Fisheries Resource Management				
Courses offered (V Dean)				
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
1.	**I**	**FRM. 111**	**Taxonomy of Finfish**	**1+1=2**
	Lecture	**Theory**		
	1	Principles of taxonomy.		
	2	Nomenclature and types		
	3	Classification and interrelationships and Criteria for generic and specific identification.		
	4-5	Morphological, morphometric and meristic characteristics of taxonomic significance.		
	6-14	Major taxa of inland and marine fishes up to family level.		
	15-16	Introduction to modern taxonomic tools: Karyotaxonomy, DNA barcoding, protein analysis and DNA polymorphism.		
	Practical	**PRACTICAL:**		
	1-8	Collection and identification of commercially important inland and marine fishes		
	9-24	Study of their external morphology and diagnostic features.		
	25-26	Modern taxonomic tools - Protein analysis and electrophoretic studies		
	27-28	Karyotaxonomy - chromosome preparation and identification		
	29-30	DNA barcoding		
	30	DNA polymorphism		
	28 -32	Visit to fish landing centres to study commercially important fishes and catch composition.		
2.	**Semester**	**Course No.**	**Title**	**Credits**
	II	**FRM. 112**	**Taxonomy of Shellfish**	**1+1=2**
	Lecture	**Theory**		
	1-6	Study of external morphology and meristic characteristics of crustacea and mollusca.		
	7-16	Classification of crustacea and mollusca up to the level of species with examples of commercially important species.		
	Practical	**PRACTICAL:**		
	1-4	Study of external morphology.		
	4-13	Collection, preservation and identification of commercially important prawns, shrimps, crabs, lobsters, bivalves, gastropods, cephalopods from natural habitats.		
	14-16	Field visits for collection and study of commercially important shellfishes.		
3.	**Semester**	**Course No.**	**Title**	**Credits**

	III	**FRM. 113**	**Anatomy and Biology of Finfish**	2+1=3
	Lecture	**THEORY :**		
	1-2	Study of external and internal anatomy of important groups of finfish.		
	3-4	Study of oral region and associated structures.		
	5-7	Digestive system and associated digestive glands.		
	8-9	Food and feeding habits of commercially important fishes.		
	10-11	Qualitative and quantitative methods of analysis of gut contents.		
	11-12	Circulatory system,		
	13-14	Respiratory system,		
	15-16	Nervous system,		
	17-18	Urino-genital system		
	19-20	Endocrine system		
	21-23	Skeletal systems and sensory organs		
	24-26	Reproductive biology – maturity stages, gonado-somatic index, ponderal index, fecundity, sex ratio and spawning.		
	27-29	Eggs and larval stages and developmental biology.		
	30	Age and growth determination by direct and indirect methods.		
	31	Fish migration - type and significance.		
	32	Tagging and marking.		
	Practical	**PRACTICAL:**		
	1-4	Study of internal organs – digestive, respiratory, circulatory, urino-genital system, nervous, skeletal systems and endocrine system.		
	5-6	Study of food and feeding habits.		
	7-8	Analysis of gut contents		
	9-10	Estimation of age and growth by direct and indirect methods.		
	11-12	Classification of maturity stages.		
	13	Estimation of fecundity.		
	14-15	Study of developmental stages.		
	16	Tagging and marking.		
4.	**Semester**	**Course No.**	**Title**	**Credits**
	II	**FRM.114**	Inland Fisheries	2+1=3
	Lecture	**THEORY :**		
	1-2	Freshwater fishery regions of the world and their major fish species composition.		
	2	Global inland fish production data.		
	3-4	Capture fishery resources of India.		
	5-8	Potential of inland water bodies with reference to respective state.		

