31. VETERINARY PHARMACOLOGY

Unit 1: General Pharmacology: Development and Scope, branches of pharmacology, Terminology, Sources and nature of drugs. Pharmacopoeia and drug compendia. Drug Schedules. Factor modifying drug activity. Definition of pharmaco-genomics, polymorphism and its use in drug development.

Pharmacodynamics: Drug structure activity relationship. Drug receptor interaction. Role of secondary messengers. Drug modulation via different types of channels. Characterisation of agonist, antagonists.

Pharamacokinetics : Principles, Drug metabolism and biotransformation. Factors modifying drug kinetics. Kinetic constants. Different models, determination of kinetic parameters and application in rational dosage regimen.

Pharmacometrics: Organisation and screening programmes and drug development. Multidimentional screening methods, bioassays. Determination of median doses – LD50, ED50, therapeutic indices. Types of dose response relationship.

Unit 2: Drug Acting on Central Nervous System

Role of neurotransmitters in CNS. Sedatives, Hypnotics, General anaesthetics, Hypotheses and clinical stages of anaesthesia. Pre-and post-anesthetics, Molecular mechanism of action of inhalent and and parenteral anesthetics. Anticonvulsants. Tranquilizers. Narcotic and non-narcotic analgesics and antipyretics. Drugs affecting behaviour. Drug dependence and addiction and abuses. CNS stimulants. Muscle relaxants. Local anaesthetics.

Unit 3: Drugs Acting on Humoral and Autonomic Nervous Systems

Neurohumoral transmission. Adrenergic and antiadranergic drugs including adrenergic neuron blockers. Cholinergic and anticholinergic drugs. Purinergic and Adenosine receptors. Dopaminergic and antidopaminergic agents. Nitric oxide mediators. Neuromuscular and ganglion stimulants and ganglion blockers.

Unit 4: Drugs Acting on Cardio-vascular and Respiratory Systems

Drugs acting on heart and blood vessles. Antihypotensive and anti-arrhythnic agents. Blood coagulants and anti-coagulants. Heamatinics. Haemorrhagic shock and its treatment.

Expectorants, antiussives. Cough sedatives. Bronchodilators. Mucolytic agents. Analeptics.

Unit 5: Drugs Acting on Digestive System

Stomachics. Antacids. Carminatives and antizymotics. Emetics and antemetics. Cathartics. Anetidiarrhoeal agents. Antispasmodics. Pharmacology of rumen and rumenotoric drugs. Drugs acting on heapatobiliary system.

Unit 6: Drug action on Uro-genital System

Drugs altering fluid balance. Diuretics and antidiuretics. General principles of elecrolyte and therapy. Drugs acting on uterus (oxytocis and tocolytics). Therapy of infertility and improving conception and synchronization of oestrus

Unit 7: Endocrine Pharmacology

Mode of action and synthesis of pituitary hormones. Therapeutics of non-pituitary gonadotropin, adrenocorticoids, sex hormones, insulin, thyroid hormones, antithyroid agents, calcitonin, parathormone.

Unit 8: Autacoids

Pharmacological effects and therapeutics of histamine, antihistaminic agents, 5-HT its antagonists, prostaglandins and leukotrences, peptides and kinins, rennin and angiotensins. Platelet activators. Anti-inflammatory drugs.

Unit 9: Chemotherapy

General principles. Drug allergy, hypersensitivity, mechanism of resistance. Antiseptics and Disinfectants. Chemistry, mechanism of action, therapeutics of sulphonamides (gut active, systemic), thrimethoprim and congener.

Antibiotics: Penicillin, cephalosporins, aminoglycosides, macrolide, surface active, tetracyclines, polypeptide. Antifungal and other emerging antibiotics. Quinolones, nitrofurans, Antitubercular, antiviral and antineoplastic drugs.

Anthelminitic: Antinematodal, anticestodal, antitrematodal drugs. Antiprotonzoons, Anticoccdials. Drugs used for ectoparasite control.

Concept of Gene based therapy, prospects of disease target therapy, overview of indigenous medicinal drugs, its components for therapeutic use.

