Fisheries Engineering				
Courses offered (V Dean)				
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
1.	**IV**	**FE. 221**	**Fishing Craft Technology**	**1+1=2**
	Lecture	**THEORY:**		
	1	Introduction: History & development of fishing crafts.		
	2	Traditional Fishing crafts of India.		
	3	Classification of fishing crafts based on fabrication dimension, nature of fishing, depth of operation.		
	4	History & development of mechanization of fishing crafts. Basic geometric concepts and important terminologies of fishing vessel.		
	5	Form coefficients, properties of irregular shapes Calculation of longitudinal and transverse sectional area of fishing craft by using Trapezoidal rule and Simpson's rules.		
	6	State of equilibrium; Volume of displacement; centre of gravity (CG); centre of buoyancy (CB); vertical centre of gravity (VCB); longitudinal centre of gravity (LCB).		
	7	Stability of fishing vessels- longitudinal and transverse.		
	8	Various equilibrium of ships-stable, unstable and neutral; Light weight, Dead weight,		
	9	Tonnage system; Gross Registered Tonnage (GRT), Net Registered Tonnage (NRT).		
	10	Boat building materials: Choice of construction materials: Wood, properties, advantages and disadvantages.		
	11	Deck fitting.		
	12	Maintenance of fishing vessels.		
	13	Fouling and boring organisms; seasoning and preservation of wood.		
	14	Constructional details of boat: Offset tables; Mould lofting; Backbone assembly of wooden boat.		
	15	Constructional details of Steel, FRP, Ferro Cement and Aluminum boats.		
	16	Introduction of Outboard and inboard engines.		
	Practical	**PRACTICAL:**		
	1	Studies on traditional fishing crafts		
	2	Introduction to drawing and drawing instruments		
	3	Lettering, Geometrical construction, Curves.		
	4	Projections		
	5	Projection of points, planes		
	6	Projection of solids		
	7	Lines plan drawing		
	8	Drawing of back bone assembly		
	9	U & V bottom hull of wooden boat		
	10	General view of boat		
	11	Drawing of sheer plan,		
	12	Body plan and		
	13	Half breadth plan		
	14	Types of marine engines		
	15	Installation of marine engines		
	16	Visit to boat building yard and dry dock.		

2.	Semester	Course No.	Title	Credits
	V	**FE.312**	**Fishing Gear Technology**	**1+1=2**
	Lecture	**THEORY :**		
	1	Development fishing gears and Fishing Technology: Evolution of Fishing gears; Mechanization of Fishing		
	2	Basic classification of fishing gears- Principle, Subsidiary and Auxiliary gears.		
	3	Classification of fishing gears and methods: FAO classification of fishing gear and methods of the world; International Standard Statistical Classification of Fishing gear (ISSCFG).		
	4	Fishing gear materials: Natural materials and Synthetic netting materials and their classification. Types and important synthetic materials used in fishing gears.		
	5	Raw-materials for synthetic material; Preparation of nylon (PA 6.66) material		
	6	Different types of fibres- continuous fibre; monofilament, staple and split fibers and production of single yarns.		
	7	Identification of synthetic fishing gear materials: Visual observation, water test, solubility test, burning test and melting point test.		
	8	Construction of twisted netting materials: Yarn, single yarns, folded yarns, netting twine, cable netting twine and cable netting twine of higher order; Construction of ropes and their higher order; construction of braided netting twines.		
	9	Yarn numbering system - direct system: Tex system Denier system and calculation of resultant tex value. Indirect system : British count, metric count, runnage system and their conversion.		
	10	Methods of Preparation of knotted and knotless webbing;, advantage and disadvantages of knotted and knotless webbings.		
	11	Shape of mesh: diamond; square hexagonal and their measurement.		
	12	Properties of netting material: physical properties- Density, twist and amount of twist, Breaking strength-tenacity, & tensile strength, breaking length, abrasion resistance, elasticity, extensibility, water absorption &, shrinkage, sinking velacity, weather resistance, melting point and visibility. Chemical and Biological properties.		
	13	Floats – buoys – its materials, types their properties; Classification of floats: based on shape and materials; calculation of buoyancy. Sinkers – types, materials, properties- negative buoyancy.		
	14	Factors to be considered while designing /selection of fishing gears; Biological, Environmental, oceanographical, Vessel characteristics and mesh size regulation.		
	15	Choice of netting materials for trawl, gillnet and purse seine. Classification of trawl gears. 2 seem trawl; 4 seam trawl and wing trawl.		
	16	Design and construction of wing trawl. Rigging of trawl gear: Arrangements of bridles, sweep lines and attachment of ground gears: tickler chain, bobbins and rock hoppers and attachment of otter board.		
	Practical	**PRACTICAL:**		
	1	Study of net making tools		
	2	Knots used in net making		
	3	Hitches used in net making		

	4	Methods of net making: a) Hand braiding,		
	5	b) Chain mesh method,		
	6	c) Loop methods of net making.		
	7	Shaping of webbing: baiting, creasing and reducing mesh size step by step.		
	8	Tailoring method: T and N direction of webbing; T-cuts, N-cuts, B-cuts and their combination.		
	9	Joining of net pieces.		
	10	Net mounting – a) hanging coefficient,		
	11	Hung depth,		
	12	Calculations for hanging coefficient and hung depth		
	13	Selvedging.		
	14	Methods of net mounting: a) reeving, b) stapling and		
	15	c) Norselling.		
	16	Mending and net shooter techniques.		
3.	**Semester**	**Course No.**	**Title**	**Credits**
	VI	**FE.323**	**Fishing Technology**	**1+1=2**
	Lecture	**THEORY :**		
	1	Structure of various commercial fishing gears.		
	2	Rigging of fishing gears: Bridles, sweep lines, otter boards, floats and ground gears arrangements.		
	3	Otter door: Different types of otter doors. Behavior of otter doors in water: Angle of attack, angle of heel and angle of tilt.		
	4	Fishing accessories – thimbles, shackles, C-links, rings, G-links, Kelly's eye, stopper, bottle screw, Deck layout of different fishing vessels.		
	5	Trawling: Beam trawling; otter trawling; side trawling; twin trawling out rig trawling bull trawling and mid water trawling.		
	6	Constructional details of single boat purse seine; two boat purse seine and method of operation.		
	7	Types of gill net – constructional details of simple gill net, trammel gill net, stick held gillnet, frame gillnet and vertical line gillnet,		
	8	Operation of gillnet: set gillnetting; drift gillnetting; bottom , mid water and pelagic gillnetting.		
	9	Line fishing: Types of hooks; structure and size of hooks.		
	10	Constructional details of long line, tuna long line, vertical long line, pole & line and trolling line.		
	11	Operation of long line: set and drift long lining: bottom, mid water and pelagic long lining; jigging.		
	12	Operation of beach seine, boat seine and traps.		
	13	Selectivity in fishing gear and by catch reducing devices.		
	14	Deck equipments – types of winches, net haulers, line haulers, triple drum, gurdy, power blocks, fish pumps.		
	15	Fishing equipment: Fish finder, GPS navigator, sonar, net sonde,		
	16	Gear monitoring equipment.		
	Practical	**PRACTICAL:**		
	1	**Survey of fishing gears: a)** Trawl,		
	2	b) Gillnet,		
	3	c) Long line,		
	4	d) Purse seine.		

