KRANTIGURU SHYAMJI KRISHNA VERMA
KACHCHH UNIVERSITY, BHUJ

Academic Year: 2025-2026

Syllabus (NEP – 2020)
B.Sc. (Honours) MARINE SCIENCE
(with Research /without Research)

Semesters: V and VI
(with Multiple exit-entryoptions)

FACULTY OF SCIENCE

A Curriculum of Marine Science
Faculty of Science framed as per UGC Guidelines and norms of National Education Policy (NEP) – 2020.

With effect from June – 2025

B.Sc. (Honours)Marine Science Program

(WithResearch/withoutResearch)

As per NEP-2020

With effect from June – 2025

FACULTY OF SCIENCE

Subject: Marine Science

B.Sc. Semesters: V&VI

AIM OF THE COURSE:

Aims of the B.Sc. (Honours) Course in Marine Science:

- Foster a hands-on learning approach that encourages students to explore and discover the wonders of marine science.
- Embrace modern educational trends like e-learning, flipped classrooms, and hybrid learning to create an engaging and interactive learning environment.
- Cultivate environmentally responsible citizens who play a pivotal role in shaping the future of marine science subject and contribute their knowledge to sustainable development.
- Provide comprehensive theoretical and practical knowledge in Marine Science, equipping graduates with the necessary skills for further studies or exciting careers in marine-related fields.
- Prepare students for national and international competitive examinations, empowering them to pursue advanced research opportunities or secure prestigious positions in marine science and related fields.

COURSE INTRODUCTION

The new curriculum of B.Sc. in Science (Marine Science) offers the essential knowledge and technical skills to study marine science in a holistic manner. Students would be trained in all areas of marine science using a unique combination of Major, Minor, MDC, AEC, SEC and VAC papers with significant inter-disciplinary components. Students would be exposed to cutting-edge technologies that are currently being used in the study of marine life forms, their evolution, and interactions with other organisms within the ecosystem. Students would also become aware of the social and environmental significance of marine life and its relevance to the national economy. B.Sc. Marine Science Programme covers academic activities within the classroom sessions along with practical concepts at laboratory sessions. Infield, outstation activities, and projects would also be organized for real-life experience and learning. Candidates who have curiosity in the field of Marine, Nature, Ecosystems and eager to exploring various exotic places, and wish to work as researchers or professionals like Marine Scientists, conservationists, Ecologists, etc. can choose the B.Sc. Marine Science course.

Programme outcomes (POs)

This curriculum in B.Sc. Marine Science aims to cultivate well-rounded individuals who are not only equipped with knowledge in the field of marine science but are also driven to contribute to their nation's progress and shape the future. By studying marine science, students will develop a deep understanding of the oceanic world and its potential for transformative impact on various sectors.

EVALUATION METHODS:

Evaluation Methods for Marine Science: To assess the achievement of students in the Marine Science subject and ensure their desired learning outcomes, a variety of assessment methods will be adopted. These methods will provide a comprehensive evaluation of the student's academic performance. Here are the innovative assessment methods for Marine Science:

1. **Engaging Examinations:** Both oral and written examinations, including scheduled and surprise tests, will be conducted. These exams will test students' theoretical knowledge, critical thinking, and problem-solving skills related to marine science concepts.

2. **Diverse Testing Approaches:** Closed-book and open-book tests will be administered to assess students' understanding and application of marine science principles. These tests will challenge their ability to think critically and apply concepts to real-world scenarios.

3. **Practical Assignments and Reports:** Students will be assigned practical assignments and laboratory reports to evaluate their hands-on skills and understanding of marine science experiments and techniques. These assignments will provide insight into their ability to collect, analyze, and interpret data in the context of marine environments.

4. **Observation of Practical Skills:** Practical skills, such as field sampling techniques or data collection methods, will be directly observed and evaluated. This assessment method allows instructors to assess students' competency in executing practical tasks related to marine science.

5. **Collaborative Projects:** Both individual and group project reports will be assigned to encourage collaborative learning and foster teamwork. These projects will assess students' ability to conduct research, analyze data, and present findings on various marine science topics.

6. **Innovative Seminar Presentations:** Students will deliver seminar presentations on specific marine science subjects. This method will not only test their understanding and communication skills but also encourage them to explore cutting-edge research and advancements in the field.

7. **Viva Voce Interviews:** Viva voce interviews will be conducted to assess students' comprehensive understanding of marine science concepts and their ability to articulate their knowledge effectively. This interactive assessment method will provide insights into their depth of understanding and critical thinking skills.

8. **Computerized Adaptive Testing:** Utilizing computerized adaptive testing methods will enable personalized assessment and help identify individual learning needs. These tests can adapt the difficulty level based on the student's responses, ensuring a tailored evaluation.

9. **Literature Surveys and Evaluations:** Students will be required to conduct literature surveys and evaluations on marine science topics. This assessment approach will develop their research skills, and ability to critically analyze scientific literature, and synthesize information from various sources.

