SACRED HEART COLLEGE (AUTONOMOUS)

Department of Aquaculture

Master of Aquaculture and Fish Processing

Course plan

Academic Year 2018-19

Semester 2

Course 1: 16P2AQCT05: ECOLOGY OF CULTURE SYSTEM AND AQUATIC BIOLOGY

COURSE PLAN

PROGRAMME	MASTER OF AQUACULTURE & FISH PROCESSING	SEMESTER	2
COURSE CODE AND TITLE	16P2AQCT05: ECOLOGY OF CULTURE SYSTEM AND AQUATIC BIOLOGY	CREDIT	4
HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	Dr. T. V. Anna Mercy, Dr. V. C. George, Dr. S. Sanjeev		

Programme Outcome

	Programme Outcome
PO 1	Exercise their critical thinking in creating new knowledge leading to innovation, entrepreneurship and employability
PO 2	Effectively communicate the knowledge of their study and research in their respective disciplines to their stakeholders and to the society at large.
PO 3	Make choices based on the values upheld by the institution, and have the readiness and know-how to preserve environment and work towards sustainable growth and development.
PO 4	Develop an ethical view of life, and have a broader (global) perspective transcending the provincial outlook.
PO5	Explore new knowledge independently for the development of the nation and the world and are able to engage in a lifelong learning process.

PROGRAMME SPECIFIC OUTCOMES

PSO1	Understand the taxonomy and biology of cultivable fin fishes and other organisms
PSO2	Understand the ecology and cultural practices of cultivable fin fishes, shell fishes, sea cucumber, seaweeds as well as engineering principles as applied to aquaculture structures
PSO3	Understand the harvest and postharvest technology of aquaculture organisms
PSO4	Awareness on the Nutrition, physiology and pathology of aquaculture organisms.
PSO5	Application of statistical and computer tools in the research field

	COURSE OUTCOMES	**PO/ PSO**	**CL**
CO 1	Understand the basic ecology and aquatic biology as applicable to aquaculture organisms in captivity and controlled conditions	PO4 PSO2	U
CO 2	Evaluate the ways and means of circumventing, ecological imbalances for production of better aquaculture yield	PO4 PSO2	U
CO 3	Understanding the basic features of fisheries oceanography	PO2 PSO2	U
CO 4	Understanding the physico-chemical characteristics of marine environment	PO4 PSO2	U

CO 5	Describing mud banks in capture fisheries	PO 2 PSO2	E
CO 6	Evaluate the effect of trawl banning in stock enhancement	PO 2, PO5 PSO2	U
CO 7	Enumeration different types of major groups of microbes from culture ecosystems	PO4 PSO2	U
CO 8	Understand the growth and reproduction of microbes in relation to different physico-chemcal conditions in pond	PO4 PSO2	U

R- Remember
U- Understand
A- Apply
An- Analyze
E- Evaluate
Cr- Create

CO - PO/PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1				1			2			
CO 2				1			2			
CO 3		1				1	2			
CO 4				2			3			
CO 5		1					2			
CO 6		1			1		2			
CO 7				1			3			
CO 8				1			3			

Mapping Strength

0- No Mapping strength
1- Low
2- Medium
3- High

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	COURSE OUTCOME
MODULE I				
1	Role of physical parameters like depth, in ponds.	PPT	video	CO 2
2	Role of physical parameter like temperature.	PPT/Lecture		CO 2
3	Role of physical parameters like salinity.	PPT/Lecture		CO 2
4	Role of physical parameters like light.	PPT/Lecture		CO 2
5	Role of physical, light, turbidly, and wind in ponds.	PPT/Lecture		CO 2
6	Circulation and mixing patterns in ponds.	PPT/Lecture		CO 2
7	Open sea farming.	PPT/Lecture		CO 3
8	Physical characteristics in relation to open sea farming.	PPT/Lecture		CO 3
9	Types of open sea farming.	PPT/Lecture		CO 3
10	Effect of monsoon on pond physical conditions.	PPT/Lecture	e-resource	CO 2
11	Seasonal and diurnal variation in pond.	PPT/Lecture		CO 2
12	Chemical characteristics with reference to carbon dioxide distribution.	PPT/Lecture		CO 2
13	Chemical characteristics with reference to dissolved oxygen distribution.	Lecture		CO 2
14	Classification of Aquatic micro organisms	Lecture		CO 7
15	Identification of aquatic micro organisms	Lecture		CO 7