	5	**Rigging of: a)** Trawl net,		
	6	b) Purse seine net,		
	7	c) Gillnet,		
	8	d) Hooks,		
	9	e) Lines.		
	10	**Commercial fishing techniques: a)** Bottom Trawling,		
	11	b) Side and Stern trawling		
	12	c) Purse seining,		
	13	d) Gillnetting,		
	14	e) Line fishing,		
	15	f) Cast net fishing,		
	16	g) Trap fishing.		
4.	**Semester**	**Course No.**	**Title**	**Credits**
	VI	**FE.324**	**Refrigeration and Equipment Engineering**	**2+1=3**
	Lecture	**THEORY :**		
	1	Fundamentals: Force, work, power, energy, volume, pressure, temperature.		
	2	Heat, specific heat, sensible heat, latent heat, comparison between heat and work-A path function.		
	3	Thermodynamics: Laws of Thermodynamics, Laws of perfect gases,		
	4	Thermodynamic processes,		
	5	Application of First and Second law of Thermodynamics in refrigeration,		
	6	Thermodynamics cycle, entropy, enthalpy.		
	7	Refrigeration: History of refrigeration, Definition, principle, classification,		
	8	Types of refrigeration systems i.e., a)Air refrigeration		
	9	b) Vapour absorption refrigeration system.		
	10	c) Vapour compression refrigeration system.		
	11	Refrigeration plant: Layout of refrigeration plant, Construction.		
	12	Insulating materials used for the cold storage construction, Frozen product storage capacity of cold storage, usage of Ante-room.		
	13	Refrigeration systems: Vapour compression refrigeration system advantages and disadvantages as compared to other refrigeration systems,		
	14	Types of Vapour compression refrigeration cycles i.e., Theoretical Vapour compression refrigeration cycle,		
	15	Actual refrigeration cycle.		
	16	Compressors: Definition, Types of compressor, construction, working principle advantages and disadvantages.		
	17	Evaporator: Definition, Types of Evaporator, construction, working principle advantages and disadvantages.		
	18	Condenser: Definition, Types of Condenser, Cooling Towers, construction, working principle, advantages and disadvantages.		
	19	Expansion valve: Definition, Types of Expansion valve, construction, working principle advantages and disadvantages.		
	20	Refrigerant: Primary refrigerant, secondary refrigerant		
	21	Ideal refrigerant properties, leakage detection.		

	22	Study of auxiliary equipment: Receiver, oil charging, refrigerant charging, gas purging, oil draining, types of defrosting.		
	23	Ice-plant: Ice plant planning Brine tank construction, preparation of brine ,Types of ice, Storing of ice, Equipments used in ice plants.		
	24	Freezers: Definition, Design and construction of freezers i.e. Plate freezer, Blast freezer,		
	25	Tunnel freezer, spray or immersion freezers, refrigerated fish rooms and fish hold.		
	26	Alternative refrigeration technique arrangements used onboard the fishing vessel i.e., Refrigerated sea water (RSW), Chilled sea water (CSW). Refrigerated transport.		
	27	Cooling load: Unit of refrigeration, coefficient of performance (C.O.P),Refrigeration effect, study and use of Psychometric chart.		
	28	Cooling load estimation, introduction, components of cooling load, heat gain through walls, roofs, products, occupants, lighting equipments.		
	29	Theory of machines: Transmission of power, friction wheels, shaft , gears, belt and Chain drive.		
	30	Study of equipments used in fish processing with particular reference to canning, sausage, freeze drying and irradiation.		
	31	Maintenance: Definition, Types of maintenance, general maintenance of freezing plant,		
	32	General maintenance of cold storage and ice plant.		
	Practical	**PRACTICAL:**		
	1	Drawing of Refrigeration and Fish processing machineries plant layout		
	2	Graphically represented symbols used in refrigeration		
	3	Handling and operation of a) Compressors,		
	4	b) Condensers,		
	5	c) Evaporators		
	6	d) Expansion valves,		
	7	e) Low and high pressure switches.		
	8	Study of auxiliary equipments: a) Receiver,		
	9	b) Oil charging,		
	10	c) Refrigerant charging and gas purging,		
	11	d) Oil draining, types of defrosting.		
	12	Power transmission line diagram of different fish processing machineries.		
	13	Visit to processing plant refrigeration plant,		
	14	Visit to ice plant,		
	15	Visit to fishing harbor to study the fish hold, refrigerated fish rooms.		
	16	Calculation on refrigeration effect and cooling load.		
5.	**Semester**	**Course No.**	**Title**	**Credits**
	VI	**FE.325**	**Navigation and Seamanship**	**1+1=2**
	Lectures	**THEORY :**		
	1	Principles of navigation –terms and definitions, finding positions and method of position fixing magnetic Compass-parts and functions, cardinal, inter cardinal, three letter and lay pointspelorus and azimuth mirror, method of observation.		
	2	Sextant -parts and functions, finding adjustable and non adjustable errors and principles and use.		

