

**KRANTIGURU SHYAMJI KRISHNA VERMA
KACHCHH UNIVERSITY, BHUJ**

Academic Year: 2026-2027



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

**Semesters: VII and VIII
(with Multiple exit-entry options)**

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 – 2026



B.Sc. (Honours) Marine Science Program

(With Research/without Research)

As per NEP-2020

With effect from June – 2026

FACULTY OF SCIENCE

Subject: Marine Science

B.Sc. Semesters: VII&VIII



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 - VII

Year	Semester	Type of Paper	Paper Code	Paper Name	Credits	Marks		Total
						CA	UA	
Fourth Year	VII	Major – 1 Theory	MJMS – 701 (Theory)	Ocean Navigation Major 1	3	35	35	70
		Major – 1 Practical	MJMS – 702 (Practical)	Ocean Navigation Major -1	1	15	15	30
		Major – 2 Theory	MJMS – 703 (Theory)	Ship building Major 2	3	35	35	70
		Major – 2 Practical	MJMS – 704 (Practical)	Ship building Major -2	1	15	15	30
		Major – 3 Theory	MJMS – 705 (Theory)	Port Management – 1 Major 3	3	35	35	70
		Major – 3 Practical	MJMS – 706 (Practical)	Port Management – 1 Major 3	1	15	15	30
		Minor – 1 Theory	MNMS – 707 (Theory)	Ocean Navigation Minor 1	3	35	35	70
		Minor – 1 Practical	MNMS – 708 (Practical)	Ocean Navigation Minor 1	1	15	15	30
	Major Based Paper (instead of OJT)	Major – 4 Theory	MJMS – 709 (Theory)	Blue economy and marine spatial planning	3	35	35	70
		Major – 4 Practical	MJMS – 710 (Practical)	Blue economy and marine spatial planning	1	15	15	30
		SEC	SEC 700	Research methodology	2	25	25	50
				TOTAL		22	275	275



For Marine Science Semester - VIII

Year	Semester	Type of Paper	Paper Code	Paper Name	Credits	Marks		Total
						CA	UA	
Fourth Year	VIII	Major – 1 Theory	MJMS – 801 (Theory)	Marine Archaeology And Maritime Heritage	3	35	35	70
		Major – 1 Practical	MJMS – 802 (Practical)	Marine Archaeology And Maritime Heritage	1	15	15	30
		Major – 2 Theory	MJMS – 803 (Theory)	Introduction To Polar Regions & Cryosphere Systems	3	35	35	70
		Major – 2 Practical	MJMS – 804 (Practical)	Introduction To Polar Regions & Cryosphere Systems	1	15	15	30
		Major – 3 Theory	MJMS – 805 (Theory)	Port Management – 2	3	35	35	70
		Major – 3 Practical	MJMS – 806 (Practical)	Port Management – 2	1	15	15	30
		Minor – 1 Theory	MNMS – 807 (Theory)	Marine Archaeology And Maritime Heritage	3	35	35	70
		Minor – 1 Practical	MNMS – 808 (Practical)	Marine Archaeology And Maritime Heritage	1	15	15	30
		Dissertation/ OJT	DSVV - 800	Major based research/ OJT	6	75	75	150
			TOTAL		22	275	275	550



DETAILED SYLLABUS OF B.Sc. 4th YEAR
SEMESTER - 7
CODE: MJMS 701
PAPER NAME: OCEAN NAVIGATION
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 7 MARINE SCIENCE MAJOR 1	NO. OF LECTURES
1	Fundamentals of Ocean Navigation Introduction to ocean navigation, History and development of marine navigation, Types of navigation: Coastal navigation, Celestial navigation (basic concept), Electronic navigation, Satellite navigation. Direction and bearings: True north, magnetic north, compasses north, Latitude and longitude. Time systems in navigation: GMT, IST, UTC. Speed and distance measurement: Knot, nautical mile. Basic marine terminology: Bow, stern, port, starboard. Draft, beam, keel. Introduction to smart navigation systems, Digital navigation platforms, Autonomous ship navigation (basic overview).	15
2	Marine Navigation Instruments & Chart Work Marine compass: Magnetic compass, Gyro compass (basic). Sextant (basic working principle), Echo sounder and depth measurement, Radar navigation (basic principle), Automatic Identification System (AIS). Nautical charts: Types and uses, Symbols and abbreviations, Tide tables and navigation marks, Route planning basics, Electronic Chart Display and Information System (ECDIS), Smart port navigation systems, Drone-assisted marine observation	15
3	Ocean Navigation & Safety Global Positioning System (GPS), Global Navigation Satellite Systems (GNSS), Differential GPS (DGPS), Remote sensing in navigation, Weather forecasting for navigation, Marine communication systems: VHF communication, Distress signals. Introduction and Importance of safety in ocean navigation, Types of marine emergencies: Collision, Grounding, Fire onboard, Flooding, Man overboard. Emergency navigation procedures, Distress communication systems: SOS signals, EPIRB, SART. Life-saving appliances: Life jackets, Lifeboats, Life rafts. International safety regulations: SOLAS (basic introduction), IMO guidelines.	15