10. **Comprehensive Continuous Assessment (CCA):** Students will undergo continuous assessment throughout the course, including internal evaluations. The weightage of CCA will be 30% of the overall evaluation, ensuring a holistic evaluation of their progress.

11. **End of Semester Examination:** The semester-end examination, comprising 70% of the evaluation, will assess students based on their knowledge, understanding, skills, application, and higher-order thinking skills related to marine science concepts. The assessment will be conducted by the university.

Additionally, to enhance their learning experience, students will be required to participate in at least one Marine Science Excursion, where they will study marine ecosystems and

biodiversity in their natural state. Laboratory work must be recorded in certified journals, which will be presented during practical examinations to showcase the students' hands-on expertise.

These innovative and varied assessment methods will enable a comprehensive evaluation of student's knowledge, skills, and understanding of Marine Science, fostering their growth and development in this field.

Paper and Credit Scheme for Marine Science

For Marine Science Semester - V

Year	Semester	Type of Paper	Paper Code	Paper Name	Credits	Marks		Total
						CA	UA	
Third Year	V	Major – 1 Theory	MJMS – 501 (Theory)	Marine Pollution Major 1	3	35	40	75
		Major – 1 Practical	MJMS – 502 (Practical)	Marine Pollution Major -1	1	10	15	25
		Major – 2 Theory	MJMS – 503 (Theory)	Biostatistics and its applications in Marine Science	3	35	40	75
		Major – 2 Practical	MJMS – 504 (Practical)	Biostatistics and its applications in Marine Science	1	10	15	25
		Major – 3 Theory	MJMS – 505 (Theory)	Marine Monitoring and Coastal Regulation Zone Major 3	3	35	40	75
		Major – 3 Practical	MJMS – 506 (Practical)	Marine Monitoring and Coastal Regulation Zone Major 3	1	10	15	25
		Minor – 1 Theory	MNMS – 507 (Theory)	Marine Pollution Major 1	3	35	40	75
		Minor – 1 Practical	MNMS – 508 (Practical)	Marine Pollution Major -1	1	10	15	25
		Minor – 2 Theory	MNMS – 509 (Theory)	Biostatistics and its applications in Marine Science	3	35	40	75
		Minor – 2 Practical	MNMS – 510 (Practical)	Biostatistics and its applications in Marine Science	1	10	15	25
			TOTAL		20	225	275	500

For Marine Science Semester - VI

Year	Semester	Type of Paper	Paper Code	Paper Name	Credits	Marks		Total
						CA	UA	
Third Year	VI	Major – 1 Theory	MJMS – 601 (Theory)	Geological Oceanography	3	35	40	75
		Major – 1 Practical	MJMS – 602 (Practical)	Geological Oceanography	1	10	15	25
		Major – 2 Theory	MJMS – 603 (Theory)	Eco–Tourism and Marine Biota	3	35	40	75
		Major – 2 Practical	MJMS – 604 (Practical)	Eco–Tourism and Marine Biota	1	10	15	25
		Major – 3 Theory	MJMS – 605 (Theory)	Aquaculture	3	35	40	75
		Major – 3 Practical	MJMS – 606 (Practical)	Aquaculture	1	10	15	25
		Minor – 1 Theory	MNMS – 607 (Theory)	Geological Oceanography	3	35	40	75
		Minor – 1 Practical	MNMS – 608 (Practical)	Geological Oceanography	1	10	15	25
			TOTAL		16	180	220	400

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
SEMESTER - 5
CODE: MJMS 501
PAPER NAME: MARINE POLLUTION
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 5 MARINE SCIENCE MAJOR 1	NO. OF LECTURES
1	• **Ocean pollution:** kinds and quantities of pollutants entering oceans. • **Ocean dumping:** Definition, general Information of dumping, fate of pollutants. • Toxic effects of different pollutants on marine life: Imposex. • **Oil spills and cleanup:** sources, major accidental spills, fate of spilled oil on the sea, Impact and consequences of oil spills and managing and treatment of oil spills.	15
2	• **Marine corrosion:** Definition, corrosion reactions, classification of corrosion, factors affecting corrosion of metals in sea water and prevention of marine corrosion. • **Metal Pollution:** Trace metals as pollutants, Important contaminant metals in marine systems – Mercury and Cadmium, Bioaccumulation-Case studies like Mina-Mata disease.	15
3	• **Thermal Pollution:** Definition, basic Introduction, causes, effects and control measures. • **Pollution by sewage and nutrients:** Definition, sources of pollutants, discharges by rivers and estuaries, effects on marine life. • **Sewage treatment:** Definition, Primary- Secondary and Tertiary methods of treatment, Importance.	15

