulated containers for fresh fish transportation.		
Outcome 2	**Students will be able to handle and preserve the fish.**	**K2/ K3**

UNIT -II		
Objective 2	**To study the chemical changes during fish processes.**	
Fish processing - post mortem changes - chemical and structural. Chemical changes in lipids, proteins and nucleotides. Changes in pH, bacterial load, sensory changes, texture, taste and odour. Factors affecting quality of fish. Pre-treatment of fish washing, gutting, filleting, beheading, peeling, deveining. Steaming of crab.		
Outcome 2	**They will get awareness about fish processing, and the chemical and microbial quality of seafood during processing and storage.**	**K3**

UNIT- III		
Objective 3	**To understand different freezing methods.**	
Methods of freezing - Processing and packaging, Chemical treatment, antioxidants, cryoprotectants and other additives. Temperature and duration of storage in quality and shelf life. Processing of crustaceans and cephalopods. Sanitation in processing plants and Quality control of fresh and processed fish and fishery products.		
Outcome 3	**They will gain knowledge about methods of freezing and storage of processed fish.**	**K2**

UNIT-IV		
Objective 4	**To study the development of protective packing methods of fishery products.**	
Packaging and packaging materials - Packaging materials; basic films and laminates - their manufacture and identification - resistance of packaging materials - development of protective packaging for fishery products. Packing of fresh and frozen fish - packaging for transport and shipping. packaging standards for domestic and international trade		
Outcome 4	**They will know about different seafood packaging materials and methods of packaging and transport.**	**K4**

UNIT-V		
Objective5	**To know the status of seafood quality standards both national and international.**	
Seafood quality: Quality assessment in fish and fishery products - Physical, chemical organoleptic and microbiological quality standards - Good manufacturing practices - National and International standards - Codex alimentarius, USFDA and EU regulation for export trade		
Outcome 5	**Students will get awareness of seafood quality, national and international regulatory agencies for quality assurance and monitoring.**	**K4**

Suggested Readings: J. E., Ryther, J. H.,&McLarney, W.O. (1972). *Aquaculture: Farming and husbandry of freshwater and marine organisms*. New York: Wiley Inter science.
Beveridge, M. (1987). *Cage culture.* England: Fishing News Books.
Bose. (1991). *Coastal Aquaculture Engineering*. Oxford: IBH Publishing Co. Pvt. Ltd.
Chen, T. P. (1976*). Aquaculture practices in Taiwan*. London: Fishing News (Books) Ltd.
K. K. Balachandran. (2002). *Post - Harvest Technology of Fish and Fish Products*.Daya Publishing House.
Kutty, M. N. (1991). *Aquaculture.* FAO Publication
Nowak, W. S. W. (1970). *The marketing of shell fish.* London: Fishing News (Books) Ltd.
Setharaman, J. J. (1966). *A method for determination of suitability of coastal regions for construction of brackish water ponds.*

Online resources
https://www.britannica.com/topic/fish-processing
https://agritech.tnau.ac.in/fishery/fish_fishingtech_onboard.html
http://ecoursesonline.iasri.res.in/course/view.php?id=278
https://www.yorksaw.com/seafood-processing-packaging/
https://www.fao.org/3/V7180E/V7180e09.htm

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S(3)	S(3)	L(1)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)	M(2)
CO2	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)
CO3	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	L(1)	S(3)	L(1)
CO4	M(2)	M(2)	M(2)	L(1)	M (2)	S(3)	M(2)	M(2)	L(1)	M (2)
CO5	L(1)	M(2)	M(2)	M(2)	M(2)	M(3)	M(2)	M(2)	M(2)	L(1)
W.AV	**2.0**	**2.4**	**1.8**	**2.0**	**2.2**	**2.4**	**2.2**	**1.6**	**2.0**	**1.6**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	M(2)	M(2)	M(2)
CO2	M(2)	M(2)	S(3)	M(2)	M(2)
CO3	M(2)	M(2)	M(2)	L(1)	L (1)
CO4	L(1)	L(1)	L(1)	S(3)	M(2)
CO5	M(2)	L(1)	L(1)	M(2)	L(1)
W.AV	**2.0**	**1.8**	**1.8**	**2.0**	**1.6**

S–Strong(3),M-Medium(2),L-Low(1)

III–SEMESTER					
Core	**Course Code 461303**	**OCEAN MANAGEMENT**	**T**	**Credits: 4**	**Hours: 4**

UNIT–I

Objective1	**To understand the interrelationship between the marine sciences - public policy through exploration - integrated coastal and ocean management.**

Developmental Activities and Impacts : Seas and Ocean Coastal zone importance developmental activities such as coastal mariculture, tourism, shorefront construction and their impacts - global and national coastal problems such as loss of habitat, sea level change, degradation of water quality and fisheries resource depletion.

Outcome1	**Students will gain knowledge on ocean managements.**	**K2**

UNIT - II

Objective2	**To understand the marine science principles compare with the needs of policy development.**

Coastal zone management issues : Coastal zone management issues social and economic trend and their importance - coastal zone regulations, aquaculture authority bill Integrated coastal economics zone management major ecological, CZM programs countries, temperate and tropical countries and their CZM environmental comparison between developed and developing Marine Fisheries management policies.