	3	Hand lead line –construction and markings and method of taking soundings.
	4	Types of speed logs –patent log, impeller log
	5	Types of marine charts, Mercator and gnomonic projections great circles and rumba lines, chart collections and chart readings, chart observation and fixing positions.
	6	The IALA-buoy age systems, cardinal and lateral marks, meaning of shapes, colours and lights top marks and explanation of approaching, international code of signals, flag signals mars code and storm signals general system, brief system and extended system ,storm signals stations
	7	Indian coasts, Fog signals, types and methods
	8	Distress signals, methods, types and communication international regulations for preventing collision at sea and recognition of lights and shapes at sea.
	9	Observation of radar and parts and functions of radar, aneroid barometer, parts and functions of echo sounder, and sonar, observation of GPS
	10	Principles of seamanship- Causes fire at sea, fire prevention on board the vessel and method of fire fighting at sea and recommended fire fighting appliances,
	11	Life saving appliances –life jackets, life buoys and method of operations and contents, SART and EPIRB.
	12	Observations of storms, formation of storms and method of locating the eye of the storms and method of escaping from the center of the storms as per buys ballet law.
	13	Preparing vessel to face heavy weather.
	14	Temporary repairs for leaks constructions of steering system and rigging emergency jury rudder .types of anchors and their applications.
	15	Selection of suitable anchorage , procedure for anchoring anchor watch and procedure to combating dragging of anchor, method of standing moor and running moor, open moor berthing procedures,
	16	Axial thrust , transverse thrust mooring and securing the vessel to the jetty rigging fenders and gangways , and method of leaving vessels from the birth.
	Practical	**PRACTICAL:**
	1	Anchoring,
	2	Coming along side the berth and leaving,
	3	Practicing the different types of knots and wire splices,
	4	Use of magnetic compass.
	5	Use of GPS and Echo-sounder.
	6	CHART WORK-Finding positions by latitudes
	7	Finding positions by longitudes
	8	Finding positions by position lines by cross bearing,
	9	Finding positions by horizontal sextant angles,
	10	Finding positions by vertical sextant angle
	11	Finding positions by running fix,
	12	Finding positions by speed,
	13	Finding positions by distance and time
	14	Findings set and drift of current

	15	Findings course made good speed made good and steering course and		
	16	Finding position by counter acting the current observation of RADAR		
6.	**Semester**	**Course No.**	**Title**	**Credits**
	VIII	**FE. 426**	**Aquaculture Engineering**	**2+1=3**
	Lecture	**THEORY :**		
	1	Fish Farm- Definition, objectives; Farm types – Freshwater, brackish water and marine farms.		
	2	Selection of site for aqua farm- site selection criteria, pre-investment survey viz., accessibility, physical features of the ground, Detailed survey viz., site condition, topography, soil characteristics.		
	3	Land Surveying- definition, principles of surveying, classification of surveying		
	4	Instruments used for chaining, chaining on uneven or sloping ground and error due the incorrect chain length. Chain surveying- definitions, instruments used for setting out right angles, basic problems in chaining, cross staff survey.		
	5	Compass surveying - definitions, bearing, meridians, whole circle bearing system, reduced bearing system, theory of magnetic compass, prismatic compass.		
	6	Leveling - definitions, methods of leveling, leveling instruments, terms and abbreviations, types of spirit leveling.		
	7	Plane table surveying- instruments required, working operation, methods.		
	8	Contour surveying- definition, contour interval, characteristics of contour, contouring methods and uses of contour.		
	9	Calculation of area of regular and irregular plane surfaces,		
	10	Trapezoidal and Simpson's rule, volume of regular and irregular shape as applied to stacks and heaps, calculation of volume of pond.		
	11	Earth work calculations- excavation, embankment, longitudinal slope and cross slope,		
	12	Calculation of volume of earth work as applied to roads and channels.		
	13	Soil and its properties- classification of soil;		
	14	Soil sampling methods; three phase system of soil, definitions of soil properties andpermeability of soil.		
	15	Ponds - classification of ponds; excavated ponds, embankment ponds, barrage and diversion ponds; rosary system and parallel system.		
	16	Planning of fish ponds, layout planning, materials planning, manual planning,		
	17	Comparison of square and rectangular ponds, large and small ponds		
	18	Types of ponds; nursing ponds, rearing ponds and stocking ponds. Design of ponds, pond geometry; shape, size, bottom slope of pond *etc.*,		
	19	construction ponds viz., marking, excavation etc.,		
	20	Dykes, types of dykes viz., peripheral dykes, secondary dyke, design of dykes, construction of dykes.		
	21	Water distribution system- canal, types of canals; feeder canal, diversion canal etc.,Pipe line system,		
	22	Water control structures- types of inlet and out let and their construction. Water budget equation,		

	23	Water control structures- types of inlet and out let and their construction. Water budget equation,
	24	Pond drainage system; seepage and the methods used for seepage control,
	25	Evaporation; factors affecting evaporation, erosion of soil in dykes and its control.
	26	Site selection, planning and construction of coastal aqua farms. Brackish water fish farms- tide fed, pump fed farms, site selection - topography, tidal amplitude, soil and water sources etc.,
	27	Hatcheries- site selection, infrastructural facilities; water supply system, main hatchery complex viz., Layout plan and design of hatcheries- brood stock ponds, artemia hatching tanks, sheds etc,
	28	Raceway culture system- site selection, layout plan,
	29	Types of raceway culture system viz.,parallel system, series system etc.,
	30	Aerators- principles, classification of aerators and placement aerators.
	31	Pumps- purpose of pumping, types, selection of pump, total head, horse power calculation.
	32	Filters- types and constructions.
	Practical	**PRACTICAL:**
	1	Evaluation of potential site for aquculture
	2	Land Survey: a) Chain surveying.
	3	b) Compass Survey.
	4	c) Leveling.
	5	d) Plane table surveying
	6	e) Countouring
	7	Soil analysis for farm construction.
	8	Design and layout plan of fresh water farms.
	9	Design and layout plan of brackish water farms.
	10	Design and layout plan of hatcheries.
	11	Design of farm structure: a) Ponds
	12	Design of farm structure: b) Dykes
	13	Design of farm structure: c) Channels
	14	Earth work calculations.
	15	Water requirement calculation.
	16	Visit to different types of farms.