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 5
CODE: MJMS 502
PAPER NAME: MARINE POLLUTION
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	Determination of Dissolved Oxygen demand (DO) from given water sample.
2	Determination of Biological Oxygen Demand (BOD) from given water sample.
3	Determination of Chemical Oxygen Demand (COD) from given water sample.
4	Determination of alkalinity from given water sample.
5	Determination of acidity from given water sample.
6	Determination of pH from given water sample.
7	Determination of salinity from given water sample.
8	Determination of hardness of water from given water sample.
9	Case study
10	Case study

Suggested Readings:

1. Chemical Oceanography (Vol: 3) 1975- Riley J.P and Skirrow, G.
2. The health of the oceans. 1976 Goldberg, E.D
3. Marine Pollution. 1986 Clark, R.B.
4. Quantitative aquatic biological indicators. 1980 Phillips J.D.H.
5. Thermal and radioactive pollution. 1994. Sharma, B.K and Kaur, H.
6. Water Pollution. 1994. Sharma, B. K and Kaur, H.
7. Marine and offshore corrosion. 1985. Chandler, K.A.
8. A practical hand book of sea water analysis, 1972 strickland, J.D.H. and parsons, T.R.
9. Marine chemistry (vol.1), 1972 – Martin, D.F.
1. 10.Methods of seawater analysis, 1983 – Grasshoff, K., Ehrhardt, M and kremling, K.
10. A manual of chemical and biological methods of seawater analysis, 1972 – Parsons T.R. Mritz, Y and Lalli, C.H.
11. Geochemistry, 1962 – Goldschmidt, V.M., Clarendon press.
12. Principles of geochemistry 1956 – Mason, B. and Moore, B.
13. Chemical oceanography (Vol. 1 & 3), 1975 – Riley, J.P. and Skirrow, G.
14. Introduction to geochemistry, 1995 – Krauskopf, K.B. and Bird, Mc-Graw Hill.
15. The geochemistry of natural waters, 1982 – Drever, J.I.
16. Estuarine chemistry, 1976 – Burton, J.D. and Liss, P.S., Academic Press.
17. Aquatic chemistry, 1996 – Stumm, W. and Morgan, J.J., Wiley- Interscience, New York.
18. Aquatic surface chemistry, 1987–Stumm, W.,Wiley–Interscience,New York.
19. Marine Chemistry, 1969 – Home, R.A.

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
SEMESTER - 5
CODE: MJMS 503
PAPER NAME: Biostatistics and its applications in Marine Science
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 5 MARINE SCIENCE MAJOR 2	NO. OF LECTURES
1	**Introduction of primary and secondary data:** Concept of primary and secondary data, Methods of data collection, direct and indirect inquiry. Inquiry and questionnaire source of secondary data. **Classification:** Concept of classification, types and importance of classification. Discrete and continuous series for univariate and bivariate data. **Statistical Graphs:** (i) Histogram (ii) Frequency Polygon (iii) Frequency curve (iv) Ogive curve(v) Pie Chart.	15
2	**Measure of central tendency**: Introduction of Mean, Median, Mode. **Measure of dispersion:** Range, Mean deviation, Standard deviation, variation. **Linear correlation**: Concept of linear correlation, Spearman's rank correlation, **Introduction to Various Statistical tests**: t- test, F -test, Z-test, Chi-square test, ANOVA, Normal distribution curve.	15
3	**Introduction and applications of Ecological parameters:** Density, Frequency, Abundance, Relative Density, Relative Frequency, Relative Abundance, A/F ratio. **Introduction of Biodiversity indices:** IVI, Shannon-Wiener Index, Species Richness index (margalef index, menhinick's index), Simpson's index, Evenness Index, index of similarity and dissimilarity.	15

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 5
CODE: MJMS 504
PAPER NAME: Biostatistics and its applications in Marine Science
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	Collect primary data and secondary data and prepare a report on it.
2	Prepare histogram, frequency curve and pie charts of given data.
3	Calculate given statical problems (any two problems based on Mean.)
4	Calculate given statical problems (any two problems based on Median.)
5	Calculate given statical problems (any two problems based on Mode.)
6	Calculate given statical problems (any two problems based on Standard deviation.)
7	Calculate density, frequency, and abundance of given data.
8	Calculate relative density, relative frequency, and relative abundance of given data.
9	Calculate IVI and A/F ratio of given data.
10	Calculate Shannon-Wiener index, Simpson's index and Evenness Index.

Suggested Readings:

1. Statistical Methods by S.P. Gupta
2. Fundamentals of Mathematical Statistics by S.C. Gupta and V.K. Kapoor
3. Statistics for Environmental Science and Management by Bryan F.J. Manly
4. An Introduction to Ecological Statistics by R. L. Magurran
5. Ecological Methods by P. S. Ramakrishnan and M. R. W. R.