Outcome2	**They will gain knowledge on habitat protection through coastal zone management issues, land sea interactions.**	**K3**

UNIT - III

Objective3	**To synthesize information from a variety of sources and to explore some aspect of public policy.**

Ocean management : Biodiversity from a global and national view - current status of marine biodiversity - marine - biodiversity conservation - marine protected areas- marine biosphere reserves- marine parks. Role of international, national agencies and organizations in ocean management Law of the sea, CBD, IOC-UNESCO, WTO, UNEP, FAO, IUCN, WWF, IMO, CMS, CITES, ICES, IOI (Malta), SCAR, SCOR, LOICZ.

Outcome3	**Students will know the role of the NGO's in coastal zone management**	**K3/K4**

UNIT - IV

Objective4	**To learn about different aspects of disaster management.**

Land sea interactions

Multiple uses of the coastal zones and conflicts. Coastal settlements - human impacts on the coastal zones with special emphasis on artisanal fishing, coastal aquaculture and coastal tourism. Coastal vulnerability - mangroves, wetlands, sand dunes, sea-grasses, lagoons and enclosed seas, islands, coral reefs and other protected areas.

Outcome4	**Students will gain knowledge on planning, habitat restoration.**	**K2**

UNIT - V		
Objective5	**To know about the methods of coastal ecosystem monitoring**	
Coastal ecosystem monitoring Coastal and marine ecosystem monitoring -Estuaries, mangroves, lagoons, backwater, reef etc. Effect of port activities and coastal pollution on mangroves, corals and beaches. Role of national and international agencies for coastal and Ocean management.		
Outcome5	**Student will gain knowledge about different methods of coastal monitoring.**	**K4**
Suggested Readings: Borgese, E.M. and N. Ginsburg, 1979 - 1986. OceanYear Book 1-6. The University of Chicago Press, Chicago. Hickling, C.F. and Peter Lancaster Brown, 1973. The Seas and Oceans. Blandford Press, London. Ross, D.A., 1980. OpportUNITies and Uses of theOcean. Springer Verlag, New York. Brahtz, J.F.P. (Ed.) 1972. Coastal Zone Management. U.N. International Economic and Social Affairs, New York. Kathiresan, K., 2014. Ocean and coastal ecology.Scientific Publishers, India, pp.271 Coastal area management and Development, 1982. UN. Department of International Economic and Social Affairs. Sharma, R.C. and P.C. Sinha, 1994. India's Ocean Policy,Khama Publishers, New Delhi. 8. Duxbury, A.C., A.B. Duxbury and K.A. Sverdrup, 2000. An Introduction to the World's Oceans. 6th Edition. McGraw Hill Companies.		
Onlineresources https://www.jagranjosh.com/general-knowledge/coastal-zone-management-purpose-objective-and-challenges-1510572939-1 https://www.eea.europa.eu/publications/92-826-5409-5/page035new.html https://unacademy.com/content/mppsc/study-material/geography/marine-protected-areas-in-india/ https://www.academia.edu/47676064/Land_ocean_interactions_in_the_coastal_zone_science_plan https://earsc-portal.eu/display/EOwiki/Monitor+coastal+ecosystem		

Course Outcome VS Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M(2)	S(3)	M(2)	S(3)	S(3)	M (2)	S(3)	M(2)	S(3)	S(3)
CO2	S (3)	M(2)	M(2)	M(2)	M (2)	S(3)	M (2)	M(2)	M(2)	M (2)
CO3	S(3)	M(2)	M(2)	S(3)	S(3)	S(3)	S(3)	M(2)	S(3)	S(3)
CO4	L(1)	S(3)	S(3)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)
CO5	S(3)	S(3)	M(2)	S(3)	M (2)	S(3)	M (2)	M(2)	S(3)	M (2)
W.AV	**2.4**	**2.6**	**2.2**	**2.6**	**2.4**	**2.6**	**2.4**	**2.2**	**2.6**	**2.4**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome VS Programme Specific Outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M(2)	S(3)	M(2)	S(3)	S(3)
CO2	S (3)	M(2)	M(2)	M(2)	M (2)
CO3	S(3)	M(2)	M(2)	S(3)	S(3)
CO4	L(1)	S(3)	S(3)	M(2)	M(2)
CO5	S(3)	S(3)	M(2)	S(3)	M (2)
W.AV	**2.4**	**2.6**	**2.2**	**2.6**	**2.4**

S–Strong(3),M-Medium(2),L-Low(1)

III – SEMESTER					
Core	**Course Code 461304**	**RESEARCH METHODOLOGY**	T	**Credits: 4**	**Hours: 4**

UNIT -I		
Objective 1	The primary objective is to develop a research orientation among the students and to familiarize them with the fundamentals of research methods.	
Methods for assessing primary productivity in animals- laboratory culture of diatoms and dino flagellates– culture systems–finfishes, shellfishes and seaweeds. Morphometric and meristic character–methods for estimation reproduction and breeding periodicity in animals.		
Outcome 1	Students will learn to develop an understanding of the basic frame work of research process.	**K2/ K3**