DETAILED SYLLABUS OF B.Sc. 4th YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 7
CODE: MJMS 702
PAPER NAME: OCEAN NAVIGATION
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To prepare a simple ship model and study the basic parts of a ship, such as bow, stern, port, starboard, keel, beam, and draft, using the model and charts.
2	To study and plot positions on a map using latitude and longitude coordinates.
3	To measure given marine distances using nautical charts and map scales in nautical miles.
4	To prepare a simple navigation route between two coastal locations using a nautical chart.
5	To study the common marine safety appliances used onboard using charts and specimens.
6	To study the structure, parts, and applications of a sextant through models, specimens, and photographs.
7	To study the principles and applications of Radar and AIS using charts and photographs.
8	To study the marine emergency communication devices through specimens and photographs.
9	To understand international marine safety regulations and safety symbols through charts and posters.
10	To study the Electronic Chart Display and Information System (ECDIS) in marine navigation.
11	To understand and convert different navigational time systems such as GMT, UTC, and IST.
12	To calculate the speed of vessels in knots using distance and time data.
13	Demonstration of simple nautical charts and understands their symbols, abbreviations, and basic interpretation.



Suggested Readings:

- Introduction to Marine Navigation by Alan Phillips
- Nicholls's Seamanship and Nautical Knowledge by Charles H. Brown
- The American Practical Navigator by Nathaniel Bowditch
- Marine Navigation and Safety of Sea Transportation by Adam Weintrit
- Radar and ARPA Manual by Alan Bole, Alan Wall, and Andy Norris
- Electronic Navigation Systems by R. W. Bridge and J. F. Kemp
- Principles of Navigation by E. W. Anderson
- IMO Standard Marine Communication Phrases by International Maritime Organization (IMO)
- Safety and Survival at Sea by D. J. House
- ECDIS and Positioning by Adam Weintrit and Tomasz Neumann



DETAILED SYLLABUS OF B.Sc. 4th YEAR
SEMESTER - 7
CODE: MJMS 703
PAPER NAME: SHIP BUILDING
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 7 MARINE SCIENCE MAJOR 2	NO. OF LECTURES
1	Introduction to Ship Building & Types of Ships Introduction, History and development of ship construction, Basic ship terminology: Bow, stern, hull, keel, deck, Port and starboard, Beam, draft, freeboard. Classification of ships: Cargo ships, Tankers, Passenger ships, Fishing vessels, Naval ships, Research vessels, Parts of a ship and their functions: Ship dimensions and measurements, Introduction to shipyards and dry docks, Smart ships (basic concept), Green ship technology.	15
2	Ship Construction Materials & Hull Structure Materials used in ship building: Steel, Aluminum, Composite materials. Properties of ship building materials, Hull structure and framework, Types of hulls: Single hull, Double hull. Bulkheads and compartments, Ship welding and joining methods, Corrosion and protection methods, Ship maintenance basics, advanced lightweight materials, Corrosion-resistant coatings, Eco-friendly construction materials.	15
3	Ship Design & Shipyard Operations Basic principles of ship design, Buoyancy and flotation, Stability of ships: Centre of gravity, Metacentric height (basic concept). Load lines and freeboard marks, Ship launching methods, Dry dock and wet dock operations, Shipyard management basics, Safety measures in shipyards, Ship recycling and waste management, International regulations related to ship construction: IMO basic guidelines, MARPOL overview.	15



DETAILED SYLLABUS OF B.Sc. 4th YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 7
CODE: MJMS 704
PAPER NAME: SHIP BUILDING
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To study the major structural parts of a ship with their functions using a model and Specimen.
2	To study the classification of different types of ships (cargo, tanker, passenger, fishing, naval, research) based on their functions and structure using a model and Specimen.
3	To study the different hull shapes of a ship using a model and Specimen.
4	To study commonly used ship construction materials and their properties.
5	To study welding and joining methods used in ship construction using charts and photographs.
6	To study different methods of ship launching using charts and a demonstration model.
7	To study routine maintenance activities required for ships.
8	To study load lines and freeboard markings and their importance in ship safety.
9	To study environmental practices in ship dismantling and recycling processes.
10	To study basic international maritime regulations related to ship construction and pollution control.
11	To study the layout and working environment of a shipyard through diagrams or a field visit.
12	To study the dry dock and wet dock operations for ship maintenance and construction.