Unit 10: Toxicology:

Terminology. Classification of poisons. Toxicity rating. Principles of selective toxicity. Toxicodynamics. Toxicokinetics. Diagnosis and treatment of poisoning (anti-dotal and non anti-dotal). Mechanism of detoxification. Poisons causing respiratory insufficiency. Toxicology of common inorganic compounds. Toxicity of metals, non-metals and metalloids. Poisonous plant-cyanogenic, nitrate and oxalate producers. Mycotoxins : aflatoxin, rubratoxin, ergot. Toxic ferns. Venoms from snakes, scorpions, toads, etc. and treatment.

Unit 11: Ecotoxicology

Types and identification of industrial contamination and pollution residual toxicity. Impact of pesticides, fungicides, weedicides, fertilizers on biosphere. Chemical warfare agents and radiation hazards. Toxicity from food additives, preservatives. Statutory regulation on agrochemical formulation and their uses. Newer parameters, immunotoxicity, teratogenicity, mutagenicity, embroyotoxicity for toxicological evaluation.

Unit 12: Miscellaneous Topics:

Drugs promoting growth and production. Agents used for doping and restraining of wild animals. Euthanising agents. Drug control and regulation.

32. VETERINARY PUBLIC HEALTH

Unit 1: Veterinary Public Health

Definitions, concept of Public Health, Intersectoral approach to Human Health, Veterinary Medicine, Veterinary Public Health, Human health goals, veterinarians participation in public health and justifications, Veterinary Public Health Unit – its dimensions and functions, National and International organizations related with Public and Veterinary Public Health, Rural health, Role of Public Health Veterinarians in Public Health, Health Delivery System.

Unit 2: Milk Hygiene

Definitions, Dairy Industry and milk hygiene in India and other countries, Microbiology, of milk and milk products, microbial spoilage of milk and its products, Bacteriophage, Contamination of milk and its products, Public health aspects of residues: agricultural chemicals, antibiotics and drugs, toxic metals, plant toxins, mycotoxins and adulterants, Milk borne diseases, Milk hygiene, Hygienic aspects of production of milk and processing and manufacture of milk products, Clean milk production, Prevention of contamination by sanitation at dairy farm, collection centers, milk processing and manufacturing plants. Pasteurization, Sterilization, Standards. Quality control tests applied to milk and milk products.

Unit 3: Meat Hygiene

Definitions, Meat industry and meat hygiene in India and other countries. Raising meat food animals and birds, their trade and transport. Hygienic aspects of slaughter, bleeding, dressing and processing and manufacture of carcass meat and meat products. Rigor mortis, Emergency and causality slaughter. Abattoir/ Meat plant Sanitation, Microbiology of meat and their products. Sources of contamination, Disposal and reclamation of slaughterhouse wastes and byproducts and associated public health problems. Spoilage of meat and meat products, Preservation of meat. Meat food safety, Ante mortem and post mortem examination, Inspection of poultry meat, eggs, fish and meat from game animals, Judgment, Indices of sanitary quality, National and International standards, Bacteriological, serological and biochemical tests for quality control, substitution and adulteration.

Section 4: Food-borne Infections and Intoxications:

Definitions, Classifications of Food borne diseases, Meat-borne diseases, Milk-borne diseases, Infections and intoxications traced to consumption of fish/eggs, Fast/Street/Convenience foods, Epidemiological characteristics of food-borne infections and intoxications, Sources of pathogens and factors favouring for poisoning, bacterial, viral, protozoan, helminthic, mycotic and chemical food poisoning, Epidemiological investigation of food-borne infections and intoxications, Food specific attack rate. Odd ratio, Detection of foodborne pathogens and their toxins. Management of food poisoning.

Unit 5: Zoonoses

Definitions, Concept and classification of Zoonoses, Ecological aspects of Zoonoses, Wild animals-, cold blooded animals - domestic animals -, and aquatic life, -associated Zoonoses, Vectors-, milk-, meat-, egg-, fish- and water- spread Zoonoses, Occupational zoonoses, Nosocomial zoonoses, xenozoonoses, Nationally and internationally emerging and re-emerging Zoonoses, Epidemiology of bacterial, rickettsial, viral, parasitic and mycotic Zoonoses, Principles of Zoonoses management: methods of prevention, control and eradication of Zoonoses.

