

<b>Lecture Schedule</b>		
<b>Department of Aquatic Animal Health Management (Code-AAHM)</b>		
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**(1) - AAHM-222, Fish and Shellfish Pathology**

<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Significance of fin Fish and Shellfish diseases in aquaculture.	2
2	Host, Pathogen and Environment Interaction.	2
3	Disease development process.	2
4	Stress in aquaculture and its role in disease development.	1
5	Pathological processes: Cellular response to injury.	3
6	Inflammatory response to diseases.	3
7	Pathogenicity mechanism of parasite, bacteria, virus and fungus.	3
8	Case history and clinical sign in disease diagnosis.	3
9	Role of physical (injuries, health, cold) in fish health.	3
10	Role of chemical (pH, salinity, toxins, ammonia, nitrogenous waste, endogenous chemicals and metabolites, free radicals, oxidants) parameters in fish health.	4
11	Role of soil and water Quality parameters in fish health.	3
12	Nutritional diseases.	1
13	Non-infectious diseases.	2
<b>Total</b>		<b>32</b>
<b>Practical</b>		
1	Live and post mortem examination of fish and shellfish.	4
2	Pathology of organ systems.	6
3	Histopathology of normal and diseases fish and shellfish.	6
4	Diagnosis of abiotic fish diseases.	5
<b>Total</b>		<b>21</b>

**(2) - AAHM-311, Pharmacology**

<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Introduction to Pharmacology: History, Importance, Terms and Definitions.	2
2	Drug development, Screening and Nomenclature, Scope of pharmacology in fishes.	2
3	Route of Administration and Method of application to fish. Source of Drugs.	2
4	Pharmaco- therapeutic classification of drugs.	2
5	Pharmacokinetics: Biological membrane, absorption, distribution, biotransformation and Excretion of drugs. Factors influencing drug metabolism.	2
6	Pharmacodynamics: Principles of drug action, concept of drug receptor, nature, chemistry, classification.	2
7	Functions of receptor.	1
8	Transducer mechanism, second messenger, non-receptor mediated action.	3
9	Dose Response Relationship, half-life withdrawal period, potency, efficacy, threshold dose, therapeutic dose, maximal dose, toxic dose, lethal dose.	3
10	Factors modifying drug action, Adverse drug effects, drug interaction and Bioassay of drugs.	4
11	Salient features in drug acting on digestive system, nervous system and cardiovascular system.	3
12	Drugs used in fish transportation. Recent advances in Pharmacology.	2
13	Biostatistics in experimental Pharmacology, Pharmaceutical industry.	3
<b>Total</b>		<b>31</b>
<b>Practical</b>		
1	Introduction to Pharmacy.	1
2	Metrology.	1
3	Prescription Writing.	2
4	Preparation of drug solution.	4
5	Source and chemical nature of drugs.	3
6	Incompatibility.	1
7	Pharmaceutical technology,.	1
8	Bioassay of drugs.	2
9	Animal models in Pharmacological experiments.	2
10	Methods of application of drugs in fish.	1
<b>Total</b>		<b>18</b>

**(3) - AAHM-221, Therapeutics in Aquaculture**

<b>(3) - AAHM-221, Therapeutics in Aquaculture</b>		
<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Scope and current scenario of therapeutics in aquaculture.	1
2	Chemotherapy: History, definition, terms used and classification of AMA.	1
3	Antibacterial agents, mode of action, general principles, classification, Antibiotics, different classes and their mode of action, properties etc.	3
4	Antibiotic resistance.	1
5	Antiseptics and disinfectants.	1
6	Anti-parasitocides, Ectoparasites, Endoparasites and Protozoanes.	3
7	Antibiotics used in aquaculture.	1
8	Biologics: Immuno-stimulants and Vaccines-Principles in preparation/formulation, mechanism of action.	2
9	Drug formulation for aquaculture-Principles in preparation/formulation.	1
10	mechanism of action, drug leaching, stabilizer, binders and dosage.	1
11	Therapeutants in aquaculture: Classification, pesticides, fungicides/ algaecides, hormones, anesthetics, flesh color enhancers, Chemicals of therapeutic value, Low priority aquaculture drugs.	2
12	Drugs used for structural material and substances for maintenance.	2
13	substances connected with zoo technical practices.	1
14	list of the drugs used in aquaculture with therapeutics	1
<b>Total</b>		<b>21</b>
<b>Practical</b>		
1	Regulations of drug use.	1
2	Introduction to antimicrobials,	2
3	preparation of potassium permanganate solution.	1
4	preparation of weak Tincture Iodine.	1
5	Minimum inhibitory concentration (MIC).	2
6	Five- plate screening test for the detection of antibiotic residue.	2
7	Calculation of different disinfectants dosage in treating fish ponds.	3
8	Generic name, patent name, dosage and indications of various aquaculture drugs used in fish health.	2
<b>Total</b>		<b>14</b>