Suggested Readings:

- Introduction to Naval Architecture by E. C. Tupper
- Ship Construction by David J. Eyres and George J. Bruce
- Basic Ship Theory by K. J. Rawson and E. C. Tupper
- Principles of Naval Architecture by Edward V. Lewis
- Ship Design and Construction by Thomas Lamb
- Merchant Ship Construction by D. A. Taylor
- Practical Ship Hydrodynamics by Volker Bertram
- Marine Structural Design by Yong Bai and Jin Wang
- Ship Stability for Masters and Mates by D. R. Derrett and C. B. Barrass
- Introduction to Marine Engineering by D. A. Taylor



DETAILED SYLLABUS OF B.Sc. 4th YEAR
SEMESTER - 7
CODE: MJMS 705
PAPER NAME: PORT MANAGEMENT – 1
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 7 MARINE SCIENCE MAJOR 3	NO. OF LECTURES
1	Introduction to Ports and Harbours Introduction to ports and harbour systems, History and development of ports, Importance of ports in international trade, Types of ports: Natural ports, Artificial ports, Commercial ports, Fishing ports, Naval ports. Components of ports: Berths, Docks, Jetties, Terminals, Warehouses Smart ports (basic introduction), Green port concepts (basic introduction), Digitalized port systems (basic introduction).	15
2	Major Ports of India Introduction to Indian Port System: Historical development of ports in India, ancient ports of India. Classification of Indian ports: major, minor, and intermediate, Importance of ports in India's trade and economy, Overview of coastal states and maritime zones. Major Ports of India: Overview of the 10 major ports Kandla (Dindayal Port), Mumbai, Jawaharlal Nehru Port (JNPT), New Mangalore, Cochin, Chennai, Visakhapatnam, Kolkata Port Complex, Paradip, Mormugao, with their location, capacity, cargo handled, specialization.	15
3	Port Infrastructure, Cargo Handling and Storage Systems Port Infrastructure Port planning and site selection, Harbour structures: Breakwaters, Piers, Wharves, Quays. Channel depth and dredging basics, Dry docks and wet docks, Port Operations and Cargo Handling: Port operation cycle: ship arrival, unloading/loading, departure, Introduction to cargo handling, Types of cargo: Bulk cargo, break-bulk, RO-RO, Liquid cargo, Container cargo, General cargo. Cargo loading and unloading methods, Containerization and container terminals, Warehousing systems, Cargo safety measures.	15



**DETAILED SYLLABUS OF B.Sc. 4TH YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 7
CODE: MJMS 706
PAPER NAME: PORT MANAGEMENT – 1
KSKV Kachchh University, Bhuj - Kachchh**

PRACTICAL	AIM OF PRACTICAL
1	To study the basic port structures, such as berths, docks, jetties, and terminals, using charts, diagrams, and models.
2	To study different types of ports, such as natural, artificial, commercial, fishing, and naval ports, using charts, diagrams, and models.
3	Mark on the map the major ports of India and Gujarat.
4	To prepare, interpret and describe a simple layout of a port with its major components.
5	To study different types of cargo, such as bulk, liquid, container, and RO-RO cargo, using charts, diagrams, and models.
6	To study container types using charts, diagrams, and models.
7	To study Harbour structures using charts, diagrams, and models.
8	To study the basic functioning of container terminals using charts, diagrams, and models.
9	To study the port operation cycle using charts, diagrams, and models.
10	To study safety procedures followed in cargo handling and storage systems.
11	To study the concept of channel depth and dredging using diagrams.
12	To study the safety signs used in port areas using charts, diagrams, and models.
13	To study containerization, cargo storage systems, and warehouse operations in ports.



Suggested Readings:

- Port Engineering: Planning, Construction, Maintenance and Security by Gregory P. Tsinker
- Ports and Harbours by R. Srinivasan and K. V. Raman
- Harbour, Dock and Tunnel Engineering by S. Ponnuswamy
- Dock and Harbour Engineering by Rangwala S. C.
- Introduction to Port Operations and Management by Alan E. Branch
- Port Management and Operations by Patrick Alderton
- Maritime Economics by Martin Stopford
- Container Terminals and Cargo Systems by Gordon Wilmsmeier and Theo Notteboom
- Port Designer's Handbook by Carl A. Thoresen
- Logistics and Transport Focused on Maritime Ports by César Ducruet and Theo Notteboom