Department of Fisheries Engineering				
Courses offered (VI Dean)				
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
1.	**III**	FE.211	Fishing Craft Technology	**1+1=2**
	Lecture	**Theory**		
	1	Introduction: History and development of fishing crafts. Traditional fishing crafts of India.		
	2	Classification of fishing crafts based on fabrication dimension, nature of fishing, depth of operation		
	3	History and development of mechanization of fishing crafts.		
	4	Basic geometric concepts and important terminologies of fishing vessel. Form coefficients, properties of irregular shapes		
	5	Calculation of the longitudinal and transverse sectional area of fishing craft by using Trapezoidal rule and Simpson's rules.		
	6	State of equilibrium; Volume of displacement; centre of gravity (CG); centre of buoyancy (CB); vertical centre of gravity (VCB); longitudinal centre of gravity (LCB). Stability of fishing vessels- longitudinal and transverse. Various equilibrium of ships-stable, unstable and neutral		
	7	Light weight, Dead weight, Tonnage system; Gross Registered Tonnage (GRT), Net Registered Tonnage (NRT).		
	8	Boat building materials: Choice of construction materials: Wood, properties, advantages and disadvantages		
	9	Deck fitting.		
	10	Maintenance of fishing vessels. Fouling and boring organisms;		
	11	Seasoning and preservation of wood.		
	12	Constructional details of boat: Offset tables; Mould lofting; Backbone assembly of wooden boat.		
	13	Constructional details of Steel, FRP, boats.		
	15	Constructional details of Ferro Cement and Aluminum boats.		
	16	Introduction of Outboard and inboard engines.		
	1	Introduction: History and development of fishing crafts. Traditional fishing crafts of India.		
	2	Classification of fishing crafts based on fabrication dimension, nature of fishing, depth of operation		
	3	History and development of mechanization of fishing crafts.		
	4	Basic geometric concepts and important terminologies of fishing vessel. Form coefficients, properties of irregular shapes		
	5	Calculation of the longitudinal and transverse sectional area of fishing craft by using Trapezoidal rule and Simpson's rules.		
	6	State of equilibrium; Volume of displacement; centre of gravity (CG); centre of buoyancy (CB); vertical centre of gravity (VCB); longitudinal centre of gravity (LCB). Stability of fishing vessels- longitudinal and transverse. Various equilibrium of ships-stable, unstable and neutral		
	7	Light weight, Dead weight, Tonnage system; Gross Registered Tonnage (GRT), Net Registered Tonnage (NRT).		
	8	Boat building materials: Choice of construction materials: Wood, properties, advantages and disadvantages		
	9	Deck fitting.		
	10	Maintenance of fishing vessels. Fouling and boring organisms;		

	11	Seasoning and preservation of wood.		
	12	Constructional details of boat: Offset tables; Mould lofting; Backbone assembly of wooden boat.		
	13	Constructional details of Steel, FRP, boats.		
	15	Constructional details of Ferro Cement and Aluminum boats.		
	16	Introduction of Outboard and inboard engines.		
	Practical	**Practical**		
	1	Studies on traditional fishing crafts;		
	2	Studies on traditional fishing crafts;		
	3	Introduction to drawing and drawing instruments;		
	4	Lettering, Geometrical construction, Curves. Projections		
	5	Projection of points, planes and Projection of solids		
	6	Lines plan drawing		
	7	Drawing of back bone assembly		
	8	U and V bottom hull of wooden boat.		
	9	General view of boat.		
	10	Drawing of sheer plan.		
	11	Drawing of body plan		
	12	Drawing of half breadth plan.		
	13	Types of marine engines and their installation of engines.		
	14	Types of marine engines and their installation of engines.		
	15	Visit to boat building yard.		
	16	Visit to boat dry dock.		
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
2.	**IV**	**FE.222**	**Fishing and Gear Technology**	**2+1=3**
	Lecture	**THEORY:**		
	1	Evolution of Fishing gears; Mechanization of Fishing; Basic classification of fishing gears Principle, Subsidiary and Auxiliary gears.		
	2	Classification of fishing gears and methods: FAO classification of fishing gear, methods of the world.		
	3	Classification of fishing gears and methods: International Standard Statistical Classification of Fishing gear (ISSCFG).		
	4	Fishing gear materials: Natural materials and Synthetic netting materials and their classification. Types and important synthetic materials used in fishing gears.		
	5	Raw-materials for synthetic material; Preparation of nylon (PA 6.66) material; Different types of fibres- continuous fibre; monofilament, staple and split fibers and production of single yarns.		
	6	Identification of synthetic fishing gear materials: Visual observation, water test, solubility test, burning test and melting point test.		
	7	Construction of twisted netting materials: Yarn, single yarns, folded yarns, netting twine, cable netting twine and cable netting twine of higher order.		
	8	Construction of ropes and their higher order. Construction of braided netting twines.		
	9	Yarn numbering system - direct system: Tex system, Denier system and calculation of resultant tex value. Indirect system: British count, metric count, runnage system and their conversion.		
	10	Methods of Preparation of knotted and knotless webbing, advantage and disadvantages of knotted and knotless webbings.		