UNIT -II		
Objective 2	To understand the principles and application of microscopy and micro-	
Microscopy: Principles and applications of microscopy, light, phase contrast, fluorescence, scanning and transmission electron microscopes. Histology: Principles of micro techniques– fixing, embedding, sectioning, staining, differential. Histochemistry: Principles and practice. Methods employed in analysis of proximate composition.		
Outcome 2	Students will understand the principles and application of microscopy and micro-technique	**K3**

UNIT- III		
Objective 3	To understand the principles and application of microscopy, centrifuge and separation **techniques**	
Spectroscopy: Principles of biophysical methods, X-raydiffraction, Spectro flurometer, flame photometer, UV-visible, atomic absorption and emission spectro photometers, NMR and Mass spectrometer. Centrifuge: Principles and applications–Ultracentrifuge (velocity, buoyance and density, gradient centrifugation). pH:Buffers–pHmeters–ion, selective electrodes.Chromatography: Principles and Application of Chromatography: Paper, Thinlayer, column, IonExchange, Gelfiltration, GasLiquid, HPLC and affinity. Electrophoresis: Principles and Application of Electrophoresis: Paper, Agarose, PAGE, SDSPAGE and Iso-Electric focusing. Hybridization, sequencing, PCR, DNA fingerprinting, screening of genome and cDNA libraries.		
Outcome 3	**Students will understand the chromatographic, spectroscopic and electrophoretic techniques**	**K4**

UNIT-IV		
Objective 4	To learn biostatistics and bioinformatics tools	
Biostatistics: Collection and analysis of biological data- mean, median, modeStandarddeviation,Standarderror,Coefficientofvariation,Student't'test,Skewness,Kurtosis, Chi-square,Correlation,RegressionandANOVA.Bioinformatics: Internet- Worldwide Web-SearchEngines - their functions.Boolean searching - file formats. Biological data bases - sequence and structure -dateretrieval-searching source databases-sequence similarity searches– FASTA and BLAST,CLustal Wand Phylip.		
Outcome 4	Students gain knowledge in analysing the biological data and application of bioinformatic database	**K3**

UNIT-V		
Objective 5	Toimparteducationinthefoundationalmethodsandtechniquesofacademicresearch and manuscript preparation.	
Biological literature library research: Abstracting, searching for literature, indexing; manuscript preparation, organization of the paper – the art of writing –presentation of results – tables – graphs – histogram – relevant titles, etc. Internet and e-journals. Computer aided techniques for data analysis, data presentation and slide preparation.		
Outcome 5	Students will develop research orientation for their future research. Students will learn the fundamentals of research methods.	**K4**

Suggested Readings:

Bajpai, P. K. (2006). *Biological Instrumentation and Methodology*. New Delhi: S. Chand & Co. Ltd.Blum,Deborah.,&MaryKnudson.(1997).*AfieldguideforsciencewritersːtheofficialguideoftheNationalAssociationofScience Writers*.New York:OxfordUniversityPress.

Comir.,&PeterWoodFord.(1979).*WritingscientificpapersinEnglish*.London:PitmanMedicalPublishingCo.

Day, R.A. (1994). *How to write and publish a scientific paper*. London: Cambridge University Press.Ewing,G.W.(1988).*Instrumentalmethodsofchemicalanalysis*.McGraw HillBookCompany.

Gurumani, N.(2006).*ResearchMethodologyforBiologicalSciences.*Chennai:MJPPublishers.

Milton, J.S. (1992). *Statistical methods in Biological and Health Sciences.* New York: McGraw Hill Inc.Skoog, A., Douglas, J.,& Leary, J. J. (1992). *Principles of Instrumental Analysis*. Philadelphia: SandersGoldenSunberstSeries.

WilsonandWalker.(2000).*Practicalbiochemistry-principlesandtechniques.*CambridgeUniversity Press.

Online resources

https://biokimicroki.com/microscope-principle-parts-and-application/
https://www.vedantu.com/physics/spectroscopy
https://www.bioxspace.com/post/data-analysis-in-biological-research
https://libguides.rowan.edu/c.php?g=237523&p=1579142

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M(2)	M(2)	L(1)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)	M(2)
CO2	M(2)	S(3)	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)
CO3	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	L(1)	L(1)	S(3)	L(1)
CO4	M(2)	M(2)	M(2)	L(1)	M (2)	S(3)	M(2)	M(2)	L(1)	M (2)
CO5	L(1)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	L(1)
W.AV	**1.8**	**2.4**	**2.0**	**2.0**	**2.4**	**2.2**	**2.2**	**1.6**	**2.0**	**1.6**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	M(2)	S(3)	M(2)
CO2	S(3)	S(3)	S(3)	M(2)	M(2)
CO3	M(2)	M(2)	M(2)	L(1)	L (1)
CO4	M(2)	L(1)	M(2)	S(3)	M(2)
CO5	M(2)	L(1)	L(1)	M(2)	L(1)
W.AV	**2.4**	**2.0**	**2.0**	**2.2**	**1.6**