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
SEMESTER - 5
CODE: MJMS 505
PAPER NAME: Marine Monitoring and Coastal Regulation Zone
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 5 MARINE SCIENCE MAJOR 3	NO. OF LECTURES
1	**Marine Monitoring:** Introduction, Goals, Objectives, Types, Approaches, and Limitations. Legal and ecological requirements of Marine Monitoring, Marine monitoring design and execution, Role of Marine Monitoring in Environmental Management, National Marine Monitoring Program – COMPAS. **Environmental Impact Assessment:** Components, Process and Methodologies of EIA, Prediction and Assessment of Impacts on Marine Resources: Biota and Surface Water. Different Maritime activities and their impact assessment	15
2	**Expedition of Ocean:** Scientific expeditions for ascertaining the wealth of the sea, The Three major Oceans and their Importance, History of idea on Ocean as a common heritage of Mankind. **Legislation of the Ocean:** Geneva Conventions, UNCLOS series, The Exclusive Economic Zone (EEZ)and its significance, Water (Pollution) Act, Coastal Zone Regulation (CRZ) 2011 and its importance, The Regional Seas Program of UN and its global significance.	15
3	**Conservation in Ocean:** Endangered and Extinct Marine animals, Marine biosphere reserves, Marine National Parks, Marine Sanctuaries. CITES Convention, Sea Level rise and its causes, effects and control measures. **Ocean Management:** Role of National and international agencies and organizations in ocean management: FAO, UNEP, MoES, WOCE, WHOI, IOI Malta, IMO, IUCN, SCAR, SCOR, Ocean policy of India.	15

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 5
CODE: MJMS 506
PAPER NAME: Marine Monitoring and Coastal Regulation Zone
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To study the Role of Marine Monitoring in Environmental Management.
2	To study the National Marine Monitoring Program – COMPAS.
3	To study the Components and Process of Environmental Impact Assessment (EIA).
4	Prepare a Map showing the sea route of Charles Darwin's Beagle expedition.
5	Prepare a Map showing the sea route of the voyage of H. M. S. Challenger.
6	Prepare a Map showing the UNCLOS maritime zones
7	To study Coastal Zone Regulation (CRZ) 2011 and its importance.
8	To study Endangered and Extinct Marine animals using photographs. (Any Five of each)
9	Prepare a Map showing the Marine National Parks of India.
10	Role and objectives of FAO and IUCN.

Suggested Readings:

1. R.W.G. Carler, Coastal Environments, Academic press.
2. Ekman S., Zoogeography of the sea, Sidgwick
3. Mc Lusky D.S., Ecology of estuaries, Hinmann, 1971.
4. Kinns O. (Ed), Marine Ecology Vol. I to V, John Wiley & S.
5. Barnes, RSK, The Coastal line, John Wiley, (1977).
6. Coastanza, R, Ecological Economics: The Science and Management of Sustainability, Columbia Univ Press, NY, (1991).

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
SEMESTER - 5
CODE: MNMS 507 (MINOR)
PAPER NAME: MARINE POLLUTION
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 5 MARINE SCIENCE MINOR 1	NO. OF LECTURES
1	• **Ocean pollution:** kinds and quantities of pollutants entering oceans. • **Ocean dumping:** Definition, general Information of dumping, fate of pollutants. • Toxic effects of different pollutants on marine life: Imposex. • **Oil spills and cleanup:** sources, major accidental spills, fate of spilled oil on the sea, Impact and consequences of oil spills and managing and treatment of oil spills.	15
2	• **Marine corrosion:** Definition, corrosion reactions, classification of corrosion, factors affecting corrosion of metals in sea water and prevention of marine corrosion. • **Metal Pollution:** Trace metals as pollutants, Important contaminant metals in marine systems – Mercury and Cadmium, Bioaccumulation-Case studies like Mina-Mata disease.	15
3	• **Thermal Pollution:** Definition, basic Introduction, causes, effects and control measures. • **Pollution by sewage and nutrients:** Definition, sources of pollutants, discharges by rivers and estuaries, effects on marine life. • **Sewage treatment:** Definition, Primary- Secondary and Tertiary methods of treatment, Importance.	15

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 5
CODE: MNMS 508 (MINOR)
PAPER NAME: MARINE POLLUTION
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	Determination of Dissolved Oxygen demand (DO) from given water sample.
2	Determination of Biological Oxygen Demand (BOD) from given water sample.
3	Determination of Chemical Oxygen Demand (COD) from given water sample.
4	Determination of alkalinity from given water sample.
5	Determination of acidity from given water sample.
6	Determination of pH from given water sample.
7	Determination of salinity from given water sample.
8	Determination of hardness of water from given water sample.
9	Case study
10	Case study

Suggested Readings:

20. Chemical Oceanography (Vol: 3) 1975- Riley J.P and Skirrow, G.
21. The health of the oceans. 1976 Goldberg, E.D
22. Marine Pollution. 1986 Clark, R.B.
23. Quantitative aquatic biological indicators. 1980 Phillips J.D.H.
24. Thermal and radioactive pollution. 1994. Sharma, B.K and Kaur, H.
25. Water Pollution. 1994. Sharma, B. K and Kaur, H.
26. Marine and offshore corrosion. 1985. Chandler, K.A.
27. A practical hand book of sea water analysis, 1972 strickland, J.D.H. and parsons, T.R.
28. Marine chemistry (vol.1), 1972 – Martin, D.F.
2. 10.Methods of seawater analysis, 1983 – Grasshoff, K., Ehrhardt, M and kremling, K.
29. A manual of chemical and biological methods of seawater analysis, 1972 – Parsons T.R. Mritz, Y and Lalli, C.H.
30. Geochemistry, 1962 – Goldschmidt, V.M., Clarendon press.
31. Principles of geochemistry 1956 – Mason, B. and Moore, B.
32. Chemical oceanography (Vol. 1 & 3), 1975 – Riley, J.P. and Skirrow, G.
33. Introduction to geochemistry, 1995 – Krauskopf, K.B. and Bird, Mc-Graw Hill.
34. The geochemistry of natural waters, 1982 – Drever, J.I.
35. Estuarine chemistry, 1976 – Burton, J.D. and Liss, P.S., Academic Press.
36. Aquatic chemistry, 1996 – Stumm, W. and Morgan, J.J., Wiley- Interscience, New York.
37. Aquatic surface chemistry, 1987–Stumm, W.,Wiley–Interscience,New York.
38. Marine Chemistry, 1969 – Home, R.A.

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
SEMESTER - 5
CODE: MNMS 509 (MINOR)
PAPER NAME: Biostatistics and its applications in Marine Science
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 5 MARINE SCIENCE MINOR 2	NO. OF LECTURES
1	**Introduction of primary and secondary data:** Concept of primary and secondary data, Methods of data collection, direct and indirect inquiry. Inquiry and questionnaire source of secondary data. **Classification:** Concept of classification, types and importance of classification. Discrete and continuous series for univariate and bivariate data. **Statistical Graphs:** (i) Histogram (ii) Frequency Polygon (iii) Frequency curve (iv) Ogive curve(v) Pie Chart.	15
2	**Measure of central tendency**: Introduction of Mean, Median, Mode. **Measure of dispersion:** Range, Mean deviation, Standard deviation, variation. **Linear correlation**: Concept of linear correlation, Spearman's rank correlation, **Introduction to Various Statistical tests**: t- test, F -test, Z-test, Chi-square test, ANOVA, Normal distribution curve.	15
3	**Introduction and applications of Ecological parameters:** Density, Frequency, Abundance, Relative Density, Relative Frequency, Relative Abundance, A/F ratio. **Introduction of Biodiversity indices:** IVI, Shannon-Wiener Index, Species Richness index (margalef index, menhinick's index), Simpson's index, Evenness Index, index of similarity and dissimilarity.	15

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 5
CODE: MNMS 510 (MINOR)
PAPER NAME: Biostatistics and its applications in Marine Science
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	Collect primary data and secondary data and prepare a report on it.
2	Prepare histogram, frequency curve and pie charts of given data.
3	Calculate given statical problems (any two problems based on Mean.)
4	Calculate given statical problems (any two problems based on Median.)
5	Calculate given statical problems (any two problems based on Mode.)
6	Calculate given statical problems (any two problems based on Standard deviation.)
7	Calculate density, frequency, and abundance of given data.
8	Calculate relative density, relative frequency, and relative abundance of given data.
9	Calculate IVI and A/F ratio of given data.
10	Calculate Shannon-Wiener index, Simpson's index and Evenness Index.

Suggested Readings:

6. Statistical Methods by S.P. Gupta
7. Fundamentals of Mathematical Statistics by S.C. Gupta and V.K. Kapoor
8. Statistics for Environmental Science and Management by Bryan F.J. Manly
9. An Introduction to Ecological Statistics by R. L. Magurran
10. Ecological Methods by P. S. Ramakrishnan and M. R. W. R.

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
SEMESTER - 6
CODE: MJMS 601
PAPER NAME: GEOLOGICAL OCEANOGRAPHY
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 6 MARINE SCIENCE MAJOR 1	NO. OF LECTURES
1	**Geological Oceanography:** Definition, Basic Introduction. **Physical Geology:** Geomorphology of Seas and oceans, Weathering and erosion, Sedimentation, Rivers, Glaciers, Sea Mountain, Mid Oceanic ridge, Trenches, Hydrothermal vent. **Environmental Geology:** Concepts and Basic introduction of volcanoes, earthquakes, floods, tsunami, Deep Sea mining and its impact. **Paleo-Oceanography:** Origin of Continents and Oceans – Concept of Pangea and Panthalassa, Tethys Sea. Ocean drilling programs: Basic Introduction, Its Major accomplishments, Challenges.	15
2	**Minerology:** Basic Introduction of Minerology, Physical properties and Classification of Minerals. **Marine Sediments:** Introduction, Origin and physical properties of Marine sediments (Lithogenous, Biogenous, Cosmogenous), Pelagic Sediments (Ooze, Clays and Phosporites) **Petrology:** Introduction, origin, occurrence, common types, basic structures and Classification of Igneous, sedimentary and metamorphic rocks.	15
3	**Structural Geology:** Introduction, concept, Approaches, Fundamentals and Scope. Continental drift and plate tectonics, sea floor spreading, polar wandering, plate boundaries, hot spots, convection currents, Internal structure of the earth, structural Geology, folds, faults, joints. **Geophysical Oceanography:** Introduction of Marine Mineral resources, Exploration techniques of marine minerals - Gravity, magnetic, seismic, electrical, methods).	15