Unit 6: Environmental Hygiene

Natural sources of water, water hygiene, Pure and wholesome water; microbial contamination and chemical pollution of water, Impurities in water, plankton, Purification and sanitization of water, Waterborne diseases, Microbiological examination of water, Potable water, Standards for drinking water. The atmosphere. Air Pollutants, Air-borne pathogens and diseases, Ventilation, Methods of air purification. Agricultural chemicals, industrial wastes, domestic and farm effluents polluting environment – and associated hazards and preventive measures. Antibiotic and pesticide residues and their effect on health. Waste-recycling, Methods of disposal of dead animals. Rodents and Vector control measures.

Unit 7: Epidemiology

Definitions, Epidemiology, Epizootiology, Casual association, concept of infection, Theory of natural nidality, Ecological basis of diseases, Disease transmission, Epidemic process, Distribution of diseases in space and time, Epidemiological hypothesis, Types of epidemiological studies, Epidemiological survey, surveillance, monitoring of diseases, experiemental epidemiology, epidemiological measurements, Predictive epidemiology, Epidemiological models, Sero-epidemiology. Use of information technology and computer applications in disease monitoring, Epidemiological investigation and evaluation of intervention measures.

Unit 8: Experimental Animal Medicine

Occupational health and safety in the care and use of research animals. Breeding, care and management of experimental animals, Production of gnotobiotic, germfree, specific pathogen free, transgenic, syngenic animals and tailor-made animals in relation to public health, provisions of Animal welfare and Society for Prevention of Cruelty to Animals Act.

Unit 9: Health Education

Health education, communication techniques, Participatory programmes for awareness creation among agricultural workers, butchers, laboratory staff and those engaged in zoological gardens, laboratory animals rearing, processing of animal produce about occupational hazards and hazards to consumers.

Unit 10: Standard Guidelines and Legislation

Definitions, standards / guidelines of products and product ingriedients. Hazards Analysis Critical Control Points (HACCP), Good Manufacturing Practices (GMP), Good Laboratory Practices (GLP), Milk and Milk Product Order (MMPO), Meat Food Products Order (MFPO), Total Quality Management (TQM), Quality assurance and food safety management systems, Bureau of Indian Standards, International Organization for Standards, Codese Alimentarius, World Trade Order, Sanitory and Phyto-sanitory (SPS) measures, Technical Barriers to Trade (TBT), National and International Standards related to milk, meat, fish and their products and hygienic standards to ensure safety to domestic and foreign consumers of products of animal origin.

Unit 11: Microbiology in Public Health

Food microbiology, Characters of food bacteria, moulds, yeast and virus, Classifications of food microbes according to their requirements for growth – temperature, acidity, moisture, oxygen and salt concentration, resistance to microenvironment, Food processing and preservation methods. Pathogen- virulence factors, microbial enzymes, toxic metabolites and other molecules associated with pathogenic mechanisms. Resistance mechanism of survival in environment in and outside the host, Antigens eliciting protective and diagnostic antibodies, Microbiological, Serological, Biological and Nucleotide based diagnostic methods. Issues on bioterrorism.

33. VETERINARY SURGERY

Unit 1 : General Surgery

Cureent concepts of inflammation and its management. Asepsis and antisepsis in surgery. Disinfection and sterilization. Surgical bacteriology. Pre-, Peri and post-operative considerations. Physiopathology of burns, tauma, surgical stress and shock. Haemorrhage, haemostasis and administration of whole blood, blood extracts and plasma substitute. Acid – base and electrolytes imbalance. Rehydration and fluid therapy. Tissue repair including its biochemical aspects. Principles of tissue and organ transplantation. Tissue transplantation immunity. Sutures and suture materials. Operation theatre management. General surgical affections viz.. abscess, cyst, haematoma, tumour, gangrene, sinus, fistula and hernia. Neurological examination, paralysis and its treatment. Surgical instrumentations. Care of critically ill patients. Cosmetic surgery. Skin grafting techniques in animals.