	9	Problems in the estimation of inland fish catch data.		
	10-13	Fishing crafts and gears.		
	14-20	Major riverine and estuarine systems of India.		
	21-24	Major brackish water lakes and their fisheries.		
	25-28	Fisheries of major reservoirs / natural lakes of India.		
	29-31	Flood-plain capture fishery- present status of their exploitation and future prospects.		
	31-32	Cold water fisheries of India.		
	Practical	**PRACTICAL:**		
	1-6	Analysis of species composition of commercial catches at landing and assembling centers, sampling and familiarization of commercially important groups.		
	7-10	Observations and experimental operations of selected fishing crafts and gears in inland / estuarine waters.		
	11-12	Maintenance of records on catch data.		
	13-16	Visit to Dept. of fisheries, lakes and reservoirs, net making yards.		
5.	**Semester**	**Course No.**	**Title**	**Credits**
		FRM.215	Physiology of Finfish and Shellfish	**2+1=3**
	Lecture	**THEORY :**		
	1-2	Water as a biological medium.		
	3-5	Gas exchange;		
	6-8	Circulation		
	9-11	Excretion		
	11-14	Osmoregulation		
	15-17	Reproductive physiology		
	18-19	Muscle physiology		
	20-21	Sense organs		
	22	Energy and nutrient status of food		
	23-24	Nitrogen balance		
	25	Standard and active metabolism		
	26	Energy utilization		
	27-28	Effect of environmental factors on physiology of fin and shellfishes		
	29-30	Stress related physiological changes.		
	31-32	Structure and functions of important endocrine glands.		
	Practical	**PRACTICAL:**		
	1-2	Estimation of oxygen consumption		
	3-4	Osmoregulation		
	5-6	Ammonia excretion and carbon-dioxide output		

	7-9	Influence of temperature and salinity on metabolism		
	10-12	Haematology of fin and shellfishes		
6.	**Semester**	**Course No.**	**Title**	**Credits**
		FRM.216	**Aquatic Mammals, Reptiles and Amphibians**	**1+0=1**
	Lecture	**THEORY :**		
	1-7	Selected aquatic mammal, reptile, amphibian and birds species of India relevant to fisheries: taxonomic status, identification characters, distribution, abundance, habitat, exploitation, threats and conservation.		
	8-14	Biology of aquatic animals: Cetaceans (whales. dolphins, porpoises and narwal), Sirenia (manates and dugongs), Carnivora (seals, sea lions walruses, polar bear and otter), Sea turtles, tortoise, crocodiles, sea/freshwater snakes and amphibians.		
	15	Red list		
	16	Wild Life (Protection) Act.		
7.	**Semester**	**Course No.**	**Title**	**Credits**
	V	**FRM.317**	**Anatomy and Biology of Shellfish**	**1+1=2**
	Lecture	**THEORY :**		
	1-3	Study of external and internal organization of commercially important crustaceans and molluscs.		
	4-5	Digestive system		
	6	Respiratory system		
	7	Circulatory system		
	8	Nervous system		
	9-10	Reproductive system		
	11	Food and feeding habits		
	12	Growth & moulting		
	13	length – weight relationship		
	14-15	Reproductive biology, larval stages		
	16	Age and growth determination by direct and indirect methods.		
	Practical	**PRACTICAL:**		
	1-5	Study of Internal Organs commercially important crustaceans and mollusks		
	6	Digestive		
	7	Respiratory		
	8	Circulatory		
	9	Nervous		
	10	Reproductive		

	11	Study of food and feeding habits		
	12	Analysis of gut contents		
	13	Age and growth		
	14	length - weight relationship and condition factor		
	15-16	Reproductive biology: maturity stages, spawning periodicity, fecundity and larval stages.		
8.	**Semester**	**Course No.**	**Title**	**Credits**
	V	**FRM.318**	**Marine Fisheries**	**2+1=3**
	Lecture	***THEORY :***		
	1-4	Classification and definition of fishery zones and fishery resources of world.		
	5-8	Overview of marine fisheries resources of the world and India.		
	9-12	Major exploited marine fisheries of India, their developmental history and present status.		
	13-22	Important pelagic - demersal fish, shellfish and seaweed resources of India.		
	23-28	Traditional, motorized and mechanized fisheries according to major gears.		
	29-30	Potential marine fishery resources of the India's EEZ.		
	31-32	GIS and Remote sensing in marine capture fishery.		
	Practical	**PRACTICAL:**		
	1-3	Visit to fish landing centres		
	4-6	Observation and analysis of catches by major crafts and gears.		
	7-12	Field collection of fishes, crustaceans, molluscs and seaweeds and record keeping of relevant data		
	13-14	Participation in fishing cruises		
	15-16	GIS and remote sensing in marine capture fishery.		
9.	**Semester**	**Course No.**	**Title**	**Credits**
		FRM.319	**Fish Population Dynamics and Stock Assessment**	**2+1=3**
	Lecture	**THEORY :**		
	1	The concept of population and unit stock		
	2-3	Biological structure of fisheries resource in space and time.		
	4	Indicators of dynamics in a fishery resource.		
	5	Characteristics of unit and mixed stock		
	6-7	Data requirements for stock assessment		
	8	Segregation of stocks		
	9	Principles of stock assessment		
	10	Population age structure		