S–Strong(3),M-Medium(2),L-Low(1)

PRACTICAL–THIRD SEMESTER

Course Code: 461305	PRACTICAL-III FISH AND FISHERIES POST HARVEST TECHNOLOGY	P	Credits: 4	Hours:8

FISH AND FISHERIES

1. Marine fishery resources – visit to nearest marine landing center – length frequency analysis –catching method – catch data analysis on marine fishery resources of India– closed season studies–gear selectivity.
2. Identification of Commercially important fin and shell fishes and study of their morphology and classification.
3. Study on food and feeding habits on fishes.
4. Observation of fish maturation cycle, larval and juveniles and adult development– a case study.
5. Identification of Fish Parasite.
6. Collection of eggs and larvae collection methods.
7. Fish net making.

POSTHARVESTTECHNOLOGY

1. Isolation and identification of pathogenic bacteria.
2. Preparation of salted and cured fishery products and sensory evaluation of freshness.
3. Estimation of moisture, salt content, protein, lipid, carbohydrates and TMA in dried and cured fishery products.
4. Fish processing industrial visit.

FOURTH SEMESTER

Core	Course Code:461999	Dissertation Work or Internship Programme	Credits: 15	Hours:30

Project Dissertation:

Project Dissertation will be carried out by the student themselves with the interest of the student as well as the interest of the faculty with mutual understanding, expertise and interest. The students continuously evaluated the work carried out day to day for further events. Finally ,the faculty will be given instruction how to write the dissertation with different components, topicsandthematerial,text,problemstobeaddressedineachassignmenttitle.Thedissertationwillconsistofintroduction,Materialsand Methods, Results and Discussion, Summary and Conclusion, References/Bibliography.Ofcourse,appropriatestatisticaltoolsmustbefollowedfortheassessmentofdata.Aproperpreparationofgraphs,diagramsandflowchartsmustbeincludedinthedissertation.Appendixmay also be taken into consideration if necessary.

DSE					
DSE	**Course Code: 461501**	**MARINE BIODIVERSITY AND CONSERVATION**	**T**	**Credits: 3**	**Hours:3**
Unit–I					
Objective1	To protect and restore marine and estuarine ecosystems. Control of invasive species, mitigatedryl and salinity, Promote ecologically sustainable grazing				
Introduction - Marine Biodiversity - Importance - levels of biodiversity – biodiversity indices. Definition of extinction of marine bio-resources - rate of extinction – causes of extinction-island/intertidal biogeography-vulnerability to extinction.					
Outcome1	Students will gain knowledge on scientific information and knowledge regarding the status of marine biodiversity, various values associated with it and the necessity for its conservation.				**K2**
Unit –II					
Objective2	To study the marine protected areas.				
Conservation- essential concepts for small populations- problems of small population-applied population biology-establishment of new populations-ex-situ conservation strategies- conservation categories of species- legal protection of species.					
Outcome2	Theywillgainknowledgeonmarinebiosphererereserveareaanditsimportance.				**K3**
Unit –III					
Objective3	**To educate National and international organizations involving the fisheries management.**				
Marine protected areas-designing of protected areas-managing protected areas-restoration ecology.					
Outcome 3	Studentswillgainnationalandinternationalapproachestoconservationandsustainabledevelopment.				**K3**
Unit – IV					
Objective4					
Impediments to marine biodiversity conservation - insufficient scientific information inadequate transfer of information - cultural and biological diversity - differingbenefitsandcostsharmingaquaticlife-jurisdictionalgapsandoverlaps-useofmarineenvironment- immunity from public scrutiny- fragmented decision making.					
Outcome 4	Students will learn about improve scientific knowledge and access to information				**K4**
Unit – V					
Objective 5	➢ To minimize impacts of climate change on biodiversity, Maintain and record indigenous peoples'ethno biological knowledge, Improve scientific knowledge and access to information.				
Conservation and sustainable development - traditional societies - Government action local legislation - national laws - National Biodiversity Act and National Biodiversity Authority. International approaches to conservation and sustainable development–On going problems-possible responses-role of conservation biologists.					
Outcome 5	Students will promote conservation of marine biodiversity and its sustainable use.				**K4**

Suggested Readings:

Heywood, V., & Watson, R. (1995). *Global Biodiversity Assessment.* Cambridge University Press.Kannaiyan, S.,&Venkatraman, K. (2011). *Marine Biodiversity in India*. Associated Publishing Company.Kumar,S.(2009).*Biodiversity,EnvironmentandSustainableManagement(1st ed).*A.K.Publications.

Sinha,P.(1998).*BiodiversityDepletion.*AnmolPublicationsPvt.Ltd.