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 6
CODE: MJMS 602
PAPER NAME: GEOLOGICAL OCEANOGRAPHY
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To Study Concept of Pangea and Panthalassa, Tethys Sea by using photographs.
2	To study marine sediments Lithogenous, Biogenous, Cosmogenous using photographs.
3	To study Pelagic Sediments Ooze, Clays and Phosporites using photographs.
4	To study given Igneous rocks.
5	To study given Sedimentary rocks.
6	To study given Metamorphic rocks.
7	To study given Minerals.
8	To study continental drift and Sea floor spreading using photographs.
9	To study faults, folds and joints using photographs.
10	To study Plate tectonics and Internal structure of Earth using photographs.

Suggested readings:

1. Marine Geology and Geophysics: A Geoscience Perspective, Dr. R. S. Sharma, Dr. R. P. Singh, *Wiley India.*
2. Physical Geology, Dr. B. K. Jain, *CBS Publishers.*
3. Environmental Geology, Dr. P. K. Gupta, *S. Chand & Co.*
4. Palaeoceanography and Paleoclimatology, Dr. S. K. Agarwal, *India's National Academy of Sciences.*
5. Introduction to Mineralogy, Dr. R. S. Verma, *Kailash Publishers.*
6. Marine Sediments: Dynamics and Depositional Environments, Dr. V. S. S. S. P. Rao, *Vikas Publishing.*
7. Petrology: Igneous, Sedimentary, and Metamorphic Rocks, Dr. M. R. S. Rao, *Oxford University Press.*
8. Structural Geology: Fundamentals and Modern Developments, Dr. S. C. Bhatt, *Prentice Hall India.*
9. Geophysical Exploration of the Sea, Dr. S. M. Patil, *Springer India.*
10. Geophysical Oceanography: An Introduction, Dr. G. C. K. Reddy, *Wiley India*

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
SEMESTER - 6
CODE: MJMS 603
PAPER NAME: ECO-TURISM AND MARINE BIOTA
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 6 MARINE SCIENCE MAJOR 2	NO. OF LECTURES
1	**Marine Tourism in India:** Famous Beaches of India (Mandvi Beach, Narara Beach, Ghogha Beach, Juhu Beach, Baga Beach, Kovalam Beach, Marina Beach, Rameshwaram Beach, visakhapatnam beach, Puri beach, Digha Beach, Radhanagar Beach). Recent tourism trends: Eco-tourism, Voluntourism, Regenerative tourism. **Overview of popular marine eco-tourism activities:** whale watching, scuba diving, snorkeling, eco-cruises, and kayaking. Sustainable practices in marine activities (e.g., no-touch policies for marine life, responsible diving). Eco-certification programs for marine tourism operators (e.g., Green Globe, Earth Check)	15
2	**Conservation Techniques:** Coral reef restoration techniques (Direct Transplant, Artificial reefs and coral gardening), Mangrove Reforestation (Introduction, Importance, Site selection, nursery production, plantation, maintenance and protection.) Seagrass bed Restoration (Introduction, Importance, Site Identification, Restoration method, and monitoring), Keystone species, Man and Biosphere Program.	15
3	**Marine Biota:** Marine Birds – Basic Introduction, Marine birds of India (Any Three Species) and Gujarat (Any Five Species), Migratory Birds (Any Five Species), conservation status, Ecological and Economic Importance. Marine Reptiles: Marine Reptiles of India (Any Three Five) and Gujarat (Any Three Species) conservation status, Ecological and Economic Importance. Marine Mammals: Marine Mammals of world (Any Five Species) their distribution, Ecological and Economic Importance. Mammals' adaptation for marine life.	15

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 6
CODE: MJMS 604
PAPER NAME: ECO-TURISM AND MARINE BIOTA
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	Mark on the map the famous beaches of India.
2	To study popular marine eco–tourism activities using photographs.
3	Mark on Map Coral reef in India.
4	Mark on Map Mangroves in India.
5	Mark on Map Sea grass in India.
6	To study Marine birds of India (Any three).
7	To study Marine birds Gujarat (Any three).
8	To study Migratory birds of India (Any three).
9	To study Marine reptiles of India (Any three).
10	To study Marine Mammals of World (Any three).

