

<b>Lecture Schedule</b>		
<b>Department of Aquatic Environment Management (Code-AEM)</b>		
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**(1) - AEM-111, Meteorology, Climatology and Geography**

<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Weather elements, Nature of Atmosphere: weather and climate; composition of atmosphere; structure of atmosphere.	1
2	Heat energy of atmosphere: process of heat transmission; heating of atmosphere; disposal of insulation;	2
3	Temperature: Temperature instruments; periodic, horizontal and vertical temperature variations.	2
4	Humidity and water vapour: relationship between temperature and humidity;	2
5	distribution of water vapour in atmosphere; evaporation, humidity instruments and measurements.	1
6	Condensation and precipitation: process of conditions of condensation, forms of condensation;	1
7	precipitation; forms of precipitation, measurement of precipitation;	2
8	rainfall in India. Clouds and thunderstorms: amount of cloudiness; ceiling; classification of clouds; conditions of cloud formation; reporting and identification of clouds; thunderstorms.	2
9	Atmospheric pressure: meaning of atmospheric pressure; the laws of Gases; pressure units; pressure instruments; vertical, horizontal and periodic variations; isobars and pressure gradients.	2
10	Wind: characteristics of wind motion; wind observation and measurement; wind representation; factors affecting wind motion. Terrestrial or planetary winds: ideal planetary wind system; planetary pressure belts. Planetary wind system; secondary winds; monsoon winds; land and sea breeze. Tropical cyclones: storm divisions; pressure and winds; vertical structure of storm centre; hurricane, sea, swell and surge; hurricane warning.	5
11	Weather forecasting: forecasting process; forecasting from local indications; role of satellite in weather forecasting; synoptic weather charts.	3
12	Effects of climate change on fisheries sector.	1
13	Introduction to Geography: shape, size and structure of the earth; concepts of latitude, longitude and great circles; model globe, maps and different types of projections; cartography; landscape. Introduction to GIS and remote sensing	5
<b>Total</b>		<b>29</b>
<b>Practical</b>		
1	Graphic representation of structure of atmosphere; physical layering and compositional layering.	1
2	Temperature instruments: simple thermometers;	2
3	Humidity measurement: hygrometer; psychrometer; relative humidity; dew point. Condensation: observation and identification of various types of clouds.	3
4	Depicting sky picture. Precipitation: measurement of rainfall using rain gauge.	2
5	Mapping Indian monsoons: south-west monsoon and rainfall in June, North-east monsoon and rainfall in December; isohyets.	2
6	Atmospheric pressure measurement: fortin's mercurial barometer; Aneroid barometer. Isobars:	2
7	Wind observation and measurement: wind vane; cup anemometer. Ideal terrestrial/planetary pressure and wind systems: diagrammatic representation.	2
8	Geography: The Earth: diagrammatic representation of shape, size, structure, zones, latitudes, longitudes and great circles. Typical landscape mapping; map reading. Geographical terms used in landscape.	4
<b>Total</b>		<b>18</b>

**(2) - AEM-112, Soil and Water Chemistry**

<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Analytical chemistry: principles, applications and types. Classical methods of analytical chemistry, volumetry and gravimetry.	3
2	Solutions: Standard solutions, titration, indicators, dilute solutions, units of concentration: standard curve; nomograph.	4
3	Chemistry of water: the water molecule, properties of pure water, fresh water and sea water. Composition of waters: surface water, ground water and sea water.	4
4	Dissolved gasses: Factors affecting natural waters. Acid, base, salts: Hydrogen ions, modern concept of pH and buffer.	8
5	Water analysis: collection and preservation of water samples. Water quality criteria/ requirements for Aquaculture.	4
6	Soil Chemistry: origin and nature of soils. Physical properties of soil; soil colour. texture, structure, pore size, bulk density, water holding capacity.	4
7	Soil types and their distribution.	1
8	Soil chemistry: soil colloids, cation exchange, organic carbon, Carbon - Nitrogen ratio, soil fertility. Soil reaction: acidity, alkalinity, conductivity, redox - potential. Submersed soils: wet lands, peat soils, fluxes between mud and water, methane and hydrogen sulphide formation. Saline soils, Alkali soils, acid sulphate soils, iron pyrites, soil reclamation.	5
9	Soil analysis: collection and preparation of soil samples. Determination of soil texture, waterholding capacity, pH, conductivity, organic carbon, nitrogen, phosphorus, lime requirement.	4
10	Soil and water amendments: lime manures, fertilizers, micronutrients, zeolites, alum, gypsum. Environmental ameliorative: chlorination, deodorizers, bacterial formulation. Soil quality criteria/ requirements for aquaculture.	4
<b>Total</b>		<b>41</b>
<b>Practical</b>		
1	Principles of Titrimetry, Gravimetry, Potentiometry, Conductometry, Refractometry, Colourimetry, Turbidimetry, Spectrophotometry (UV, Visible, Flame, AAS), computerized instrument system.	5
2	Demonstration: demonstration of laboratory glass wares and equipment used in water and soil analysis.	2
3	Water analysis: measurement of temperature, turbidity, determination of pH and EC. Total solids, Redox potential, DO, Free CO <sub>2</sub> . Determination of inorganic nitrogen, and phosphorus	8
4	Soil analysis: Determination of soil texture, soil pH, conductivity, soil available nitrogen, available phosphorus, and organic carbon.	5
<b>Total</b>		<b>20</b>