DETAILED SYLLABUS OF B.Sc. 4TH YEAR**SEMESTER - 7****CODE: MNMS 707****PAPER NAME: OCEAN NAVIGATION****KSKV Kachchh University, Bhuj - Kachchh**

UNIT	SEMESTER 7 MARINE SCIENCE MINOR 1	NO. OF LECTURES
1	Fundamentals of Ocean Navigation Introduction to ocean navigation, History and development of marine navigation, Types of navigation: Coastal navigation, Celestial navigation (basic concept), Electronic navigation, Satellite navigation. Direction and bearings: True north, magnetic north, compasses north, Latitude and longitude. Time systems in navigation: GMT, IST, UTC. Speed and distance measurement: Knot, nautical mile. Basic marine terminology: Bow, stern, port, starboard. Draft, beam, keel. Introduction to smart navigation systems, Digital navigation platforms, Autonomous ship navigation (basic overview).	15
2	Marine Navigation Instruments & Chart Work Marine compass: Magnetic compass, Gyro compass (basic). Sextant (basic working principle), Echo sounder and depth measurement, Radar navigation (basic principle), Automatic Identification System (AIS). Nautical charts: Types and uses, Symbols and abbreviations, Tide tables and navigation marks, Route planning basics, Electronic Chart Display and Information System (ECDIS), Smart port navigation systems, Drone-assisted marine observation	15
3	Ocean Navigation & Safety Global Positioning System (GPS), Global Navigation Satellite Systems (GNSS), Differential GPS (DGPS), Remote sensing in navigation, Weather forecasting for navigation, Marine communication systems: VHF communication, Distress signals. Introduction and Importance of safety in ocean navigation, Types of marine emergencies: Collision, Grounding, Fire onboard, Flooding, Man overboard. Emergency navigation procedures, Distress communication systems: SOS signals, EPIRB, SART. Life-saving appliances: Life jackets, Lifeboats, Life rafts. International safety regulations: SOLAS (basic introduction), IMO guidelines.	15



DETAILED SYLLABUS OF B.Sc. 4TH YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 7
CODE: MNMS 708
PAPER NAME: OCEAN NAVIGATION
KSKV Kachchh University, Bhuj – Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To prepare a simple ship model and study the basic parts of a ship, such as bow, stern, port, starboard, keel, beam, and draft, using the model and charts.
2	To study and plot positions on a map using latitude and longitude coordinates.
3	To measure given marine distances using nautical charts and map scales in nautical miles.
4	To prepare a simple navigation route between two coastal locations using a nautical chart.
5	To study the common marine safety appliances used onboard using charts and specimens.
6	To study the structure, parts, and applications of a sextant through models, specimens, and photographs.
7	To study the principles and applications of Radar and AIS using charts and photographs.
8	To study the marine emergency communication devices through specimens and photographs.
9	To understand international marine safety regulations and safety symbols through charts and posters.
10	To study the Electronic Chart Display and Information System (ECDIS) in marine navigation.
11	To understand and convert different navigational time systems such as GMT, UTC, and IST.
12	To calculate the speed of vessels in knots using distance and time data.
13	Demonstration of simple nautical charts and understands their symbols, abbreviations, and basic interpretation.



Suggested Readings:

- Introduction to Marine Navigation by Alan Phillips
- Nicholls's Seamanship and Nautical Knowledge by Charles H. Brown
- The American Practical Navigator by Nathaniel Bowditch
- Marine Navigation and Safety of Sea Transportation by Adam Weintrit
- Radar and ARPA Manual by Alan Bole, Alan Wall, and Andy Norris
- Electronic Navigation Systems by R. W. Bridge and J. F. Kemp
- Principles of Navigation by E. W. Anderson
- IMO Standard Marine Communication Phrases by International Maritime Organization (IMO)
- Safety and Survival at Sea by D. J. House
- ECDIS and Positioning by Adam Weintrit and Tomasz Neumann



DETAILED SYLLABUS OF B.Sc. 4TH YEAR**SEMESTER - 7****CODE: MJMS 709****PAPER NAME: BLUE ECONOMY AND MARINE SPATIAL PLANNING****KSKV Kachchh University, Bhuj - Kachchh**