	11	Theory of life tables
	12	Von Bertalanffy growth parameters
	13-14	Graphical models.
	15-16	Monte Cario Simulation model and ECOPATH mode
	17-18	Estimation of total fishing and natural mortality
	19	The concept of yield, yield in number and yield in weight, yield per recruit, yield curve.
	20	Yield models & CPUE
	21-22	The concept of Maximum Sustainable Yield and Maximum Economic Yield
	23	Biological symptoms of under-fishing and over-fishing.
	24	Growth over-fishing and recruitment over-fishing.
	25	Eumetric fishing
	26	Open access fisheries
	27-29	Fisheries regulations.
	30	Trawl selection and gillnet selection
	31-32	Analytical models of fish stocks.
	Practical	**PRACTICAL:**
	1	Study of length – weight relationship
	2	segregation of stock using direct methods.
	3	Study of analytical models
	4	Beverton and Holt model.
	5	VBGF
	6	Pauly's integrated methods
	7	graphical models
	8-9	Estimation of Z, F and M
	10	Estimation of net selectivity coefficient
	11	Fitting of surplus production model:
	12	Schaeffer model
	13	Fox model
	14	Study of yield isopleth diagrams.
	15-16	Micro-computer packages ELEFAN, FISAT.

Fisheries Resource Management				
Courses offered (VI Dean)				
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
1.	**I**	**FRM. 111**	**Taxonomy of Finfish**	**1+2=3**
	Lecture	**Theory**		
	1	Principles of taxonomy.		
	2	Nomenclature, types		
	3	Classification and interrelationships and Criteria for generic and specific identification.		
	4-5	Morphological, morphometric and meristic characteristics of taxonomic significance.		
	6-7	Major taxa of inland and marine fishes up to family level.		
	8-9	Commercially important freshwater and marine fishes of India and their morphological characteristics.		
	10	Introduction to modern taxonomic tools: Karyo-taxonomy, DNA barcoding, protein analysis and DNA polymorphism.		
	11-13	Study of external morphology and meristic characteristics of crustacea and mollusca.		
	14-16	Classification of crustacea and mollusca up to the level of species with examples of commercially important species.		
	Practical	**Practical**		
	1-8	Collection and identification of commercially important inland and marine fishes. Study of their external morphology and diagnostic features.		
	9-11	Modern taxonomic tools - Protein analysis and electrophoretic studies; Karyo-taxonomy - chromosome preparation and identification. DNA barcoding, DNA polymorphism		
	12-17	Visit to fish landing centres to study commercially important fishes and catch composition.		
	18-28	Study of external morphology. Collection, preservation and identification of commercially important prawns, shrimps, crabs, lobsters, bivalves, gastropods, and cephalopods from natural habitats.		
	29-32	Field visits for collection and study of commercially important shellfish.		
2.	**Semester**	**Course No.**	**Title**	**Credits**
	II	**FRM. 122**	**Anatomy and Biology of Fish and Shellfish**	**2+1=3**
	Lecture	**Theory**		
	1-2	Study of the external and internal anatomy of important groups of finfish.		
	3-4	Study of oral region and associated structures.		
	5-6	Digestive system and associated digestive glands.		
	7	Food and feeding habits of commercially important fishes.		
	8	Qualitative and quantitative methods of analysis of gut contents.		

	9-12	Circulatory system, respiratory system, nervous system, urino-genital system, endocrine system, skeletal systems and sensory organs.
	13-14	Reproductive biology – maturity stages, gonado-somatic index, ponderal index, fecundity, sex ratio and spawning.
	15-16	Eggs and larval stages and developmental biology.
	17	Age and growth determination by direct and indirect methods.
	18	Fish migration - type and significance.
	19	Tagging and marking.
	20-26	Study of external and internal organization of commercially important crustaceans and molluscs. Digestive, respiratory, circulatory, nervous and reproductive systems.
	27-29	Food and feeding habits, growth, moulting, length – weight relationship.
	30-32	Reproductive biology, larval stages.
	Practical	**Practical**
	1-3	Study of internal organs – digestive, respiratory, circulatory, urino-genital system, nervous, skeletal systems and endocrine system.
	4-5	Analysis of gut contents.
	6	Estimation of age and growth by direct and indirect methods.
	7	Classification of maturity stages.
	8	Estimation of fecundity.
	9-10	Study of developmental stages.
	11	Tagging and marking.
	12-13	Study of Internal Organs commercially important crustaceans and molluscs.
	14	Study of Digestive, respiratory, circulatory, nervous, and reproductive systems.
	15	Length - weight relationship and condition.
	16	Reproductive biology: maturity stages, spawning periodicity, fecundity, and larval stages.