**(3) - AEM-121, Limnology**

<b>(3) - AEM-121, Limnology</b>		
	<b>Theory</b>	
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Introduction to limnology:	1
2	inland water types, their characteristics and distribution;	1
3	ponds and lakes; swamps, bogs, backwaters, streams and rivers and irrigation canals;	2
4	dynamics of lentic and lotic environments.	2
5	Natural Lakes - their origin and diversity.	2
6	Famous lakes of the world and India;	1
7	Man-made lakes of India and its history,	1
8	nature of lake environment; morphometric, physical and chemical conditions and related phenomena;	4
9	biological relations: influence of physical and chemical conditions on living organisms in inland waters.	3
10	Plankton: planktonic organisms; classification of plankton; distribution of plankton: geographic, vertical, horizontal, diurnal and seasonal distribution;	3
11	seasonal changes of body form in planktonic organisms;	3
12	primary productivity: Aquatic plants: characteristics, classification, zonation, And seasonal variations,	2
13	Nekton: definition and composition;	2
14	Benthos: classification; periphyton;	1
15	profundal bottom fauna.	2
16	Biological productivity:	2
17	classification of lakes based on productivity;	1
18	laws of minimum; biotic potential and environmental resistance;	2
19	quantitative relationships in a standing crop; indices of productivity of lakes; artificial enrichment.	2
20	Lotic environments: running waters in general;	2
21	physical conditions; classification of lotic environments, biological conditions; productivity of lotic environments.	2
22	Influence of currents;	1
23	Lake and river conservation.	1
<b>Total</b>		<b>43</b>
	<b>Practical</b>	
1	Morphometry of lakes, ponds and streams,	3
2	hactarage from map/ planimeter	1
3	Determination of physical and chemical characteristics of lentic and lotic water bodies.	2
4	Estimation of primary productivity in fresh water bodies.	2
5	Collection and identification of common fresh water phytoplankton and zooplankton.	4
6	Collection and identification of benthos from lakes / ponds.	2
7	Collection and identification of nekton/aquatic insects from freshwater bodies.	2
8	Collection and identification of aquatic plants from different fresh water bodies.	2
9	Field visit to lotic and lentic water bodies.	2
<b>Total</b>		<b>20</b>

<b>(4) - AEM-212, Fishery Oceanography</b>		
<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Introduction to Oceanography: Major Oceans of the world; Major oceanic expeditions. Major feature of topography and terminology; Relief of sea floor; Relief in Indian oceans.	5
2	Ocean Waves: definition and terms; classification, Difference between surface and long waves; wave theories; surface wave generation; spilling and breaking waves; long waves, Tsunamis, internal waves.	3
3	Ocean Tides: Definition; Tidal phenomenon, elementary tidal definition; tidal inequalities; tide producing forces types of tides tidal bores, tide prediction.	2
4	Ocean Currents: Definitions and features; measurements of currents; drift currents Ekman spirals, upwelling, sinking, gradient currents; thermohaline circulation; characteristics; course; and significance of some major ocean currents of the world.	5
5	El-Nino and La-Nina.	1
6	Physical properties of sea water: temperature; thermal properties of sea water; colligative properties of sea water; Properties of sea ice; transmission of sound; absorption of radiation; eddy conductivity; diffusivity and viscosity.	5
7	General distribution of temperature, salinity and density and their relationship: Salinity and temperature of surface layer (SST), The T-S diagram;	3
8	Chemistry of sea water: Constancy of composition; elements present in sea water; dissolves gases in sea water; CO <sub>2</sub> system and alkalinity; inorganic agencies affecting composition of sea water distribution of phosphorus, nitrogen compounds, silicates and manganese in the oceans.	5
<b>Total</b>		<b>29</b>
<b>Practical</b>		
1	Field visits and operation of oceanographic instruments- Nansen reversing water sampler, Bathythermograph, Grabs, Dredge, Corers, Current meters, Tidal gauges, Echo-sounder.	5
2	Measurement of temperature, Reversing thermometer and sensing probes. Transparency, pH.	2
3	Determination of DO, Salinity, Ammonia, Nitrate, Nitrite, Phosphate and Silicate in sea water	5
<b>Total</b>		<b>12</b>