**(4) - AAHM-312, Fish Toxicology**

<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	<i>General Toxicology</i> : Definitions, Branches of Toxicology, Historical developments.	2
2	Classification of poison.	1
3	Types of poisoning.	1
4	Toxicity testing - Chronicity factor, Untoward effects.	2
5	Common causes, Diagnosis of poisoning.	1
6	Factors modifying toxicity.	1
7	Toxico-kinetics.	1
8	Toxico-dynamics.	1
9	General approaches to diagnosis and treatment of poisoning.	2
10	<i>Systemic Toxicology</i> : Toxicity caused by metal and non-metals.	1
11	Phyto-toxins- Toxic principles of various alkaloids and toxic plants.	2
12	Drug toxicity and toxicity caused by agrochemicals.	1
13	Myco-toxins and Bacterial toxins.	2
14	Collections and dispatch of specimens in Toxicological cases.	2
15	Toxicity of drugs in Aquaculture: Maximum Residual Limits (MRL) of various drugs and chemicals in fish Metabolism of toxic substances by aquatic organisms.	2
<b>Total</b>		<b>22</b>
<b>Practical</b>		
1	Detection of heavy metal poisoning. Spot tests for metals.	2
2	Group reaction for metals- Arsenic, Antimony, Lead (Pb), Mercury (Hg), Zinc (Zn), Barium (Ba), Iron (Fe <sup>+</sup> ), Copper (Cu), Ammonia (ammonium ions) NH <sub>4</sub> <sup>+</sup> Chloride (Cl <sup>-</sup> ), Phosphate (PO <sub>4</sub> ) Sulphate (SO <sub>4</sub> ) Flouride (F <sup>-</sup> ).	6
3	Qualitative detection of Nitrite and Nitrate.	2
4	Detection of hydrocyanic acid.	2
5	Detection and Estimation of Myco-toxins.	2
6	Test for detection of alkaloids.	2
7	Estimation of LD <sub>50</sub> and ED <sub>50</sub> .	2
8	Demonstration of drug toxicity.	2
<b>Total</b>		<b>20</b>

**(5) - AAHM-211, Fish Immunology**

<b>(5) - AAHM-211, Fish Immunology</b>		
	<b>Theory</b>	
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Introduction, brief history to immunology.	1
2	Types of immunity: Innate and adaptive immunity, cell mediated and humoral immunity, cells and organs of the immune system.	2
3	Antigens – structure and types.	2
4	Epitopes, haptens. Antibody – fine structure, classes with structure and functions, antigenic determinants on immunoglobulin.	1
5	MHC complex– types, structure, and functions.	2
6	Antigen-antibody interactions- principle, antigen recognition by B-cells and T cells.	2
7	Antigen-antibody reaction - Precipitin reactions, agglutination reactions.	1
8	Microorganisms associated with fishes in health and disease.	1
9	Defense mechanism in finfish and shellfish- specific and non-specific immune system.	2
10	Pathogenicity and virulence.	1
11	Sources of infection, transmission of disease producing organisms, portals of infection.	1
12	Immunity to bacteria, fungi and parasites.	2
13	Role of stress and host defense mechanism in disease development.	1
14	Vaccines - types of vaccines – whole cell vaccine, purified macromolecules, recombinant –vector.	2
15	DNA vaccines and multivalent subunit vaccines.	1
16	modes of vaccine administration.	1
17	Serological methods in disease diagnosis.	1
18	Immuno stimulants –types, mechanism of action, modes of administration.	2
19	Immunoassays, immuno diffusion, ELISA, immunofluorescence, neutralization, radioimmunoassay, serotyping.	2
<b>Total</b>		<b>28</b>
	<b>Practical</b>	
1	Collection, separation and identification of fish leucocytes.	2
2	Separation of blood plasma and serum.	2
3	Differential counting - RBC and WBC by Haemocytometer.	2
4	Study of different types of leukocytes and isolation of macrophages.	1
5	Precipitin reactions - Agglutination test.	2
6	immunogel diffusion.	1
7	double immuno diffusion.	1
8	radial immuno diffusion assay.	1
9	ELISA.	2
10	Methods of vaccine	1
11	preparation and techniques of fish immunization.	2
<b>Total</b>		<b>17</b>