	11	Shape of mesh: diamond, square, hexagonal and their measurement.
	12	Properties of netting material: physical properties- Density, twist and amount of twist, breaking strength-tenacity, and tensile strength, breaking length, abrasion resistance, elasticity, extensibility, water absorption and shrinkage, sinking velocity, weather resistance, melting point and visibility. Chemical and Biological properties.
	13	Floats and buoys – its materials, types their properties. Classification of floats: based on shape and materials; calculation of buoyancy. Sinkers – types, materials, properties- negative buoyancy.
	14	Factors to be considered while designing /selection of fishing gears; Biological, Environmental, oceanographical, Vessel characteristics and mesh size regulation.
	15	Choice of netting materials for trawl, gillnet and purse seine.
	16	Classification of trawl gears. 2 seem trawl; 4 seam trawl and wing trawl. Design and construction of wing trawl. Rigging of trawl gear.
	17	Arrangements of bridles, sweep lines and attachment of ground gears: tickler chain, bobbins and rock hoppers and attachment of otter board.
	18	Structure of various commercial fishing gears.
	19	Rigging of fishing gears: Bridles, sweep lines, otter boards, floats and ground gear arrangements.
	20	Otter door: Different types of otter doors. Behavior of otter doors in water: Angle of attack, angle of heel and angle of tilt.
	21	Fishing accessories – thimbles, shackles, C-links, rings, G-links, Kelly's eye, stopper, bottle screw,.
	22	Deck layout of different fishing vessels. Trawling: Beam trawling; otter trawling; side trawling; twin trawling out rig trawling bull trawling and mid-water trawling.
	23	Constructional details of single-boat purse seine; two-boat purse seine and method of operation.
	24	Types of gill net – constructional details of simple gill net, trammel gill net, stick held gillnet, frame gillnet and vertical line gillnet,
	25	Operation of gillnet: set gillnetting; drift gillnetting; bottom, mid-water and pelagic gillnetting
	26	Line fishing: Types of hooks; structure and size of hooks. Constructional details of long line, tuna long line, vertical long line, pole and line and trolling line.
	27	Operation of long line: set and drift
	28	Long lining: bottom, mid-water and pelagic long lining; jigging.
	29	Operation of beach seine, boat seine and traps.
	30	Selectivity in fishing gear and by catch-reducing devices.
	31	Deck equipment – types of winches, net haulers, line haulers, triple drum, gurdy, power blocks, fish pumps.
	32	Fishing equipment: Fish finder, GPS navigator, sonar, net sonde, gear monitoring equipment.
	Practical	**Practical**
	1	Study of net making tools.
	2	Knots and hitches used in net making.
	3	Methods of net making: Hand braiding- Chain mesh method and loop methods of net making.

	4	Shaping of webbing: baiting, creasing and reducing mesh size step by step.		
	5	Tailoring method: T and N direction of webbing; T-cuts, N-cuts, B-cuts and their combination.		
	6	Joining of net pieces.		
	7	Net mounting – hanging coefficient, hung depth and their calculation.		
	8	Selvedging.		
	9	Methods of net mounting: reeving, stapling and norselling.		
	10	Mending and net shooter techniques.		
	11	Survey of fishing gears; Trawl; gillnet fishing gears.		
	12	Survey of fishing gears; long line fishing gears.		
	13	Survey of fishing gears; purse seine fishing gears.		
	14	Rigging of trawl, purse seine, gillnet and hook and line.		
	15	Commercial fishing techniques: Bottom trawling; purse seining; gillnetting and line fishing.		
	16	Commercial fishing techniques: Cast net fishing and trap fishing.		
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
3.	**IV**	**SEC.226**	**NET MAKING AND MENDING**	**0+2=2**
	Lecture	***PRACTICAL***		
	1	Introduction to Fishing Nets		
	2	Importance of nets in aquaculture and fishing		
	3	Types of fishing nets (gill nets, seine nets, cast nets, trawl nets, etc.)		
	4	Materials used in net making (nylon, polyethylene, monofilament, multifilament)		
	5	Tools and Materials for Net Making & Mending: Needles		
	6	Twine types and their uses		
	7	Knotting vs. knotless netting		
	8	Net Making Techniques: Basic knots used in net making (reef knot, slip knot, square knot)		
	9	Mesh formation techniques		
	10	Weaving patterns for different net types		
	11	Net Mending and Repair Techniques: Common damages in nets (tears, holes, fraying)		
	12	Repair tools and materials		
	13	Step-by-step mending techniques I		
	14	Step-by-step mending techniques II		
	15	Net Mending: Identifying Damages: Inspecting nets to detect broken meshes or weakened areas.		
	16	Patch Repairing: Attaching patches to damaged sections using netting needles and twine.		
	17	Patch Repairing: Attaching patches to damaged sections using netting needles and twine.		
	18	Replacing Meshes: Removing and replacing torn meshes while maintaining the original mesh size and shape.		
	19	Replacing Meshes: Removing and replacing torn meshes while maintaining the original mesh size and shape.		
	20	Reinforcing Weak Points: Strengthening stress points, such as attachment areas, with additional twine or stitching.		
	21	Reinforcing Weak Points: Strengthening stress points, such as attachment areas, with additional twine or stitching.		

	22	Tension Adjustments: Ensuring uniform tension to prevent distortions in the net structure.		
	23	Tension Adjustments: Ensuring uniform tension to prevent distortions in the net structure.		
	24	Testing and Quality Control: Checking the strength and flexibility of repaired nets before use.		
	25	Testing and Quality Control: Checking the strength and flexibility of repaired nets before use.		
	26	Prevention of frequent net damage		
	27	Net Treatment and Preservation: Coating and treating nets for durability		
	28	Protection against UV rays, fouling, and wear		
	29	Proper storage and maintenance		
	30	Safety and Environmental Considerations: Sustainable net usage to prevent overfishing		
	31	Reducing ghost fishing (lost or abandoned nets)		
	32	Proper disposal and recycling of old nets		
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
4.	**V**	**FE.313**	**Aquaculture Engineering**	**2+1=3**
	Lecture	**Theory**		
	1	Fish Farm: Definition, objectives, types of farms; fresh water, brackish water and marinefarms		
	2	Selection of site for aqua farm: site selection criteria, pre-investment survey viz., accessibility, physical features of the ground, detailed survey viz., site condition, topography, soil characteristics.		
	3	Land Surveying: definition, principles of surveying, classification of surveying.		
	4	Instruments used forchaining, chaining on uneven or sloping ground and error due to the incorrect chain length.		
	5	Chainsurveying: definition, instruments used for setting out right angles, basic problems in chaining, cross-staff survey.		
	6	Compass surveying: definitions, bearing, meridians, whole circle bearing system,reduced bearing system, theory of magnetic compass, prismatic compass.		
	7	Levelling: definitions,methods of levelling, levelling instruments, terms and abbreviations, types of spirit levelling.		
	8	Planetable surveying: instruments required, working operation, methods.		
	9	Contour surveying: definition,contour interval, characteristics of contour.		
	10	Contour surveying: Contouring methods and uses of contour.		
	11	Soil and itsproperties: classification of soil; soil sampling methods;		
	12	Three-phase system of soil, definitions of soilproperties and permeability of soil.		
	13	Ponds: classification of ponds; excavated ponds, embankmentponds, barrage and diversion ponds; rosary system and parallel system.		
	15	Planning of fish pond:layout planning, materials planning, manual planning,		
	16	Comparison of square and rectangularponds, large and small ponds.		
	17	Types of ponds: nursery ponds, rearing ponds and stocking ponds.		
	18	Design of ponds, pond geometry; shape, size, bottom slope of pond etc.,		