Unit 2 : Anaesthesia

History and instrumentation. Pre-anaesthetic considerations of patient. Selection of various anaesthetic and pre-anaesthetic agents and their effects on different body organs. Inhalant and non-inhalant anaesthetic agents including dissociative, neurolept and balanced anaesthesia and their administration in small and large animals. Monitoring of patient during anaesthesia. Anaesthetic emergencies and their management. Muscle relaxants. Local anaesthetic agents. Local and regional anaesthetic procedures. Anaesthesia for special surgical procedures and special disease conditions. Electronarcosis. Hypothermia. Acupuncture analgesia. Anaethesia and methods of capture of zoo animals. Therapeutic usage of local anaesthetic agents and techniques. Methods of artificial ventilation.

Unit 3 : Radiology

Production and quality of X-rays; exposure factors and formulation of technique chart. Basics of radiation physics. Interaction of particulate and non-particulate radiations with matter. Radiographic artifacts and their prevention. Radiographic quality and factors affecting it. Radiographic features of diseases of musculo-skeletal, digestive, urogenital, cardiovascular, respiratory and lymphatic system of small and large animals. Radiation hazards. Radiation biology including its mechanism of action and effects on various organ systems. Radiation protection. Radiological contrast agents and common contrast radiographic procedures. Principles of radiotherapy and physiotherapy. Invasive and non-invasive imaging modalities viz. echocardiography, computed tomography, scintigraphy, magnetic resonance imaging, ultrasonography and substraction angiography.

Unit 4 : Orthopaedics and Lameness

Physiological and biochemical considerations of bone. Osteogenesis and mineralization of bone. Bone research techniques. Circulation of long bones. Biomechanics of fractures. Etiology, classification and healing of fracture; factors affecting fracture healing. Complications of fractures and their management. Methods of internal and external fixations of fracture and factors governing selection of fixation methods. Effect of various internal fixation methods on physiology and blood circulation of bone. Bone grafts. Metallic and non-metallic materials in bone surgery and their biological behaviour. Surgical affection of vertebral column. Etiology, pathophysiology, diagnosis and treatment of affections of bones and joints. Technique of arthroscopy. Lameness and allied surgical conditions of fore and hind limbs. Various foot diseases. Affections of tendons, ligaments and their management. Relationship between conformation of the limbs, foot and its axis to soundness. Soundness and examination of horse for soundness.

Unit 5 : Surgery of Head and Neck Region

Etiology, diagnosis and surgical management of the affections of sinuses, horn, nasal and buccal cavity, teeth, tongue, salivary glands, larynx, pharynx, trachea and oesophagus. Surgical affections of eye lids, lacrimal apparatus, nictitating membrane, conjunctiva, cornea, sclera, chloroids, iris, retina, lens, optic nerve, aqueous and vitreous humours and other parts of eye and their management. Surgical affections and management of ear and guttural pouch.

Unit 6 : Thoracic Surgery

Various approaches for thoracic surgery in large and small animals. Physiological alterations following thoracotomy. Heart lung machine and its use in thoracic surgery. Different congenital and acquired surgical affections of thoracic wall and thoracic organs viz. lung, mediastinum, oesophagus, heart and diaphragm in large and small animals. Surgical diseases of the vascular and lymphatic systems.

Unit 7 : Abdominal and Pelvic Surgery

Different surgical approaches for abdomen. Hemia: etiology, pathophysiology and treatment. Various acquired and congenital surgical affections of abdominal organs viz. Traumatic reticulitis, abdomasal displacement, impaction of omasum, pyloricstenosis, gastric torsion, caecal dilation, intestinal obstruction, rectal and anal prolapse, and peritonitis. Colic in horse:- etiology, diagnosis and treatment. Affection of liver, spleen, kidney and urinary bladder their complications and surgical management. Urolithiasis, uraemia and their management. Surgery of male and female gential organs. Etiology, diagnosis and surgical management of the affections of udder, teat and tail.