Onlineresources

https://www.marinebio.org/conservation/marine-conservation-biology/biodiversity/

https://oceans-and-fisheries.ec.europa.eu/ocean/marine-biodiversity/marine-biodiversity-objectives_en

https://www.drishtiias.com/daily-updates/daily-news-analysis/marine-protected-areas-2

https://www.bmuv.de/en/topics/water-resources-waste/marine-environment/marine-conservation-what-is-it-all-about

https://en.wikipedia.org/wiki/Marine_ecosystem

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M(2)	S(3))	L(1)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)	L(1)
CO2	S(3)	S(3)	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)
CO3	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	S(3)	L(1)	S(3)	S(3)
CO4	M(2)	S(3)	M(2)	L(1)	S(3)	S(3)	L(1)	M(2)	L(1)	M (2)
CO5	S(3)	M(2)	S(3)	S(3)	M(2)	S(3)	M(2)	M(2)	S(3)	L(1)
W.AV	**2.4**	**2.8**	**2.2**	**2.2**	**2.6**	**2.4**	**2.4**	**1.6**	**2.4**	**2.4**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	M(2)	S(3)	M(2)	M(2)
CO2	S(3)	M(2)	S(3)	M(2)	S(3)
CO3	M(2)	S(3)	S(3)	S(3)	S(3)
CO4	S(3)	M(2)	M(2)	M(2)	L(1)
CO5	M(2)	S(3)	M(2)	S(3)	S(3)
W.AV	**2.6**	**2.4**	**2.6**	**2.4**	**2.4**

S–Strong(3),M-Medium(2),L-Low(1)

DSE					
DSE	**Course Code: 461502**	**COASTAL ZONE MANAGEMENT**	**T**	**Credits: 3**	**Hours: 3**

UNIT–I

Objective1	The paper deals with coastal zone management.	
Definition and Concept: Introduction to Coastal Zone: Environment status of the coastal and marine ecosystems: Estuaries, mangroves, coral reef, lagoon, and wetland-Major threats to coastal ecosystem-Scientific expeditions for ascertaining the wealth of the sea-Five majorOceansandtheirrelativeimportance-lawofthesea-UNESCO,UNEP,IMO,regionalseas programme-Antarctic expedition convention		
Outcome1	Students will gain knowledge on balancing environmental, economic and human activities relating to coastal zone management.	**K2**

UNIT –II

Objective2	To provide knowledge about the protected areas and importance.	
Protected Area Management: Marine biosphere reserves, marine park, biosphere reserve and Sanctuaries-Categories background and basic concepts and applications -strict nature-reserve, national park, natural monument-Habitat/species management areas-Protected landscape/seascape-managed resource protected area- Coastal ecosystem-use of Coastal resources-Conservation issue and problems-Species of conservation concern– Recommendation and management practices for future action.		
Outcome2	Students will gain knowledge on protected area management.	**K3**

UNIT –III

Objective3	To provide basic knowledge of natural hazards, global warming and climatic changes.	
Natural Hazards and mitigation: Natural hazards, volcanoes, tides, tsunamis, cyclones, storm, Global warming and sealevel rice, erosion, emergence and submergence and sub-emergence of coastline-Mitigation. Monitoring strategies of marine pollution: Mitigation-Global warming and Climate change. Role of international and national organizations and role of NGO.		
Outcome3	Studentswillgainnationalandinternationalapproachestoconservationandsustainabledevelopment.	**K3**

UNIT – IV

Objective4	To provide knowledge on coastal protection structures.	
Coastal Protection Structures: Bioshields and their impact on coasts, beach stability, ocean and seabeach nourishment;interaction of waves with structures like seawalls, groins, break waters, revetments and replantation. Implementation of CRZ regulation and their Protection		
Outcome4	Students will gain knowledge on natural hazards	**K4**

UNIT – V

Objective5	To know the roles of various national and international organization regarding coastal zone management.	
Managerial organization: Role of national and international agencies and organizations in Ocean management. UNESCO,FAO,IMCO,UNEP, UNDP, NIOT, NIO, MOEFs and CPCB,MPEDA.		
Outcome5	Students will learn the role of international and national organizations.	**K4**

Suggested Readings

Beatley.(1994).*IntroductiontoCoastalZoneManagement*.IslandPress.

Edward. D. Goldberg. (1976). *The Health of the Oceans*. Paris: The Unesco

Press.ParimalSharma.(2008).*CoastalZoneManagement*.GlobalIndiaPublications.
Pilarczyk,K.(1990).*CoastalProtection*.A.A.BalkemaPublishers.
Platzoder, R. (1995). *The 1994 United Nations Convention on the Law of the Sea*. MartinusNijhoffPublishers.
Trives,T.,&Pineschi,L.(1997).*TheLawoftheSea*.MartinusNijhoffPublications.
Valiela,I.(2006).*GlobalCoastalChange.* BlackwellScienceLtd.