**(5) - AEM-122, Marine Biology**

<b>(5) - AEM-122, Marine Biology</b>		
<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Introduction to Marine Biology:	2
2	Divisions of marine environment- pelagic, benthic, euphotic, aphotic divisions and their subdivisions.	4
3	Life in oceans - general account of major groups of phytoplankton, sea weeds, and major zooplankton groups.	4
4	Environmental factors affecting life in the oceans-salinity, temperature, light, currents, waves, tides, oxygen, and carbon dioxide.	8
5	Vertical migration of zooplankton,	2
6	Phytoplankton-Zooplankton relationship,	2
7	geographical and seasonal variation in plankton production, plankton and fisheries.	3
8	Inter tidal ecology: Rocky shore, sandy shore and mud flats, zonation, communities, and the adaptation.	3
9	Mud banks: formation, characteristics.	1
10	Estuaries: Classification, Physio-chemical factors, Biota and productivity, examples of some Indian Estuaries.	2
11	Boring and fouling organisms.	1
12	Nekton outline, composition of nekton, habitats of nekton.	2
13	Bioluminescence and indicator species, Blooms, Red tides: cause and effects.	2
<b>Total</b>		<b>36</b>
<b>Practical</b>		
1	Study of different instruments and plankton nets used for collection study of phytoplankton, zooplankton and benthos.	4
2	Collection, preservation and quantitative analysis of phytoplankton, zooplankton and benthos,	6
3	use of Sedgwick-Rafter cell;	1
4	Bolting silk of different numbers and their mesh size;	1
5	Collection preservation and analysis of inter tidal organisms of rocky, sandy and muddy shores and sea weeds.	4
<b>Total</b>		<b>16</b>

<b>(6) - AEM-211, Aquatic Ecology, Biodiversity and Disaster Management</b>		
<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Aquatic environment: Components of aquatic systems,	2
2	Animal associations: Symbiosis, commensalisms, parasitism, prey-predator relationship, host parasite relationship.	3
3	Brief idea of different types of aquatic biodiversity and its importance, diversity, indices.	3
4	Ecological niches – lagoons, creeks, estuaries, mangroves, coral reefs, flood plains, coastal wet lands, bheels, oxbow lakes.	5
5	Threats to biodiversity- habitat destruction, introduction of exotic species, Conservation of habitats, marine parks and sanctuaries.	4
6	Conservation programmes for endangered species, ex situ and in situ conservation, captive breeding and management of endangered species.	4
7	Various national and international conventions and regulations concerning biodiversity, including use of selective gears and exclusion devices.	4
8	Basic concepts: Hazard, risk, vulnerability, disaster, capacity building. Multi-hazard and disaster vulnerability of India.	3
9	Types of natural and manmade hazards in fisheries and aquaculture - cyclones, floods, droughts, tsunami, El-nino, algal blooms, avalanches, pollution, habitat destruction, over fishing, introduction of exotic species, landslides, epidemics, loss of bio-diversity etc.	4
10	Management strategies: pre-disaster, during disaster and post-disaster.	2
11	Pre-disaster: prevention, preparedness and mitigation; different ways of detecting and predicting disasters; early warning, communication and dissemination, community based disaster preparedness, structural and non- structural mitigation measures, group insurance.	3
12	During disaster: response and recovery systems at national, state and local, coordination between different agencies, international best practices.	2
13	Post- disaster: Methods for assessment of initial and long term damages, reconstruction and rehabilitation. Prevalent national and global management practices in disaster management.	3
14	Agencies involved in monitoring and early warnings at district, state, national and global levels.	1
15	Sea safety and health. Acquaintance with fire-fighting devices. Life saving appliances and first-aid. Uses of distress signals and technologies. Relief and rehabilitation measures, trauma counselling.	3
<b>Total</b>		<b>46</b>
<b>Practical</b>		
1	Collection of species of fishes and other organisms and studying the assemblages of organisms of lentic and lotic habitats.	5
2	Observation of adaptive characters and interrelationships like commensalisms, symbiosis, parasitism and predation.	4
3	Field visits to mangroves, marine parks, sanctuaries, coral reefs, rivers, hills, streams, lakes and reservoirs. Working out biodiversity indices.	5
<b>Total</b>		<b>14</b>