34. AQUACULTURE

Unit-1. Aquaculture System

History and scope of Aquaculture; Aquaculture practices in different parts of the world; Global Aquaculture production, consumption scenario and emerging trends; Different systems of Aquaculture-traditional, extensive, intensive, semi-intensive, flow through and re-circulatory. Farming methods-ponds, lens, cages, raceway, raft, rope, monoculture, polyculture, mixed culture; Capture based Aquaculture and culture based Aquaculture, integrated multi-trophic Aquaculture (IMTA). Recirculation Aquaculture Systems (RAS, Integration of Aquaculture with agriculture and animal husbandry; sewage-fed faming, organic Aquaculture.

Unit 2. Species selection criteria for various culture practices

Criteria for candidate species selection, criteria for site selection for various culture practices; Aquaculture practices for freshwater fish (carps, catfishes, snake heads, feather backs, tilapia, murrels, mahsee; trouts, etc) freshwater prawn, brackishwater and marine shrimp and fish (seabass, milkfish, mullets, pearlspot, cobia, pompano, grouper, snappers, breams, other perches) lobsters, freshwater and marine ornamentals, exotics.

unit 3 Broodstock Development and Management

Broodstock management and seed production technology-Natural seed collection, holding, packaging, transportation; Environmental, nutritional and endocrine control of reproduction, improvement of seed quality throuth stock upgradation induced breeding, synthetic hormones and its analogues and their application, lay out and design of hatcheries, PIT tagging, canulation, hormonal and volitional spawning, incubation of eggs, cryopreservation of gametes, larval rearing, live feeds, microalgae, rotifers, Artemia, copepods, seed production of : carps, snakeheads, mahseer, trout, tilapia, pearlspot, ornamentals, Cobia, Grouper, Pompano, Tilapia, Mullets, Milkfish, Snappers, Breams, Shrimps (*Penaeus monodon, P. indicus, P. semisulcatus, Litopenaeus vannamei*) sand lobster, spiny lobster, mud crab (*Scylla serrata*) blue swimmer crab (*Portunus pelagicus*), giant freshwater prawn (*Macrobrachium rosenbergii)* mussel, edible oyster, pearl oyster. Larval transportation, bio-security principles, Specific pathogen Free (SPF) broodstock development, seed certification, quarantine and hatcheryk protocols, Nusery rearing, pre-stocking, stocking and post stocking management, feeding and nutrition management, health management, biofilm and its uses, probiotics, bioremediation, bioflok based nutrition.

Unit 4. Farm Design, Construction and Operational Management

Design and construction of aqua-farms: site selection, nutrient and soil quality, micro organisms and their roe, water supply and water circulation, soil and water quality management, liming, manuring and fertilization, bio-fertilization, poly houses, recirculatory system; construction of pens, cage design and construction, fixed cages, floating cages, semi-submerged and submerged cages, towing cages, flow through systems, race ways.

Feed and nutrition management-Natural and formulated feeds, weaning to artificial feeds, feeding strategies, rations and feeding methods, manual and automatic feed dispersers, demand feeders, feed rationing, feeding protocols: Carrying capacity of aquafarms, use of biofilters, aerators; protocols in grow out systems.
Harvest management- continuous stocking and harvesting, staggered harvest, managing differential growth, live fish marketing, Best Management Practices (BMP) in Aquaculture, Hazards of drugs and chemicals, Environmental Impact Assessment (EIA), Responsible Aquaculture, Sanitary and Phytosanitary (SPS) agreement, IPR in Aquaculture, Ecosystem approach to Aquaculture, CRZ implications, CAA and its role. Ecolabeling, Organic certification.