**(6) - AAHM-111, Fundamentals of Microbiology**

<b>Theory</b>		
<b>S.No.</b>	<b>Topic</b>	<b>Class</b>
1	Milestones in microbiology. Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Flemming, Joseph Lister, Winogradsky.	2
2	Microscopy- Principle and construction of brightfield, dark field, phase contrast, stereo, SEM and TEM.	2
3	Microbial taxonomy –Bergey's and molecular taxonomy Types of Microorganisms: Prokaryotes– Morphology and ultrastructure of bacterial cell.	2
4	General features, types and importance of viruses, cyanobacteria, actinomycetes, archaea, mycoplasma, rickettsiae.	2
5	Eukaryotes – Diagnostic features and importance of fungi and protozoa.	1
6	Microbial Techniques - Types of media, types of sterilization - physical and chemical agents, cultivation of microorganisms, staining techniques – simple, differential, structural staining; enumeration of micro-organisms, culture preservation methods.	2
7	Bacterial metabolism: Nutrient requirements, nutritional types, bacterial photosynthesis and their ecological significance.	2
8	Microbial growth: Growth phases, measurement of cell growth, factors affecting growth- influence of physio-chemical factors - pH, temperature, moisture, light, osmotic pressure, fermentation - types and significance.	3
9	Microbial genetics- general principles, genetic recombination, transformation, transduction and conjugation.	2
10	Plasmids- types and their importance. Mutation–types and significance. Microbial ecology: Introduction and types of interaction, extremophiles and their significance	2
11	Aquatic Microbiology: Introduction and scope of aquatic microbiology, aquatic environment as habitat for microorganisms - bacteria, cyanobacteria, fungi, algae, parasites and viruses.	4
12	Distribution of microorganisms and their biomass in rivers, lakes, sea and sediment.	2
13	Influence of physical, chemical and biological factors on aquatic microbes.	1
14	Microbial biofilms. Role of microbes in the production and breakdown of organic matter.	1
15	Role of microbes in sedimentation and mineralization process.	1
16	Nutrient cycles-carbon, nitrogen, sulphur, phosphorus, iron, and manganese cycles.	2
17	Sewage microbiology, self-purification in natural waters, sewage treatment.	2
18	Drinking water microbiology, sanitary quality of water for aquaculture, bioremediators.	2
19	Economic significance of aquatic microbes.	1
<b>Total</b>		<b>36</b>
<b>Practical</b>		
1	Handling of microscopes, Wet mount, smear and hanging drop preparations Micrometry- Determination of size of microorganisms (ocular, stage micrometers).	3
2	Tools and techniques in sterilization methods: Filtration, dry heat, moist heat, chemical agents.	2

3	Cultivation technique: Media preparation, Isolation -pure culture, subculture.	3
4	Observation of fungi, blue-green algae, and protozoans.	2
5	Staining techniques for bacteria– simple, differential, structural and Biochemical tests: Indole, methyl red, Vogues Proskauer, citrate test, oxidase test, catalase tests.	2
6	Collection of water and sediment samples for microbiological analysis.	1
7	Winogradsky cylinder.	1
8	Isolation, identification and enumeration of various groups of microorganisms from different water bodies including aquaculture systems.	2
9	Study of bacteria involved in nutrient cycles.	2
10	Biofilms, water testing for portability, enumeration of coliform.	3
<b>Total</b>		<b>21</b>