UNIT	SEMESTER 7 MARINE SCIENCE MINOR 2	NO. OF LECTURES
1	Blue Economy Introduction, definition and concept of Blue Economy, Importance of oceans in economic development, Marine and Coastal Resources: Marine living and non-living resources (basic overview), Coastal and offshore resources, Ocean-based economic sectors: Shipping and ports, Tourism, Renewable energy, Offshore industries, Blue Economy and SDGs - SDG 14: Life Below Water, India's Blue Economy policy framework, Sagarmala Programme, Blue Economy projects in India, Role of oceans in global trade and economy, Importance of Indian coastline and Exclusive Economic Zone (EEZ), Future scope of Blue Economy in India	15
2	Introduction to Marine Spatial Planning Marine Spatial Planning: Introduction, definition and concept, Importance of MSP in marine resource management, Objectives and principles of MSP Ocean Zoning Concepts: Definition and need for ocean zoning, Types of marine zones: Coastal zones, Economic zones, Conservation zones, Industrial zones, Shipping zones, Tourism zones, Multiple-use marine areas, Ecosystem-based marine planning (basic introduction) Marine Mapping Techniques: Basics of marine mapping, Nautical charts and marine maps, GIS applications in marine planning, Remote sensing applications in MSP	15
3	Sustainable Marine Spatial Planning Conflicts in Marine Resource Use: Port development vs conservation, Tourism vs fishing activities, Offshore energy vs marine transport Indian and International Case Studies: Gulf of Kachchh marine planning, Coastal planning in Kerala and Gujarat, Great Barrier Reef zoning system. Sustainable Marine Spatial Planning: Sustainable ocean resource management, Coastal hazard management, Offshore renewable energy planning, Marine tourism planning, Future of marine spatial planning in India.	15



**DETAILED SYLLABUS OF B.Sc. 4TH YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 7
CODE: MJMS 710
PAPER NAME: BLUE ECONOMY AND MARINE SPATIAL PLANNING
KSKV Kachchh University, Bhuj - Kachchh**

PRACTICAL	AIM OF PRACTICAL
1	To study major ocean-based economic sectors using charts, diagrams, and models.
2	To study marine living and non-living resources using charts and diagrams.
3	To study India's coastline and mark on a map the Exclusive Economic Zone in India.
4	To study the structure of the Blue Economy using flow charts.
5	To study India's port-led development initiative (Sagarmala Programme) using charts and diagrams.
6	To study different types of marine zones, such as coastal, industrial, tourism, and conservation zones, using charts, diagrams, and models.
7	To study the basic use of GIS in marine spatial planning through sample data.
8	To study different types of conflicts in marine resource use.
9	Draw a basic marine zoning map (economic, conservation, and shipping zones) showing different ocean uses.
10	To study the objectives, principles, and importance of MSP using diagrams and charts.
11	To study Sustainable Development Goal 14 related to life below water.
12	To study international examples like the Great Barrier Reef zoning system.
13	To study major ocean-based economic sectors using charts, diagrams, and models.



Suggested Readings:

- The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs by Gunter Pauli
- Marine Spatial Planning by Charles Ehler and Fanny Douvere
- Marine Policy: An Introduction to Governance and International Law of the Oceans by Marcus G. Haward and Joanna Vince
- Ocean Sustainability in the 21st Century by Marcus Haward
- Handbook on Marine Environment Protection by Markus Salomon and Till Markus
- Marine Resource Economics and Policy by Jon G. Sutinen and Hennie van der Zwaag
- GIS for Coastal Zone Management by D. R. Green and S. D. King
- Remote Sensing and GIS for Ecologists by Martin Wegmann, Benjamin Leutner, and Stefan Dech
- Blue Economy and Ocean Sustainable Development in a Globalised World by Peter Nijkamp and Jacques Bouman
- Coastal and Marine Spatial Planning by Biliana Cicin-Sain and Robert W. Knecht



DETAILED SYLLABUS OF B.Sc. 4TH YEAR**SEMESTER - 8****CODE: MJMS 801****PAPER NAME: MARINE ARCHAEOLOGY AND MARITIME HERITAGE****KSKV Kachchh University, Bhuj - Kachchh**

UNIT	SEMESTER 8 MARINE SCIENCE MAJOR 1	NO. OF LECTURES
1	Introduction to Marine Archaeology Introduction to Archaeology: Definition and Branches of archaeology, Introduction to marine archaeology, Importance of underwater cultural heritage, History and Development of marine archaeology in the world and India, Contribution of marine trade in ancient civilizations, Ancient Indian maritime trade routes, Role of Indian institutions in marine archaeology, Archaeological Survey of India (ASI) regulations, Future scope of marine archaeology in India	15
2	Maritime Heritage Definition of maritime and underwater heritage, Types of underwater heritage: Shipwrecks, Submerged ports, Ancient harbours, Cargo remains, Stone anchors. Important archaeological coastal sites in India: Dwarka, Lothal, Poompuhar, Bet Dwarka. Importance of preservation of underwater heritage, Underwater museums, famous underwater archaeological sites of the world, UNESCO Convention on Underwater Cultural Heritage, Global significance of marine archaeology.	15
3	Underwater Exploration and Conservation Basics introduction and Principles of underwater exploration, Safety measures in underwater operations. Survey Methods: Visual survey techniques, Transect and grid methods, Sampling techniques, Underwater mapping, Site recording methods in underwater archaeology. Conservation and Management of Underwater Heritage: Importance of conservation, Threats to underwater heritage: Corrosion, Sedimentation, Looting, Coastal development, Preservation methods for underwater artifacts, Indian laws related to heritage protection, Coastal and maritime heritage management policies.	15