35. FISHERIES RESOURCES MANAGEMENT

Unit 1: Fisheries Resources

Major fisheries resources of the world, global trends in production; Target and non-target fisheries resources of the Indian subcontinent and the EEZ; Distribution, composition, trends and dynamics of major exploited fishery resources in hill streams, rivers, reservoirs, lakes, lagoons, estuaries, territorial waters, oceanic waters, deep sea oceanic islands; Straddling/shared stocks and non-conventional resources; Sports, game and ornamental fisheries; Major commercially exploited stocks, their potentials, status, bionomics, methods of capture and yields; Issues related to capture fisheries; Endangered and threatened species, *in-situ* and *ex-situ* conservation; Fisheries and Biodiversity Acts; Juvenile fishing, destructive gears, by-catch and discards; Status and impact of exotic species, accidental introductions; Guidelines and policies for exotics.

Unit 2: Fishery Biology

Life history of economically important fish species; Food and feeding habits, methods of studying food and feeding habits; Reproductive biology, maturity stages, fecundity, ova diameter studies and breeding cycles; Length- weight relationships; Condition Factor, Gonado-Somatic Index; Age and growth studies - methods for determination of age, study of growth rates, direct and indirect methods; Taxonomy of major fish groups; Recruitment, growth and mortality of fish in natural water bodies; Different analytical and Holistic models for fish stock assessment, their advantages and disadvantages; Catch per unit effort, Concept of Maximum Sustainable Yield and Maximum Economic Yield; Application of remote sensing and Geographical Information System (GIS) in resource mapping and forecasting; Mechanisms, methods and status of fish yield data acquisition, storage, retrieval and processing for national estimates; Ecosystem-based fisheries management tools; Monitoring, control and surveillance (MCS) systems for major fisheries; Computer softwares in stock assessment; Use of Virtual Population Analysis and Predictive models.

Unit 3: Aquatic Environment

Various aquatic habitats and fish faunal compositions, trophic relationships, distribution and abundance; Fisheries oceanography and marine fisheries; Limnological parameters; Influence of environmental parameters on fish abundance, distribution, resource resilience; Impact of fishing, aquaculture, other anthropogenic activities on the environment and fish stock. Disaster management in fisheries; Methods for increasing productivity of water bodies (Use of thermal energy and deep sea water through artificial upwelling, Use of ranching, Artificial reefs, FADs and their uses); Habitat degradation and its impact on fisheries; Pollution of water bodies and its impact; Bioindicators and Bioremediation; Protected areas (sanctuaries, marine parks, biosphere reserves and Ramsar sites); Potential fishing zones.

Unit 4: Fisheries Management

Concepts and principles of fisheries management; Fisheries Acts and Legislations, revisions and amendments; Fisheries policies, instruments and mechanisms for inland, coastal and open ocean fisheries management; Management of riverine, reservoir and lacustrine fisheries; Management of marine fisheries; Modes of fisheries management - Open access, regulated, advisory; participatory, user rights; International fishery regulations, treaties and instruments; Input control measures such as access control, size, type, number and power of boats, duration of fishing; Output control measures such as Total Allowable Catch, Catch Quotas, Licensing, Technical control measures such as size limitations, closed fishing areas, closed seasons, size of nets and mesh size regulations, limited entry; Impediments to

fisheries governance; UNCLOS, FAO Code of Conduct for Responsible Fisheries; India's commitment to international treaties and resolutions.

Unit 5: Fishing Technology

Different types of craft and gear, their operation and their maintenance; Selectivity of fishing gears, by-catch reduction devices in trawls, turtle excluder devices; Use of modern techniques and equipment for fish finding and capturing.

Unit 6: Economics and Marketing

Supply, demand and price dynamics in the fisheries sector; domestic and export marketing of fish and fish products, trends, channels, mechanisms, regulations, trade and non-trade barriers, concerns and strategies; modern marketing methods and channels, cold chains, storage; value addition; domestic and international market demands; International regulations and practices affecting Indian fisheries trade; WTO and Indian fisheries scenario; Issues in branding and labelling; Quality concerns; Growth of domestic and exports markets; Market trends and diversification; Emerging consumer preferences and trade practices; Fisheries co-operatives; Institutional support for fisheries development.