Onlineresources

https://www.jagranjosh.com/general-knowledge/coastal-zone-management-purpose-objective-and-challenges-1510572939-1
https://www.eea.europa.eu/publications/92-826-5409-5/page035new.html
https://unacademy.com/content/mppsc/study-material/geography/marine-protected-areas-in-india/
https://www.academia.edu/47676064/Land_ocean_interactions_in_the_coastal_zone_science_plan
https://earsc-portal.eu/display/EOwiki/Monitor+coastal+ecosystem

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M(2)	S(3))	M(2)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)
CO2	S(3)	S(3)	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)
CO3	S(3)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	L(1)	S(3)	S(3)
CO4	M(2)	S(3)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)	L(1)	M (2)
CO5	S(3)	M(2)	S(3)	M(2)	M(2)	S(3)	M(2)	M(2)	S(3)	M(2)
W.AV	**2.6**	**2.6**	**2.4**	**2.4**	**2.4**	**2.4**	**2.2**	**1.8**	**2.4**	**2.2**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	M(2)	M(2)	S(3)	M(2)
CO2	S(3)	M(2)	M(2)	S(3)	M(2)
CO3	S(3)	M(2)	S(3)	M(2)	M(2)
CO4	M(2)	M(2)	S(3)	S(3)	S(3)
CO5	M(2)	S(3)	M(2)	M(2)	M(2)
W.AV	**2.6**	**2.2**	**2.4**	**2.6**	**2.2**

S–Strong(3),M-Medium(2),L-Low(1)

DSE					
DSE	**Course Code: 461503**	**MARINE RESOURCES**	**T**	**Credits: 3**	**Hours: 3**
UNIT–I					
Objective1	**To gain knowledge on marine resources.**				
Non-living resources- Ocean resources in coast, shelf, slope and abyssal - Distribution of various kinds particularly in India ocean- Their forms, grade and potentiality- Coastal aquifer its nature, form, migration - Integrated resource management-Preservation andconservationofnon-livingresourcesincludingwater-Renewable&non-renewableresources.Resourcesoriginated-terrigenous, chemogenous, biogenous, allogenic and antigenic.					
Outcome1	**Students will get an idea on fisheries resource management and EEZ.**				**K2**
UNIT –II					
Objective2	**To provide the basic knowledge of marine mineral resources and its importance.**				
Marine minerals - Potential in east and west coasts of India-Mineral resources - MineralenrichmentintheBlacksea-Marinephosphorites-Placerminerals-Marinesulfides-Manganese nodules and crusts-Methods in the exploration of seafloor minerals deposits-Methods of exploration in manganese nodules, phosphorite and polymetallic sulfides-Sea baulk(non-living resources)					
Outcome2	**The students will get awareness about drugs from the marine based organisms.**				**K4**
UNIT –III					
Objective3	**To provide the basic knowledge of fishery resource management**				
Fishery resources management and deep-sea fishery potential-Resource potential- Resource estimates-Fishre sources of Indian EEZ-Reasons for decline in fish production-Profitable vessel management and requirement- Exploitation of marine fisheries resources and exports-Export management. Living resources–Captures- Sardines, Mackerels, Bombay Duck and Prawn fisheries-Principle methods of exploitation of sea fishes- Indigenous and modern Crafts and Gears.					
Outcome3	**Students will get an idea about biological diversity, fish and seafood supplies.**				**K4**
UNIT– IV					
Objective4	**To get an idea about biological diversity, fish and seafood supplies, oil and gas, minerals, sand and gravel, renewable energy resources, tourism potential, and unique ecosystems like coral reefs.**				
Drugs-Marine drugs–Importance–Sources-Carbohydrate and derivatives-Nitrogenous Compounds-Antibiotic compound from marine animals-Bioactive compound–Sources-Natural function-Ecological and distribution in the marine environment.					
Outcome4	**They will gain knowledge on oil and gas, minerals, sand gravel, renewable energy resources.**				**K2**
UNIT– V					
Objective5	**To study the marine drugs and importance, toxins from marine animals.**				
Toxin from marine animals- Type of toxins- Functional properties – toxin-Venoms-Venom in marine animals- sea snake, fish and mollusks-Pharmacological and toxicological properties-Marine steroids-Types-Marine carotenoids-Sterols of marine invertebrate.					
Outcome5	**Students will know about the Tourism potential, and unique ecosystems like coral reefs.**				**K4**

Suggested Readings:

Gautam,A.(1998).*Conservation& ManagementofAquaticResources.*DayaPublishingHouse.
Madhu,M.,Jakhar,P.,&Adhikary,P.(2013).*NaturalResourceConservation.*SatishSerialPublishingHouse.Singh ,R.(2013).*Fishery Resources*.PearlBooksPublishing.
Teleki,P.,Dobson,&M.,Moore,R.(1987).*MarineMinerals*.ReidelPublishingCompany.
Thompson,M.,Sarojini,R.,&Nagabushanam,R.(1991).*BioactiveCompoundsfromMarineOrganisms.* Oxford &IBHPublishingCo.Pvt.Ltd.
Yadav,B.N.(1997). *Fish&Fisheries*.DayaPublishingHouse.