DETAILED SYLLABUS OF B.Sc. 4TH YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 8
CODE: MJMS 802
PAPER NAME: MARINE ARCHAEOLOGY AND MARITIME HERITAGE
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To study safety protocols followed during underwater archaeological activities.
2	Prepare an ancient Indian maritime trade route on the world's map.
3	To study different types of underwater heritage such as shipwrecks, submerged ports, and ancient harbours.
4	Prepare a report on the archaeological coastal site in India: Dwarka
5	Prepare a report on the archaeological coastal site in India: Lothal
6	Prepare a report on the archaeological coastal site in India: Poompuhar
7	Mark on the map: Famous underwater archaeological sites of the world (Any 10 Sites)
8	To understand survey techniques such as visual survey, transect, grid methods, and sampling in underwater archaeology.
9	To understand the role of marine trade in the development of ancient civilizations.
10	To study the role of the Archaeological Survey of India (ASI) in protecting underwater heritage.
11	To study threats such as corrosion, sedimentation, looting, and coastal development.
12	To study Indian laws and policies for the protection of maritime heritage.



Suggested readings:

- Maritime Archaeology: A Technical Handbook by Jeremy Green
- Underwater Archaeology: The NAS Guide to Principles and Practice by Nautical Archaeology Society
- Ships and Shipwrecks of the Americas by George F. Bass
- Archaeology Under Water by George F. Bass
- Maritime Heritage of India by Alok Tripathi
- Marine Archaeology in India by S. R. Rao
- The Archaeology of Seafaring in Ancient South Asia by Himanshu Prabha Ray
- Handbook of Maritime Archaeology by Claire Smith
- UNESCO Manual for Activities Directed at Underwater Cultural Heritage by UNESCO
- Underwater Cultural Heritage and International Law by Sarah Dromgoole



DETAILED SYLLABUS OF B.Sc. 4TH YEAR**SEMESTER - 8****CODE: MJMS 803****PAPER NAME: INTRODUCTION TO POLAR REGIONS & CRYOSPHERE SYSTEMS****KSKV Kachchh University, Bhuj - Kachchh**

UNIT	SEMESTER 8 MARINE SCIENCE MAJOR 2	NO. OF LECTURES
1	Introduction to Polar Studies Introduction, Definition and scope of polar studies and Cryosphere, Components of cryosphere: Glaciers, Ice sheets, Sea ice, Snow cover, Permafrost. Importance of Polar Regions in Earth systems, Geographic features and major differences of Arctic and Antarctic, Polar climate overview, Polar ecosystems overview. Importance of Cryosphere: Freshwater storage, Climate regulation, Sea level implications, Importance in global environmental balance. India's polar research programme, Indian Antarctic missions, Indian Arctic research activities, Indian research stations: Dakshin Gangotri, Maitri, Bharati, Himadri.	15
2	Polar Resources, Human Activities & Environmental Challenges Polar Resources: Mineral resources of polar regions, Oil and natural gas potential. Freshwater importance, Marine transportation routes in polar regions Human Activities in Polar Regions: Polar exploration history, Scientific expeditions, Polar tourism and its impacts, Fishing and shipping activities (general overview) Environmental Challenges: Melting glaciers and ice sheets, Permafrost degradation, Pollution in polar regions, Plastic and waste accumulation, Biodiversity threats (general overview only) Governance and Protection: Environmental protection policies, Antarctic Treaty environmental protocols, Sustainable polar management, Sustainable polar infrastructure.	15
3	Polar Research Basics of polar field research, Remote sensing applications in polar studies, GIS applications in cryosphere mapping, Polar Technology: Icebreakers and polar vessels, Polar research stations and infrastructure, Drone and satellite-based polar surveys, National Centre for Polar and Ocean Research (NCPOR), Indian scientific contributions in polar studies, SCAR and Arctic Council research activities, Global climate and cryosphere monitoring programmes, Sustainable development in polar regions	15