Unit 7: Fisheries Livelihood

Relevance of capture fisheries in food, nutrition, employment, income and livelihood securities of fishers; Vulnerability of fishers to changes in resource availability, exploitation and utilization patterns; Marginalization of fishermen, small scale processors and traders due to changing scenarios of product diversification, markets and trade; Impact of dams, river linking, CRZ, Biodiversity Bill, protected/closed area, fishing bans, closed seasons, protected areas, mangroves, sanctuaries and parks on the fisher communities. Land and water body use issues in fisheries. Role of extension in fisheries, mechanisms and modes of extension and their impact on capture fisheries and fisher's livelihood, alternative livelihood options; Management of conflicts within sub-sectors in fisheries; Women in fisheries, status, role, impact, future; Vulnerability of fishers to natural disasters and coping mechanisms in disaster management.

36. FISH PROCESSING TECHNOLOGY

Unit 1: Craft Technology

Fishing crafts of the world; Principles of design and construction; Corrosion protection; Craft materials - wood, marine plywood, fibreglass, reinforced plastic, aluminium, steel, ferro-cement; Bio-deterioration and preventive measures; FAO classification of fishing vessels; Different types of fishing vessels in India; General arrangements of fishing vessels; Basic principles of fishing vessel design; Stability of fishing vessels - factors affecting stability; Powering of fishing boats; Deck machinery for trawlers, seiners, gill netters and liner; Winches- net haulers, line haulers, power blocks, special purpose winches; Engine installation- types of engines for fishing vessels, four stroke cycle, two stroke cycle; Selection of engine for fishing vessels; Transmission systems - Reduction/reverse gear boxes; Modern navigation equipment, navigation and fishing lights; Life saving devices - life jacket, life buoy, life raft, SART, EPIRB.

Unit 2: Gear Technology

Gear Materials - Netting yarns, natural fibres and their classification, origin, properties & preservation; Synthetic fibres- Classification, manufacture, identification and comparative properties; Construction of netting twines; designation of netting yarns and twine twist-coeffeient; direction, yarn numbering system; Specification and characteristics of netting; Fishing accessories- Floats, buoys and sinkers, connectors and swivels, ground gear sheer devices, hooks; Classification of fishing gear. Fishing gears used in India; Fish behaviour in relation to fishing techniques; Factors affecting fishing gear design; Fishing gear selectivity - Selectivity of trawls, gill nets and lines; Model testing of fishing gear - flume tank; Structure and operation of trawls; Otter boards - principles of operation, variation in design; Structure, design variation and operation of purse seines, gillnets and trammel nets, lines and traps. Electrical fishing; Harvesting machines; Selective fishing gear and practices: By catch and discards, By catch reduction devices (BRDs), Turtle excluder devices (TEDs); Fish aggregating devices.

Unit 3: Process Biochemistry

Major and minor constituents of fish, their distribution and function- moisture, proteins, lipids, carbohydrates, vitamins and minerals; Glycogen in fish and its functions; Structure, classification and constitution of proteins; Use of functional properties of proteins for developing fish products; Essential amino acids and limiting amino acids and their requirements; Post-mortem changes -rigor mortis, autolysis, auto-oxidation and their significance; antioxidant mechanisms; Biochemical and microbial spoilage of fish; Lipids in fish -their structure and classification; Enzymes in fish -their classification and mechanism of action; Vitamins in fish - vitamin deficiency diseases; Minerals and trace elements in fish; Toxins and toxic substances in fish, their bioaccumulation and biomagnification; Biogenic amines.

Unit 4: Fish Processing Technology

Factors affecting spoilage of fish; Principles of fish preservation; Preservation of fish by curing (drying, salting and smoking); Water content, water activity (aw) and storage stability; Onboard handling of fish; sanitary and phyto-sanitary requirements for maintenance of quality; grading of fish; Chilling and freezing of fish - principles of chilling and freezing, crystallisation, nucleation, crystal growth, methods of chilling, transportation and marketing of chilled fish, the application of freezing systems in fish processing; Changes in quality of chilled and frozen products during storage; Canning of fish and fish products- principles of canning, can materials, can shapes, process value calculation and spoilage of canned food; Modified atmosphere