Suggested readings:

1. Field Guide to the Marine Life of India by Deepak Apte
2. Marine Mammals of India by Kumaran Sathasivam and J.C. Daniel
3. Marine Biology and Ecology by Khajure and Rathod
4. Ecology and Conservation of Tropical Marine Faunal Communities, edited by Venkataraman, Sivaperuman, and Raghunathan
5. Sustainable Coastal and Marine Tourism Practices edited by Ritu Tiwari

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
SEMESTER - 6
CODE: MJMS 605
PAPER NAME: AQUACULTURE
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 6 MARINE SCIENCE MAJOR 3	NO. OF LECTURES
1	**Aquaculture:** Introduction, Definition, Principles, Types and Importance. Historical Development of Aquaculture. Global and Local Trends in Aquaculture Production. Present status and prospects of coastal aquaculture and traditional aquaculture practices of India. **Aqua-farming systems:** Traditional, Intensive, Extensive and Semi-intensive. **Pond Management:** Overview and Importance of Ponds. Types of Ponds: Freshwater, Brackish, and Coastal.	15
2	**Pond Construction and Design:** Site Selection: Topography, Water Availability, Soil Quality. Design: Shape, Size, Depth, Water Flow. Structures: Dams, Dikes, Inlet/Outlet Systems, Drainage, Aeration. Construction Materials: Liner Systems, Concrete, Clay, and Geomembranes. **Culture Technique:** Monoculture and Polyculture – Definition, basic information **Culture techniques** - Pond, Raceway, Cages, Pens, Raft and Rope culture. **Hatchery seed production techniques**- Introduction, breeding, hatchery and nursery phases. Hatchery Infrastructure: Spawning Tanks, Incubation Systems, Larval Rearing Tanks, and Biosecurity Systems. Post-Hatchery Management.	15
3	**Cultivable Species:** Selection criteria of species, Basic Information of the species, cultivation methods, Importance/ Uses of Fin fishes - Asian sea bass, groupers, pearl spot, mullets, milkfish and ornamental fishes and Shell fishes - shrimps, crabs, lobsters, mussels, edible oysters, pearl oysters, clams **Cultivation of Algae:** Definition, Need for cultivation, Importance. **Mass Cultivation of Algae:** Brief Introduction, Mass cultivation of Kappaphycus and Gracilaria. **Single cell Protein:** Definition, Importance, Large cultivation of Spirulina.	15

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 6
CODE: MJMS 606
PAPER NAME: AQUACULTURE
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To study intensive, semi-intensive and extensive aqua farming system using photograph.
2	To study Culture techniques using photographs.
3	To study larval stages of Shrimp using photographs.
4	To study cultivation method of Shrimp and Oyster.
5	To study cultivation method of Fish.
6	To study cultivation method of Sea weeds and Mussels
7	To study general characters, cultivation method and uses of Asian sea bass, groupers, pearl spot.
8	To study general characters, cultivation method and uses of mullets, milkfish, and ornamental fishes
9	To study general characters, cultivation method and uses of shrimps, crabs, and lobsters.
10	To study general characters, cultivation method, and uses of mussels, edible oysters, pearl oysters, and clams.

Suggested readings:

1. Principles of Aquaculture by Dr. C.J. Khune, Dr. Rajendra V. Tijare, Dr. S.R. Sitre, Prof. S.B. Zade.
2. Basic Principles and Practices in Aquaculture by M. Bhosle.
3. Technological Interventions in Indian Aquaculture edited by M.B. Katare et al.
4. Handbook on Freshwater Aquaculture by N.P. Singh & B. Santhosh.
5. Aquaculture Technology and Environment by Ujwala Jadhav.

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
SEMESTER - 6
CODE: MNMS 607 (MINOR)
PAPER NAME: GEOLOGICAL OCEANOGRAPHY
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 6 MARINE SCIENCE MINOR 1	NO. OF LECTURES
1	**Geological Oceanography:** Definition, Basic Introduction. **Physical Geology:** Geomorphology of Seas and oceans, Weathering and erosion, Sedimentation, Rivers, Glaciers, Sea Mountain, Mid Oceanic ridge, Trenches, Hydrothermal vent. **Environmental Geology:** Concepts and Basic introduction of volcanoes, earthquakes, floods, tsunami, Deep Sea mining and its impact. **Paleo-Oceanography:** Origin of Continents and Oceans – Concept of Pangea and Panthalassa, Tethys Sea. Ocean drilling programs: Basic Introduction, Its Major accomplishments, Challenges.	15
2	**Minerology:** Basic Introduction of Minerology, Physical properties and Classification of Minerals. **Marine Sediments:** Introduction, Origin and physical properties of Marine sediments (Lithogenous, Biogenous, Cosmogenous), Pelagic Sediments (Ooze, Clays and Phosporites) **Petrology:** Introduction, origin, occurrence, common types, basic structures and Classification of Igneous, sedimentary and metamorphic rocks.	15
3	**Structural Geology:** Introduction, concept, Approaches, Fundamentals and Scope. Continental drift and plate tectonics, sea floor spreading, polar wandering, plate boundaries, hot spots, convection currents, Internal structure of the earth, structural Geology, folds, faults, joints. **Geophysical Oceanography:** Introduction of Marine Mineral resources, Exploration techniques of marine minerals - Gravity, magnetic, seismic, electrical, methods).	15