DETAILED SYLLABUS OF B.Sc. 4TH YEAR

**MARINE SCIENCE
(PRACTICAL PAPER)**

SEMESTER - 8

CODE: MJMS 804

PAPER NAME: INTRODUCTION TO POLAR REGIONS & CRYOSPHERE SYSTEMS

KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To study major components of the cryosphere, such as glaciers, ice sheets, sea ice, snow cover, and permafrost, using charts, diagrams, and specimens.
2	To study the geographical, climatic, and ecological differences between the Arctic and Antarctic regions.
3	To study the role of the cryosphere in freshwater storage, climate regulation, and sea level control.
4	To study the role of polar ice in global freshwater storage.
5	To study mineral resources available in polar regions and their importance.
6	Prepare a map showing marine transportation routes in polar regions on a world map.
7	To study scientific, tourism, fishing, and shipping activities in polar areas using charts, diagrams, and specimens.
8	To study basic methods and principles used in polar field investigations.
9	To study icebreakers, polar vessels, and modern technologies used in polar exploration.
10	To study the basic characteristics of polar climate and temperature variations.
11	To study basic polar ecosystems and their adaptation to extreme conditions.
12	To study the major environmental challenges such as melting ice, pollution, and biodiversity loss in the polar region.
13	To study objectives and role of the National Centre for Polar and Ocean Research in Indian polar studies.



Suggested readings:

- Polar Regions: A Very Short Introduction by Klaus Dodds
- The Cryosphere by Shawn J. Marshall
- Polar Science: An Introduction by E. C. Carmack and F. A. McDougall
- Arctic and Antarctic: The Will and the Way of John Riddoch Rymill by Geoffrey Hattersley-Smith
- Introduction to Polar Ecology by David N. Thomas
- Remote Sensing of the Cryosphere by Marco Tedesco
- GIS and Remote Sensing Applications in Polar Studies by Ming-ko Woo
- Antarctica: A Biography by David Day
- Polar Tourism: Human, Environmental and Governance Dimensions by Patrick T. Maher, Emma J. Stewart, and Michael Lück
- The Antarctic Treaty System: Law, Politics and Democracy by Olav Schram Stokke and Davor Vidas



DETAILED SYLLABUS OF B.Sc. 4TH YEAR
SEMESTER - 8
CODE: MJMS 805
PAPER NAME: PORT MANAGEMENT – 2
KSKV Kachchh University, Bhuj - Kachchh

UNIT	SEMESTER 8 MARINE SCIENCE MAJOR 3	NO. OF LECTURES
1	Port Logistics and Supply Chain Management Basics of maritime logistics, Supply chain management in ports, Intermodal transportation systems: Road, Rail, Inland waterways. Freight forwarding and distribution, Port connectivity systems, Documentation in logistics, Digital logistics platforms, Block chain in maritime logistics, AI-based supply chain management (Basic introduction).	15
2	Port Administration and Maritime Regulations Port administration structure, Functions of port authorities, Customs and port documentation, Port tariffs and charges, Labour management in ports, Maritime laws related to ports (basic introduction), International Maritime Organization (IMO) overview, National port laws and regulations, E-governance in ports, Smart administrative management.	15
3	Port Safety, Security & Environmental Management Port safety management, Occupational hazards in ports, Fire safety and emergency response, Port security systems, Pollution control in port areas, Waste management in ports, Environmental issues: oil spills, air and noise pollution, dredging impact, Smart surveillance systems, Digital environmental monitoring, Green and carbon-neutral port concepts.	15



**DETAILED SYLLABUS OF B.Sc. 4TH YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 8
CODE: MJMS 806
PAPER NAME: PORT MANAGEMENT – 2
KSKV Kachchh University, Bhuj - Kachchh**

PRACTICAL	AIM OF PRACTICAL
1	To study the basic flow of maritime logistics from ship arrival to cargo delivery using diagrams and case studies.
2	To study port supply chain processes using diagrams and flow charts.
3	To study basic freight forwarding and distribution systems in ports.
4	To study the steps involved in customs clearance of cargo using diagrams and case studies.
5	To study fire safety equipment and emergency response procedures in ports.
6	To study basic waste segregation and disposal methods used in ports.
7	To study the basic concept and applications of blockchain in shipping.
8	To study basic international maritime regulations and the IMO structure.
9	To study pollution control, green ports, and carbon-neutral port concepts.
10	To study basic shipping and customs documents.
11	To study environmental impacts such as oil spills and dredging effects.
12	To identify occupational hazards and safety measures in port operations.