3.	**Semester**	**Course No.**	**Title**	**Credits**
	II	**FRM. 123**	**Physiology of Fish and Shellfish**	**2+1=3**
	Lecture	**Theory**		
	1 - 2	Water as a biological medium.		
	3 - 5	Gas exchange;		
	6 - 8	Circulation		
	9 - 11	Excretion		
	12 -14	Osmoregulation		
	15 - 17	Reproductive physiology		
	18 - 19	Muscle physiology		
	20 - 21	Sense organs		
	22	Energy and nutrient status of food		
	23 - 24	Nitrogen balance		
	25	Standard and active metabolism		
	26	Energy utilization		
	27 - 28	Effect of environmental factors on physiology of fin and shellfishes		
	29 - 30	Stress related physiological changes.		
	31 -32	Structure and functions of important endocrine glands.		

	Practical	**Practical**		
	1 - 2	Estimation of oxygen consumption		
	3 - 4	Osmoregulation		
	5 - 6	Ammonia excretion and carbon-dioxide output		
	7 - 9	Influence of temperature and salinity on metabolism		
	10 - 12	Haematology of fin and shellfishes		
	13 - 16	Histological techniques		
4.	**Semester**	**Course No.**	**Title**	**Credits**
	III	**FRM. 214**	**Inland Fisheries**	**1+1=2**
	Lecture	**Theory**		
	1	Freshwater fishery regions of the world and their major fish species composition.		
	2	Global inland fish production data.		
	3	Capture fishery resources of India.		
	4	Potential of inland water bodies with reference to the respective state.		
	5	Problems in the estimation of inland fish catch data.		
	6	Fishing crafts and gears.		
	7-10	Major riverine and estuarine systems of India.		
	11-13	Major brackish water lakes and their fisheries.		
	14	Fisheries of major reservoirs / natural lakes of India.		
	15	Flood-plain capture fishery- present status of their exploitation and future prospects.		
	16	Cold water fisheries of India.		
	Practical	**Practical**		
	1-4	Analysis of species composition of commercial catches at landing and assembling centers, sampling and familiarization of commercially important groups.		
	5-8	Observations and experimental operations of selected fishing crafts and gears in inland / estuarine waters.		
	9-10	Maintenance of records on catch data.		
	11-16	Visit to Dept. of fisheries, lakes and reservoirs, floodplain wetlands, coldwater bodies, net making yards.		
5.	**Semester**	**Course No.**	**Title**	**Credits**
	III	**FRM.225**	**Marine Fisheries**	**1+1=2**
	Lecture	**Theory**		
	1	Classification and definition of fishery zones and fishery resources of world.		
	2-3	Overview of marine fisheries resources of the world and India.		
	4-6	Major exploited marine fisheries of India, their developmental history and present status.		
	7-9	Important pelagic, demersal fish, shellfish and seaweed resources of India.		
	10-12	Traditional, motorized and mechanized fisheries according to major gears.		
	13-14	Potential marine fishery resources of India's EEZ.		
	15	GIS and Remote sensing in marine capture fishery.		
	16	Conservation and management of marine fisheries resources in India.		
	Practical	**Practical**		