	19	Construction of ponds,marking, excavation.		
	20	Dykes: types of dykes viz., peripheral dykes, secondary dyke, design of dykes,		
	21	Constructionof dykes.		
	22	Water distribution system: canal, types of canals; feeder canal, diversion canaletc., Pipe line system.		
	23	Water control structures: types of inlets and outlets and their construction.		
	24	Water budget equation. Pond drainage system; seepage and the methods used for seepage control, evaporation; factors affecting evaporation, erosion of soil in dykes and its control.		
	25	Site selection,planning and construction of coastal aqua farms.		
	26	Brackish water fish farms: tide-fed, pump-fedfarms.		
	27	Hatcheries: Site selection, infrastructural facilities; water supply system, main hatcherycomplex viz.,		
	28	Layout plan and design of hatcheries: brood stock ponds, artemia hatching tanks,sheds etc.		
	29	Raceway culture system: site selection, layout plan, types of raceway culture system viz.,parallel system, series system etc.,		
	30	Aerators: principles, classification of aerators and placement ofaerators.		
	31	Pumps: purpose of pumping, types, selection of pump, total head, horse power calculation.		
	32	Filters: types and constructions.		
	Practical	**Practical**		
	1	Evaluation of potential site for aquaculture.		
	2	Land survey – chain surveying		
	3	Land survey –compass surveying		
	4	Land survey – leveling		
	5	Land survey –plane table surveying		
	6	Land survey –contouring;		
	7	Soilanalysis for farm construction.		
	8	Soilanalysis for farm construction.		
	9	Design and layout plan of fresh water farms		
	10	Design and layout plan of brackish water farms		
	11	Design and layout plan of hatcheries.		
	12	Design of farm structure: ponds, dykesand channels.		
	13	Earth work calculations		
	14	Estimation of water requirement		
	15	Visit to freshwater fish farms.		
	16	Visit to brackish water fish farms.		
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
5.	**VI**	**FE.324**	**Refrigeration and Equipment Engineering**	**1+1=2**
	Lecture	**Theory**		
	1	Fundamentals: Force, work, power, energy, volume, pressure, temperature. Heat, specific heat, sensible heat, latent heat, comparison between heat and work - A path function.		
	2	Thermodynamics: Laws of Thermodynamics, Laws of perfect gases, Thermodynamic processes, application of First and Second law of		

		Thermodynamics in refrigeration, Thermodynamics cycle, entropy, enthalpy.
	3	Refrigeration: History of refrigeration, definition, principle, classification, Types of refrigeration systems i.e., Air refrigeration, vapour absorption refrigeration system. Vapour compression refrigeration system.
	4	Refrigeration plant: Layout of refrigeration plant, Construction and insulating materials used for the cold storage construction, Frozen product storage, capacity of cold storage, usage of Anteroom.
	5	Refrigeration systems: Vapour compression refrigeration system advantages and disadvantages as compared to other refrigeration systems, Types of Vapour compression refrigeration cycles i.e., Theoretical Vapour compression refrigeration cycle, Actual refrigeration cycle.
	6	Compressors: Definition, Types of compressors, construction, working principle, advantages and disadvantages.
	7	Evaporator: Definition, Types of Evaporators, construction, working principle, advantages and disadvantages.
	8	Condenser: Definition, Types of Condensers, Cooling Towers, construction, working principle, advantages and disadvantages.
	9	Expansion valve: Definition, Types of Expansion valve, construction, working principle advantages and disadvantages. Refrigerant: Primary refrigerant, secondary refrigerant, properties, ideal refrigerant, leakage detection.
	10	Study of auxiliary equipment: Receiver, oil charging, refrigerant charging, gas purging, oil draining, types of defrosting.
	11	Ice-plant: Ice plant planning, Brine tank construction, preparation of brine. Types of ice, storing of ice, Equipment used in ice plants.
	12	Freezers: Definition, Design, and construction of freezers i.e. Plate freezer, Blast freezer, Tunnel freezer, spray or immersion freezers, refrigerated fish rooms and fish hold. Alternative refrigeration technique arrangements used onboard the fishing vessel i.e., Refrigerated Sea water (RSW), Chilled Sea water (CSW). Refrigerated transport.
	13	Cooling load: Unit of refrigeration, coefficient of performance (C.O.P), Refrigeration effect, study, and use of Psychrometric chart. Cooling load estimation, introduction, components of cooling load, heat gain through walls, roofs, products, occupants, lighting equipment.
	15	Theory of machines: Transmission of power, friction wheels, shaft, gears, belt, and Chain drive. Study of equipment used in fish processing with reference to canning, sausage, freeze drying and irradiation.
	16	Maintenance: Definition, Types of maintenance, general maintenance of freezing plant, cold storage and ice plant.
	1	Fundamentals: Force, work, power, energy, volume, pressure, temperature. Heat, specific heat, sensible heat, latent heat, comparison between heat and work - A path function.
	2	Thermodynamics: Laws of Thermodynamics, Laws of perfect gases, Thermodynamic processes, application of First and Second law of Thermodynamics in refrigeration, Thermodynamics cycle, entropy, enthalpy.