**(7) - AEM-321, Aquatic Pollution**

<b>(7) - AEM-321, Aquatic Pollution</b>		
	<b>Theory</b>	
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Introduction to aquatic pollution,	1
2	the sources of pollutants, toxic organic compounds and their impacts in the aquatic organisms and the abiotic environment,	2
3	Classification of pollution- physical, chemical and biological classification of water pollution- description of terminologies.	2
4	Sewage and domestic wastes- composition and pollution effects- sewage treatment and its reuse.	2
5	Agricultural wastes- organic detritus, nutrients, Adverse effects of oxygen demanding wastes:	2
6	importance of dissolved oxygen; Oxygen demand; BOD; COD; Eutrophication;	2
7	Red tides, oxygen depletion and fish kills.	1
8	Pesticide types and categories; inorganic pesticides, Organo-chlorine compounds, Organo-phosphorous compounds; Polychlorinated biphenyls (PCBs); Bioaccumulation and impact on aquatic fauna and human health; toxicology.	4
9	Heavy metals: Interaction of heavy metals with water and aquatic	1
10	organisms. Bioremediation and Phytoremediation. Oil pollution its Sources;	1
11	Treatment of oil spills at sea; Beach Cleaning; Toxicity of Petroleum Hydrocarbons; Ecological Impact of Oil pollution.	1
12	Microbial pollution: Transmission of Human Pathogenic Organisms;	1
13	Radioactivity, Radionuclide and radioactive pollution.	1
14	Thermal pollution and its effects, Physical and chemical nature of possible effluents from major industries in India. Monitoring and control of pollution: Biological indicators of pollution.	2
<b>Total</b>		<b>23</b>
	<b>Practical</b>	
1	Physical characteristics of polluted waters;	2
2	Colour, Odour, Turbidity.	1
3	Determination of pH, salinity, alkalinity, hardness, BOD, COD, Hydrogen sulphide,	3
4	Phosphates, Ammonia, Nitrates, Heavy metals and Oil and grease in water.	4
5	Study of pathogenic and coliform bacteria. Bacteriological quality of water;	2
6	Colliform tests, test, standard plate count, methods of enumerating bacterial biomass in waters and waste waters.	3
7	Pollution flora and fauna: indicator species- algae, protozoa and insect larva.	3
8	Bioassay and toxicity study.	2
<b>Total</b>		<b>20</b>



**(8) - AEM-311, Coastal Zone Management**

<b>(8) - AEM-311, Coastal Zone Management</b>		
<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Estuaries, Wet lands and Lagoons coastal backwaters;	2
2	Living resources – Non living resources.	2
3	Principles of remote sensing: orbits, electromagnetic radiation, diffraction, electro-optical, and microwave systems.	3
4	Data Input, Data Management, Data Quality. Remote Sensing for Coastal Management.	2
5	Geographical Information System (GIS): Definition, Concepts, Data Acquisition and Data Management. Applications of GIS in aquatic resource identification.	3
6	Definition of territorial waters, EEZ, EFZ, problems in their demarcation and delineation.	2
7	Coastal Regulation Zone (CRZ) Act, Coastal regulation zones for main land and islands – CRZ mapping.	2
8	Integrated Coastal Zone Management (ICZM); concept, application and case studies. Communication, research, integration, institutional arrangements, regulations, stakeholder participation, the role of the private sector in ICZM.	3
9	Impacts of human activities on coastal and ocean areas: Challenges related to climate change, expanding tourism, declining fisheries, intensive shipping and biodiversity protection.	3
10	Problems related to sectors such as tourism and fisheries in the ICZM context; Maritime industry and their effect on coastal areas. Environmental Impact Assessment (EIA): Principles and process.	4
<b>Total</b>		<b>26</b>
<b>Practical</b>		
1	Field visit to different coastal environments to study erosion of beaches, Identification of ecologically sensitive areas and protection,	5
2	Study of CRZ, ICZM along the coastal belt, Study on implementation and violation of CRZ,	2
3	Study of application of remote sensing and GIS, Project preparation of EIA.	2
<b>Total</b>		<b>9</b>