	1-8	Visit to fish landing centres, Observation and analysis of catches by major crafts and gears.		
	9-12	Field collection of fishes, crustaceans, molluscs and seaweeds and record keeping of relevant data.		
	13-14	Participation in fishing cruises.		
	15-16	GIS and remote sensing in marine capture fishery.		
6.	**Semester**	**Course No.**	**Title**	**Credits**
	IV	**FRM.316**	**Fish Population Dynamics and Stock Assessment**	**1+1=2**
	Lecture	**Theory**		
	1	The concept of population and unit stock. Biological structure of fisheries resource in space and time. Indicators of dynamics in a fishery resource.		
	2	Characteristics of unit and mixed stock. Data requirements for stock assessment.		
	3	Segregation of stocks.		
	4	Principles of stock assessment.		
	5	Population age structure. Theory of life tables.		
	6	Von Bertalanffy growth parameters.		
	7	Graphical models.		
	8	Monte Cario simulation model and ECOPATH model.		
	9	Estimation of total fishing and natural mortality.		
	10	The concept of yield, yield in number and yield in weight, yield per recruit, yield curve. Yield models.		
	11	The concept of Maximum Sustainable Yield and Maximum Economic Yield.		
	12	Biological symptoms of under-fishing and over-fishing. Growth over-fishing and recruitment over-fishing.		
	13	Eumetric fishing. Open access fisheries.		
	14	Fisheries regulations.		
	15	CPUE. Trawl selection and gillnet selection.		
	16	Analytical models of fish stocks.		
	Practical	**Practical**		
	1-2	Study of length – weight relationship, segregation of stock using direct methods.		
	3-4	Study of analytical models: Beverton and Holt model.		
	5	VBGF,		
	6	Pauly's integrated methods,		
	7	graphical models.		
	8-9	Estimation of net selectivity coefficient.		
	10-13	Fitting of surplus production model: Schaeffer model, Fox model.		
	14	Study of yield isopleth diagrams.		
	15-16	Micro-computer packages ELEFAN, FISAT.		
7.	**Semester**	**Course No.**	**Title**	**Credits**
	VII	**FRM.417**	**Sustainable Fisheries Management and Conservation**	**2+1=3**

	Lecture	**Theory**
	1-2	Inland fisheries: Major inland fisheries resource of the World-India-Overview.
	3-4	State of the fisheries- Fishing gears-and crafts- Catch composition.
	5-7	Marine fisheries: Major marine fisheries resources of the world and India.
	8-10	Overview- State of the fisheries -Fishing gears – Catch composition-pelagic, Demersal, Oceanic, Deep-sea.
	11-13	Sustainability issues in fisheries: Ghost fishing- Overexploitation, Overcapacity, pollution, Habitat degradation/ biodiversity loss.
	14-16	Damming of rivers. Interlinking of rivers, Environmental flows; Fishing Conflicts-Exotics; Trans-boundary issues, IUU fishing, inter-linking of rivers-Climate change, By-catch and discards.
	17-19	Principle of fisheries Management- Management approaches-By catch reduction- Rebuilding fishery, Rebuilding stock, Co-management - right based fishing input control (fishing efforts, mesh regulations, fishing ban, licensing, capital investments, etc.) - output control (catch quotas, minimum legal size, etc.).
	20	Fishery reserve-technical measures.
	21-23	Spawning aggregates; trade agreement- Market-based instruments; Access right – Catch sharing-balanced Fishing-Subsidy-certification and Traceability-Sustainable management approach in lake, Reservoir and beels.
	24-26	Functions and importance of Aquatic habitats: Mangrove, Corals, Seagrass beds, and dunes, Turtle nesting grounds, horseshoe crab habitat; Role and functions of aquatic habitat; Human activities and pollution sources; Effects of Conservation Practices on Aquatic Habitats and Fauna.
	27-28	Aquatic habitat conservation: Freshwater habitat and Marine water habitat; Erosion and sediment control-transplantation-stocking-population stabilization.
	29	Fish refugee- ex-situ conservation.
	30	Responsible fishing practices Precautionary management –Fisheries co-management: Right-based fishing - Catch sharing access right - Balanced fishing.
	31-32	Technical Guidelines of CCRF for responsible fishing; National and International treaties (National policy on marine fisheries-2017; National policy on inland fisheries 2019; MFRA's; UNCLOS; UNFSA; IOTC).
	Practical	**Practical**
	1-2	Capture fisheries observation at lakes, reservoirs, river stretches, and marine landing centers.
	3-4	Species landings analysis. Interaction with manager's Co-operative societies and stakeholders.
	5-6	Fleet capacity assessment.
	7-8	Visit to fishery reserves to understand management.
	9-10	Field survey and observation of fisheries issues.

	11-12	Development of management plan.
	13-14	Suggest management plan for aquatic habitat protection- permit application form.
	15	Valuation of ecosystems – awareness on fisheries resource conservation.
	16	Visit to reservoir and assess the threats and developing plan for stock rebuilding.