DETAILED SYLLABUS OF B.Sc. 3rd YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 6
CODE: MNMS 608 (MINOR)
PAPER NAME: GEOLOGICAL OCEANOGRAPHY
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To Study Concept of Pangea and Panthalassa, Tethys Sea by using photographs.
2	To study marine sediments Lithogenous, Biogenous, Cosmogenous using photographs.
3	To study Pelagic Sediments Ooze, Clays and Phosporites using photographs.
4	To study given Igneous rocks.
5	To study given Sedimentary rocks.
6	To study given Metamorphic rocks.
7	To study given Minerals.
8	To study continental drift and Sea floor spreading using photographs.
9	To study faults, folds and joints using photographs.
10	To study Plate tectonics and Internal structure of Earth using photographs.

Suggested readings:

1. Marine Geology and Geophysics: A Geoscience Perspective, Dr. R. S. Sharma, Dr. R. P. Singh, *Wiley India.*
2. Physical Geology, Dr. B. K. Jain, *CBS Publishers.*
3. Environmental Geology, Dr. P. K. Gupta, *S. Chand & Co.*
4. Palaeoceanography and Paleoclimatology, Dr. S. K. Agarwal, *India's National Academy of Sciences.*
5. Introduction to Mineralogy, Dr. R. S. Verma, *Kailash Publishers.*
6. Marine Sediments: Dynamics and Depositional Environments, Dr. V. S. S. S. P. Rao, *Vikas Publishing.*
7. Petrology: Igneous, Sedimentary, and Metamorphic Rocks, Dr. M. R. S. Rao, *Oxford University Press.*
8. Structural Geology: Fundamentals and Modern Developments, Dr. S. C. Bhatt, *Prentice Hall India.*
9. Geophysical Exploration of the Sea, Dr. S. M. Patil, *Springer India.*
10. Geophysical Oceanography: An Introduction, Dr. G. C. K. Reddy, *Wiley India*

KRANTIGURU SHYAMJI KRISHNA VERMA KACHCHH UNIVERSITY

Theory assessment

Pattern for Semester end Examination

Question	Question Type	Total Marks	Remarks
1 (From Unit – 1)	Descriptive Questions with Internal Option.	**10 Marks**	**Question may be of 10 marks/ 5 + 5 marks**
2 (From Unit – 2)	Descriptive Questions with Internal Option.	**10 Marks**	**Question may be of 10 marks/ 5 + 5 marks**
3 (From Unit – 3)	Descriptive Questions with Internal Option.	**10 Marks**	**Question may be of 10 marks/ 5 + 5 marks**
4 (From Unit – 1, 2, 3, 4)	Short Questions, fill in the Blanks, MCQ, etc. 12 questions (4 questions x 3 units) will be asked with option (10 out of 12)	**10 Marks**	**Total 12 questions from all units will be ask; students have to attempt any 10**

Note:

1. The descriptive questions i.e. Question 1, 2, 3 will be like *Explain, describe, discuss* etc. type which may be of 10 marks or 05 + 05 marks.
2. Examiner can ask two questions of 10 marks, of which one must be attempt or examiner can ask three questions of 05 marks, of which two must be attempt.
3. The fourth question can ask from all three units. Total 12 questions (4 questions x 3 units) will be asked, of which 10 must be attempt. Each question carries 01 mark.

For Internal / College theory assessment

Continuous evolution method will be applied for college assessment. Internal theory examination/ Unit test, Seminar, Assignments, Group discussions etc. will be the key part for the internal/ college assessment. The internal assessment will be of 35 marks.

The passing criteria for Internal/ college assessment is 40% i.e. students have to secure 14 marks out of 35 marks.

KRANTIGURU SHYAMJI KRISHNA VERMA KACHCHH UNIVERSITY

Practical assessment

Pattern for Semester end Examination

For university assessment of practicals, 4 to 5 exercises will be arranged for students according to the prescribed syllabus.
The University Practical assessment is of 10 marks.
The passing criteria for practical assessment is 40% i.e. students have to secure 04 marks out of 10 marks.

For Internal / College assessment

For Internal/ college assessment of practicals, 4 to 5 exercises will be arranged for students according to the prescribed syllabus.
The Internal/ college Practical assessment is of 15 marks.
The passing criteria for practical assessment is 40% i.e. students have to secure 06 marks out of 15 marks.

(Dr. P. K. Mehta)
BOS chairmen
Marine Science
KSKV Kachchh University