Onlineresources

https://www.studyiq.com/articles/major-ocean-relief-features/
https://extension.psu.edu/renewable-and-nonrenewable-resources
https://worldoceanreview.com/en/wor-1/energy/marine-minerals/
https://medcraveonline.com/JAMB/indian-deep-sea-fisheries---its-prospects-issues-and-challenges.html
https://www.encyclopedia.com/media/educational-magazines/marine-toxins

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M(2)	S(3)	M(2)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)
CO2	S(3)	S(3)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)
CO3	S(3)	M(2)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)
CO4	M(2)	S(3)	M(2)	M(2)	M(2)	S(3)	L(1)	M(2)	M(2)	M (2)
CO5	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)
W.AV	**2.6**	**2.6**	**2.4**	**2.2**	**2.2**	**2.2**	**2.0**	**2.0**	**2.4**	**2.2**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	S(3)	S(3)	S(3)	S(3)
CO2	M(2)	S(3)	M(2)	M(2)	S(3)
CO3	S(3)	M(2)	M(2)	S(3)	M(2)
CO4	M(2)	M(2)	M(2)	S(3)	M(2)
CO5	S(3)	M(2)	S(3)	M(2)	S(3)
W.AV	**2.6**	**2.4**	**2.4**	**2.6**	**2.6**

S–Strong(3),M-Medium(2),L-Low(1)

DSE					
DSE	**Course Code: 461504**	**COASTAL DISASTER MANAGEMENT**	**T**	**Credits: 3**	**Hours: 3**

Unit–I

Objective1	**This course is intended to develop the basic understanding of the natural disaster –understanding of the basic concepts in coastal disaster management and its mitigations.**

Definition–Hazards as natural process-Benefits and importance of disasters Nature disaster- creeping disaster- creeping disaster- Death and Damage-Evaluating hazards –Human response to hazards.

Outcome1	**The students will gainknowledgeonvarioustypesofdisastersandthechallengesposedbydisasters.**	**K2**

Unit –II

Objective2	**To know the major threats to the coastal ecosystem.**

Major threats to coastal ecosystem-Habitat loss-Landslides- Sea level change, Degradation of water quality, Fisheries resource depletion, Earth quakes, Tsunami, Volcanic activity, Coastal flooding, Cyclones, Erosion, Seawater intrusion, Cause and preventive measures-Hazards Relief and management

Outcome2	**The students will be able to understand the impacts of disasters and risk management strategies.**	**K3**

Unit –III

Objective3	**To understand the disaster mitigation,**

Disaster mitigation, actions to reduce risks, the menu of mitigation actions,
Classification of mitigation measures, Environmental hazards, typology, assessment and response, the strategies, the scale of disaster, vulnerability, disaster trends.

Outcome3	**They will get knowledge about major threats to the coastal ecosystem.**	**K3**

Unit – IV

Objective4	**To provide the basic knowledge of geo hazards effects.**

Nature, humanity and development, disruption of development by disasters, loss of resources, interruption of programs, impact on investment and climate, impact on non- formal sector, socio-political destabilization, development as causes of disaster, fundamentals of disaster, causal factor of disasters, characteristics of particular hazards in disaster.

Outcome4	**Students will gain knowledge on the conservation and management of coastal ecosystem.**	**K2**

Unit – V

Objective5	**To study about the long-term disasters - climate change and sea level rise and manmade disasters like nuclear, epidemic and air pollution.**

Geohazards, international decade for natural disaster reduction, problems off in ancing and insurance, tend sinclimatology, meteorology and hydrology, trends in seismic activities, training of emergency management personnel.

Outcome5	**Students will learn the basic knowledge of geohazards–effects-training of emergency management personnel**	**K4**

Suggested Readings:

HarshKGupta.(2013).*DisasterManagement*.UniversitiesPress(India)Pvt.Ltd.Pp.185.
Haruyama,S&**Sugai,**T.(2016).*NaturalDisasterandCoastalGeomorphology*.Springer.Pp.165.

Miguel Esteban, Hiroshi Takagi.,&TomoyaShibayama. (2015). *Handbook of Coastal DisasterMitigationforEngineersandPlanners*. Butterworth-Heinemann.Pp.788.
PranamDhar. (2011). *Disaster Management and Preventions*. LAP Lambert Academic Publication.Sinha, P. C. (1998). *Encyclopaedia of Disaster Management (Vol. 1- 4).* Anmol Publications Pvt. Ltd.Vidyanathan,S.(2011).*AnIntroductiontoDisasterManagement*.IKON Books.Pp.401

Onlineresources

https://www.coastalwiki.org/wiki/Threats_to_the_coastal_zone
https://www.samhsa.gov/find-help/disaster-distress-helpline/disaster-types
https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/dsstr-prvntn-mtgtn/bt-dsstr-mtgtn-en.aspx
https://www.academia.edu/47676064/Land_ocean_interactions_in_the_coastal_zone_science_plan
https://earsc-portal.eu/display/EOwiki/Monitor+coastal+ecosystem

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M(2)	S(3)	M(2)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)
CO2	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)	S(3)	M(2)
CO3	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)
CO4	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	S(3)	M(2)	M (2)
CO5	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)
W.AV	**2.2**	**2.4**	**2.2**	**2.0**	**2.2**	**2.2**	**2.2**	**2.4**	**2.2**	**2.2**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M(2)	S(3)	M(2)	M(2)	S(3)
CO2	M(2)	M(2)	M(2)	M(2)	S(3)
CO3	M(2)	M(2)	M(2)	M(2)	M(2)
CO4	M(2)	M(2)	M(2)	M(2)	M(2)
CO5	M(2)	M(2)	S(3)	S(3)	M(2)
W.AV	**2.0**	**2.2**	**2.2**	**2.2**	**2.4**