	3	Refrigeration: History of refrigeration, definition, principle, classification, Types of refrigeration systems i.e., Air refrigeration, vapour absorption refrigeration system. Vapour compression refrigeration system.
	4	Refrigeration plant: Layout of refrigeration plant, Construction and insulating materials used for the cold storage construction, Frozen product storage, capacity of cold storage, usage of Anteroom.
	5	Refrigeration systems: Vapour compression refrigeration system advantages and disadvantages as compared to other refrigeration systems, Types of Vapour compression refrigeration cycles i.e., Theoretical Vapour compression refrigeration cycle, Actual refrigeration cycle.
	6	Compressors: Definition, Types of compressors, construction, working principle, advantages and disadvantages.
	7	Evaporator: Definition, Types of Evaporators, construction, working principle, advantages and disadvantages.
	8	Condenser: Definition, Types of Condensers, Cooling Towers, construction, working principle, advantages and disadvantages.
	9	Expansion valve: Definition, Types of Expansion valve, construction, working principle advantages and disadvantages. Refrigerant: Primary refrigerant, secondary refrigerant, properties, ideal refrigerant, leakage detection.
	10	Study of auxiliary equipment: Receiver, oil charging, refrigerant charging, gas purging, oil draining, types of defrosting.
	11	Ice-plant: Ice plant planning, Brine tank construction, preparation of brine. Types of ice, storing of ice, Equipment used in ice plants.
	12	Freezers: Definition, Design, and construction of freezers i.e. Plate freezer, Blast freezer, Tunnel freezer, spray or immersion freezers, refrigerated fish rooms and fish hold. Alternative refrigeration technique arrangements used onboard the fishing vessel i.e., Refrigerated Sea water (RSW), Chilled Sea water (CSW). Refrigerated transport.
	13	Cooling load: Unit of refrigeration, coefficient of performance (C.O.P), Refrigeration effect, study, and use of Psychrometric chart. Cooling load estimation, introduction, components of cooling load, heat gain through walls, roofs, products, occupants, lighting equipment.
	15	Theory of machines: Transmission of power, friction wheels, shaft, gears, belt, and Chain drive. Study of equipment used in fish processing with reference to canning, sausage, freeze drying and irradiation.
	16	Maintenance: Definition, Types of maintenance, general maintenance of freezing plant, cold storage and ice plant.
	Practical	**Practical**
	1	Drawing of Refrigeration and Fish processing machineries.
	2	Drawing of plant layout.
	3	Graphically represented symbols used in refrigeration.
	4	Handling and operation of compressors.
	5	Handling and operation of condensers.
	6	Handling and operation of evaporators.
	7	Handling and operation of expansion valves, low- and high-pressure switches.
	8	Study of auxiliary equipment: Receiver, oil charging,
	9	Study of auxiliary equipment: refrigerant charging, gas purging,

	10	Study of auxiliary equipment: oil draining, types of defrosting.		
	11	Power transmission line diagram of different fish processing machineries.		
	12	Visit to processing plant.		
	13	Visit to refrigeration plant.		
	14	Visit to ice plant.		
	15	Visit to fishing harbor or landing center to study the fish hold, refrigerated fish rooms.		
	16	Calculation on refrigeration effect and cooling load.		
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
+6.	**VI**	**FE.325**	**Navigation and Seamanship**	**1+1=2**
	Lecture	**THEORY**		
	1	Principles of navigation –terms and definitions, finding positions and method of position fixing, magnetic		
	2	Compass-parts and functions, cardinal, inter cardinal, three letter and lay points, pelorus and azimuth mirror, method of observation.		
	3	Sextant -parts and functions, finding adjustable and nonadjustable errors and principles and use.		
	4	Hand lead line – construction and markings and method of taking soundings. Types of speed logs –patent log, impeller log.		
	5	Types of marine charts, Mercator and gnomonic projections great circles and rumba lines, chart collections and chart readings, chart observation and fixing positions.		
	6	The IALA-buoy age systems, cardinal, and lateral marks, meaning of shapes, colours and lights top marks and explanation of approaching,		
	7	International code of signals, flag signals mars code and storm signals general system, brief system and extended system, storm signals stations Indian coasts, Fog signals, types and methods.		
	8	Distress signals, methods, types and communication international regulations for preventing collision at sea and recognition of lights and shapes at sea.		
	9	Observation of radar and parts and functions of radar, aneroid barometer, parts and functions of echo sounder, and sonar, observation of GPS.		
	10	Principles of seamanship- Causes of fire at sea, fire prevention on board the vessel and method of firefighting at sea and recommended firefighting appliances.		
	11	Life saving appliances – life jackets, life buoys and method of operations and contents, SART and EPIRB.		
	12	Observations of storms, formation of storms and method of locating the eye of the storms and method of escaping from the center of the storms as per buys ballet law.		
	13	Preparing vessels toface heavy weather. Temporary repairs for leaks constructions of the steering system and rigging emergency jury rudder.		
	15	Types of anchors and their applications: selection of suitable anchorage, procedure for anchoring anchor watch and procedure to combating dragging of anchor. Method of standing moor and running moor, open moor berthing procedures		
	16	Axial thrust, transverse thrust mooring and securing the vessel to the jetty, rigging fenders and gangways. Method of leaving vessels from the berth.		

	Practical	**Practical**		
	1	Anchoring.		
	2	Coming alongside the berth and leaving.		
	3	Practicing the different types of knots and wire splices.		
	4	Use of magnetic compass.		
	5	Use of GPS.		
	6	Use of Echo-sounder.		
	7	Finding positions by latitudes and longitudes.		
	8	Finding positions by position lines,		
	9	Finding positions by cross-bearing method		
	10	Finding positions by cross-bearing method.		
	11	Finding positions by horizontal sextant angles,		
	12	Finding positions by vertical sextant angle.		
	13	Finding positions by running fix.		
	14	Finding position by speed, distance and time.		
	15	Finding set and drift of current and finding course.		
	16	Steering course and finding position by counter acting the current observation of RADAR.		
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
7.	**VII**	FE.416	Responsible and Sustainable Fishing Methods	**1+1=2**
	Lecture	**Theory**		
	1	CCRF: Scope and objectives of FAO Code of conduct for Responsible Fisheries, Articlesof CCRF – Description of the code, Analysis of marine catch data (present and past); analysis of CCRF concept.		
	2	Definition of sustainability, Rules and regulations for sustainable fishing, Properties of a sustainable fishery, Present scenario and problems of sustainable fishing, Trends in global and Indian fishery, Environmental defects.		
	3	By-catch: Elaboration of Article 8 – Fishing operations; By-catch and discards – Definitions, By-catch estimation methods, by-catch reduction devices, turtle excluder devices, Finfish and shrimp excluder devices.		
	4	Selective fishing gear and practices: Selectivity of trawls, gill nets and lines – Environmentally friendly fishing methods and fishing gears – Energy conservation and resource enhancement.		
	5	Fish Aggregation Devices (FADs and Artificial reefs): Objectives, Types of FADs and artificial reefs; Design and construction of FADs and artificial reefs; Energy optimization in fisheries – Methods of energy conservation in fish harvesting.		
	6	Remote Sensing and PFZ: Application of Remote sensing, PFZ and GIS in fisheries.		
	7	IUU - Illegal, Unregulated and Unreported fishing methods; Destructive and prohibited fishing systems and practices.		
	8	Effect of fishing on non-target species.		
	9	Impacts of unsustainable fishing: Habitat degradation due to bottom trawling, purse seining, Habitat modification, changing the ecosystem balance, Climate change, Ocean pollution, Disease and toxin.		
	10	Fisheries management, Ecosystem-based fisheries,		
	11	Marine protected area, Laws and treaties,		
	12	Conservation methods issues and implications for biodiversity.		