Suggested readings:

- Maritime Logistics: A Complete Guide to Effective Shipping and Port Management by Dong-Wook Song and Photis Panayides
- Port Management and Operations by Patrick Alderton
- Global Logistics and Supply Chain Management by John Mangan, Chandra Lalwani, and Tim Butcher
- Logistics and Supply Chain Management by Martin Christopher
- Maritime Economics by Martin Stopford
- Introduction to Logistics Systems Management by Gianpaolo Ghiani, Gilbert Laporte, and Roberto Musmanno
- Port Security Management by Patrick Alderton and Lesley Rimmer
- International Maritime Organization and Maritime Safety by Khalid Bichou
- Environmental Management for Ports and Harbors by Jon Burroughs and Darcy Lemieux
- Smart Ports and Digital Supply Chains by Theo Notteboom and Thanos Pallis



DETAILED SYLLABUS OF B.Sc. 4TH YEAR**SEMESTER - 8****CODE: MNMS 807****PAPER NAME: MARINE ARCHAEOLOGY AND MARITIME HERITAGE****KSKV Kachchh University, Bhuj - Kachchh**

UNIT	SEMESTER 8 MARINE SCIENCE MINOR 1	NO. OF LECTURES
1	Introduction to Marine Archaeology Introduction to Archaeology: Definition and Branches of archaeology, Introduction to marine archaeology, Importance of underwater cultural heritage, History and Development of marine archaeology in the world and India, Contribution of marine trade in ancient civilizations, Ancient Indian maritime trade routes, Role of Indian institutions in marine archaeology, Archaeological Survey of India (ASI) regulations, Future scope of marine archaeology in India	15
2	Maritime Heritage Definition of maritime and underwater heritage, Types of underwater heritage: Shipwrecks, Submerged ports, Ancient harbours, Cargo remains, Stone anchors. Important archaeological coastal sites in India: Dwarka, Lothal, Poompuhar, Bet Dwarka. Importance of preservation of underwater heritage, Underwater museums, famous underwater archaeological sites of the world, UNESCO Convention on Underwater Cultural Heritage, Global significance of marine archaeology.	15
3	Underwater Exploration and Conservation Basics introduction and Principles of underwater exploration, Safety measures in underwater operations. Survey Methods: Visual survey techniques, Transect and grid methods, Sampling techniques, Underwater mapping, Site recording methods in underwater archaeology. Conservation and Management of Underwater Heritage: Importance of conservation, Threats to underwater heritage: Corrosion, Sedimentation, Looting, Coastal development, Preservation methods for underwater artifacts, Indian laws related to heritage protection, Coastal and maritime heritage management policies.	15



DETAILED SYLLABUS OF B.Sc. 4TH YEAR
MARINE SCIENCE
(PRACTICAL PAPER)
SEMESTER - 8
CODE: MNMS 808
PAPER NAME: MARINE ARCHAEOLOGY AND MARITIME HERITAGE
KSKV Kachchh University, Bhuj - Kachchh

PRACTICAL	AIM OF PRACTICAL
1	To study safety protocols followed during underwater archaeological activities.
2	Prepare an ancient Indian maritime trade route on the world's map.
3	To study different types of underwater heritage such as shipwrecks, submerged ports, and ancient harbours.
4	Prepare a report on the archaeological coastal site in India: Dwarka
5	Prepare a report on the archaeological coastal site in India: Lothal
6	Prepare a report on the archaeological coastal site in India: Poompuhar
7	Mark on the map: Famous underwater archaeological sites of the world (Any 10 Sites)
8	To understand survey techniques such as visual survey, transect, grid methods, and sampling in underwater archaeology.
9	To understand the role of marine trade in the development of ancient civilizations.
10	To study the role of the Archaeological Survey of India (ASI) in protecting underwater heritage.
11	To study threats such as corrosion, sedimentation, looting, and coastal development.
12	To study Indian laws and policies for the protection of maritime heritage.



Suggested readings:

- Maritime Archaeology: A Technical Handbook by Jeremy Green
- Underwater Archaeology: The NAS Guide to Principles and Practice by Nautical Archaeology Society
- Ships and Shipwrecks of the Americas by George F. Bass
- Archaeology Under Water by George F. Bass
- Maritime Heritage of India by Alok Tripathi
- Marine Archaeology in India by S. R. Rao
- The Archaeology of Seafaring in Ancient South Asia by Himanshu Prabha Ray
- Handbook of Maritime Archaeology by Claire Smith
- UNESCO Manual for Activities Directed at Underwater Cultural Heritage by UNESCO
- Underwater Cultural Heritage and International Law by Sarah Dromgoole



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)	Short Questions, fill in the Blanks, MCQ, etc. 7 questions (from all three units) will be asked with option (05 out of 07)	05 Marks	Total 07 questions from all units will be asked; students have to attempt any 05

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 07 questions will be asked, of which 05 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 15 marks.

The passing criteria for practical assessment is 40% i.e. students have to secure 06 marks out of 15 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.


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