S–Strong(3),M-Medium(2),L-Low(1)

DSE					
DSE	**Course Code: 461505**	**MARINE BIOFOULING, PREVENTION AND MANAGEMENT**	**T**	**Credits: 3**	**Hours: 3**

UNIT–I

Objective1	To study the basic aspects of corrosion and type of corrosion.	
Fundamentals of Corrosion: Basic aspects of Corrosion–Types of Corrosion–Mechanisms of Corrosions–Factors influencing corrosion–Corrosion testing and monitoring–Electro chemical methods, surface analysis		
Outcome1	**Student will get an idea on bio fouling and corrosion mitigation techniques**	**K2**

UNIT –II

Objective2	**To study about microbial influenced corrosion.**	
Marine Biofouling Basics: Principle fouling organisms - Micro-fouling - Mechanisms ofbiofilmformation-Propertiesofabiofilm-Characteristicsofthemacro-organisms-Factors influencing biofouling growth - Geographical location - Distance from shore –Depth-Temperature and season-Water current and tidal conditions-Water quality- Other factors.		
Outcome2	**Students will gain knowledge about biofilm formation and properties.**	**K2**

UNIT –III

Objective3	**To study the macro fouling communities.**	
BiofoulingCommunities: Bioflims–attachedmacro-foulingcommunities–mobilecommunities – Commensals – Parasites and pathogens. Activities of microorganisms as the driving force for bio corrosion - Sulfate-Reducing Bacteria (SRB)- Metal-Reducing Bacteria(MRB)-Metal-DepositingBacteria(MDB)-Slime-producingbacteria-Acid-Producing Bacteria(APB)-Fungi.		
Outcome3	**Students will gain knowledge about major bio fouling–primary and secondary pathways.**	**K3**

Unit – IV

Objective4	**To understand the primary and secondary pathways of corrosion.**	
Biofouling as a Pathway: Hull fouling and other ship components–Ports–harbors and marinas-Mariculture–fisheries/fishing and diving equipment–marine debris–Primary and Secondary pathways. Economic losses caused by bio corrosion.		
Outcome4	**Students will get sound knowledge on macro and micro fouling organisms and its consequences.**	**K4**

Unit – V

Objective5	**To get knowledge on biofouling management.**	
Biofouling Management: Anti-fouling strategies–anti-fouling systems–Cleaning Programs in the Shipping and aquaculture Industries–Current practice–natural and non- toxic antifoulants–risk analysis– education and training.		
Outcome5	**Students will gain knowledge on corrosion management- maintenance of shipping.**	**K4**

Suggested Readings:

Alexander I.Railkin. (2005). *Marine biofouling: Colonization Processes and Defenses*. Taylor & Francis.Drane, C.W. (1963). *Chapter on natural waters. "Corrosion", Vol (1).* London: George Newness Limited.LynnJackson.(2008).*MarineBiofoulingandInvasivespecies*:*GuidelineforPreventionandManagement.* Compiled by Lynn Jackson on behalf of The Global Invasive programme and The UNEPRegionalSeasProgramme.

Peter Maaß.,& Peter Peißker. (2011). *Handbook of Hot-dip Galvanization*. WILEY-VCH Verlag GmbH &Co.KGaA,Weinheim.

VolkanCicek.,&BayanAl-Numan.(2011).*CorrosionChemistry*.NewJersey,Massachusetts:Co-published by JohnWiley&Sons,Inc.Hobokenand ScrivenerPublishing LLC

Onlineresources

https://www.polygongroup.com/en-US/blog/the-fundamentals-of-corrosion/
https://www.corrosionpedia.com/definition/541/fouling-organism
https://marinegeo.si.edu/protocols/fouling-community
https://www.imo.org/en/OurWork/Environment/Pages/Biofouling.aspx
https://www.imarest.org/special-interest-groups/biofouling-management

Course Outcome vs Programme Outcome

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	S(3)	M(2)
CO2	M(2)	M(2)	M(2)	M(2)	S(3)	S(3)	M(2)	M(2)	S(3)	M(2)
CO3	M(2)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	S(3)
CO4	M(2)	S(3)	M(2)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M (2)
CO5	M(2)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	M(2)
W.AV	**2.2**	**2.2**	**2.4**	**2.0**	**2.4**	**2.2**	**2.2**	**2.2**	**2.4**	**2.2**

S–Strong(3),M-Medium(2),L-Low(1)

Course Outcome vs Programme Specific Outcome

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S(3)	M(2)	M(2)	S(3)	M(2)
CO2	S(3)	M(2)	M(2)	M(2)	M(2)
CO3	M(2)	S(3)	M(2)	M(2)	M(2)
CO4	M(2)	M (2)	M(2)	M(2)	M(2)
CO5	M(2)	M(2)	M(2)	M(2)	S(3)
W.AV	**2.4**	**2.2**	**2.0**	**2.2**	**2.2**

S–Strong(3),M-Medium(2),L-Low(1)

SCIENCE CAMPUS