	13	Remediation for sustainable fishery, Fisheries management, Ecosystem-based fisheries,
	15	Marine protected area, Laws and treaties, Awareness campaigns, Sustainable fishing gears and devices, designing of eco-friendly long line,
	16	Eco-friendly gillnet, Eco-friendly trawl net, Techniques reducing the risk of unsustainability, Eco-friendly fishing methods and gears.
	1	CCRF: Scope and objectives of FAO Code of conduct for Responsible Fisheries, Articlesof CCRF – Description of the code, Analysis of marine catch data (present and past); analysis of CCRF concept.
	2	Definition of sustainability, Rules and regulations for sustainable fishing, Properties of a sustainable fishery, Present scenario and problems of sustainable fishing, Trends in global and Indian fishery, Environmental defects.
	3	By-catch: Elaboration of Article 8 – Fishing operations; By-catch and discards – Definitions, By-catch estimation methods, by-catch reduction devices, turtle excluder devices, Finfish and shrimp excluder devices.
	4	Selective fishing gear and practices: Selectivity of trawls, gill nets and lines – Environmentally friendly fishing methods and fishing gears – Energy conservation and resource enhancement.
	5	Fish Aggregation Devices (FADs and Artificial reefs): Objectives, Types of FADs and artificial reefs; Design and construction of FADs and artificial reefs; Energy optimization in fisheries – Methods of energy conservation in fish harvesting.
	6	Remote Sensing and PFZ: Application of Remote sensing, PFZ and GIS in fisheries.
	7	IUU - Illegal, Unregulated and Unreported fishing methods; Destructive and prohibited fishing systems and practices.
	8	Effect of fishing on non-target species.
	9	Impacts of unsustainable fishing: Habitat degradation due to bottom trawling, purse seining, Habitat modification, changing the ecosystem balance, Climate change, Ocean pollution, Disease and toxin.
	10	Fisheries management, Ecosystem-based fisheries,
	11	Marine protected area, Laws and treaties,
	12	Conservation methods issues and implications for biodiversity.
	13	Remediation for sustainable fishery, Fisheries management, Ecosystem-based fisheries,
	15	Marine protected area, Laws and treaties, Awareness campaigns, Sustainable fishing gears and devices, designing of eco-friendly long line,
	16	Eco-friendly gillnet, Eco-friendly trawl net, Techniques reducing the risk of unsustainability, Eco-friendly fishing methods and gears.
	Practical	**Practical**
	1	Study of design and operation of BRDs
	2	Study of design and operation of TEDs.
	3	Preparation of document listing and prohibited fishing practices.
	4	Compilation of package of practices for energy conservation.
	5	Designing of eco-friendly fishing devices,
	6	Designing of square mesh cod end,
	7	Designing of traps with escape vents,
	8	designing of longline with circular hooks.

	9	Interpretation of SST charts		
	10	Interpretation of Ocean colour charts.		
	11	Study of Potential Fishing Zone(PFZ) maps.		
	12	Problems on fishing gear selectivity.		
	13	Problems on fishing gear selectivity.		
	14	Problems on fishing gear selectivity.		
	15	Studies on impact of various fishing gears on the environment		
	16	Studies on impact of various fishing gears on the biodiversity.		
Sr. No.	**Semester**	**Course No.**	**Title**	**Credits**
8.	**VII**	**FE.417**	**GIS and Remote Sensing in Fisheries**	**1+1=2**
	Lecture	**Theory**		
	1	Aerial Photography: Basics of photography- terminologies- Photogrammetry – Stereoscopy - Principal points - Parallax and its measurement, Colours - Composite colour images.		
	2	Remote Sensing - Electromagnetic Spectrum - Radiation		
	3	laws - Interaction with atmosphere and surfaces, Spectral reflectance of earth materials and vegetation,		
	4	Satellite Remote Sensing - Resolution - Scanning - Sensors, Land Observation Satellites - Visual image interpretation.		
	5	Image and Data: Digital image processing, Image rectification and Image enhancement - Filtering - Band rationing, Image classification - Supervised and unsupervised classification,		
	6	Remote sensing application in soil and water conservation.		
	7	GIS - Types, raster, vector, Database management systems, Data types.		
	8	Spatial - non-spatial, Spatial data models, Spatial referencing.		
	9	Map projections, Data input, Editing, Encoding.		
	10	Raster data analysis, Vector data analysis		
	11	Satellite Application: NOAA and IRS Satellites for Ocean and Fisheries studies.		
	12	Digital image processing and interpretation		
	13	Application of remote sensing and GIS to fisheries and aquaculture planning and development.		
	15	PFZ- Basics and application		
	16	Validation of PFZ data- INCOIS- Data Dissemination.		
	Practical	**Practical**		
	1	Study of satellite information.		
	2	Interpretation of satellite pictures for resource management.		
	3	Interpretation of satellite pictures for resource management.		
	4	Casestudies on remote sensing		
	5	Casestudies on GIS applications.		
	6	Development of GIS with local parameters related to fisheries.		
	7	Development of GIS with local parameters related to fisheries.		
	8	INCOIS data processing		
	9	INCOIS data interpretation.		
	10	Collection of INCOIS data.		
	11	Validation of INCOIS data.		
	12	Collection of PFZ data.		
	13	Validation of PFZ data.		

	14	INCOIS data dissemination methods among coastal fishermen.
	15	INCOIS data dissemination methods among coastal fishermen.
	16	Survey of effectivenessand usefulness of PFZ data.