16	Sampling, isolation and purification of major groups of microbes from culture ecosystems.	Lecture		CO 7
17	Rivers of Kerala.	PPT/Lecture		CO 2
18	Characteristics of estuaries.	PPT/Lecture		CO 2
19	Classification, of estuaries.	PPT/Lecture		CO 2
20	Estuarine horizontal stratification, communities and adaptation.	PPT/Lecture		CO 1
21	Aerobic and anaerobic degradation of organic matter in pond bottom.	PPT/Lecture		CO 1
22	Anaerobic degradation of organic matter in pond bottom.	PPT/Lecture		CO 1
23	Sludge accumulation.	PPT/Lecture		CO 1
24	Water quality management.	PPT/Lecture		CO 1
25	Primary and secondary productivity in ponds	Lecture		CO 1
26	Benthic productivity	Lecture		CO 1
27	Macro and micro benthos including benthic algae in ponds	Lecture		CO 1
28	Benthic algae production in ponds	PPT/Lecture		CO 1
29	Growth and reproduction in bacteria	Lecture		CO 8
CIA 1				
30	Microbial population in relation to physical, chemical and biological characteristics in ponds	PPT/Lecture		CO 8
31	Major estuaries of India	PPT/Lecture		CO 2
32	Physico-chemical characteristics of marine environment.	PPT/Lecture		CO 3

33	Microbial population in relation to physical, chemical and biological characteristics in ponds.	PPT/Lecture		CO 8
34	Classification thermal stratification.	PPT/Lecture		CO 5
35	Ecological energetic of ponds.	PPT/Lecture		CO 2
36	Effect of organic fertilizers on pond productivity.	Lecture	Quiz	CO 1
37	Effect of inorganic fertilizers on pond productivity.	Lecture	Q & Ans Session	CO 1
38	Carrying capacity of culture systems.	PPT/Lecture		CO 2
39	Lotic aquatic systems.	PPT/Lecture		CO 2
40	Lentic aquatic systems.	PPT/Lecture		CO 2
41	Mud banks and monsoon trawling.	PPT/Lecture		CO 5
42	Eutrophication.	PPT/Lecture		CO 2
43	Ecological energetic of ponds.	Lecture		CO 1
44	Effect of organic fertilizers on pond productivity.	PPT/Lecture		CO 1
45	Effect of inorganic fertilizers on pond productivity.	PPT/Lecture		CO 1
46	Carrying capacity of culture systems.	PPT/Lecture		CO 2
47	Lotic aquatic systems.	PPT/Lecture		CO 2
48	Lentic aquatic systems.	PPT/Lecture		CO 2
49	Mud banks and monsoon trawling.	PPT/Lecture		CO 6
50	Eutrophication.	PPT/Lecture		CO 2
51	Pathogenic bacteria in culture systems	PPT/Lecture		CO 8
52	Role of microbes in regeneration of	PPT/Lecture		CO 8

	nutrients.			
53	Role of microbes in sulphide production in ponds.	PPT/Lecture		CO 8
54	Seminar		Group discussion	
55	Seminar		Group discussion	
56	Seminar		Group discussion	
57	Seminar		Group discussion	
58	Seminar		Group discussion	
CIA 2				
59	Special groups of bacteria relevant in culture systems.	Lecture	Demo video	CO 8
60	Objective, scope and relation to fishery science,	Lecture		CO 6
61	Relation to fishery science.	Lecture	Group discussion	CO 6
62	Major oceans.	Lecture		CO 3
63	Chemical composition of sea water	PPT/Lecture		CO 3
64	Marine communities.	PPT/Lecture		CO 3
65	Different types of stratification in ocean.	PPT/Lecture		CO 3
66	Major estuaries of India.	PPT/Lecture		CO 2
67	Special group of bacteria relevant in culture system.	PPT/Lecture		CO 8

68	Seminar		Group discussion	
69	Seminar		Group discussion	
70	Seminar		Group discussion	
71	Seminar		Group discussion	
72	Seminar		Group discussion	

GROUP ASSIGNMENTS/SEMINAR – Details & Guidelines

	Topic of Assignment & Nature of Seminar (Individual Presentation)	Course Outcome
1	Physical characteristics of water required for fish culture in fresh water system.	CO 1
2.	Open sea farming- present status and future prospects	CO 3
3	Rivers of Kerala and scope of fish culture in rivers	CO 2
4	Carrying capacity of a pond.	CO 2
5	Factors affecting the productivity of a fresh water fish pond	
6	Present status & future prospects of fresh water fish culture in Kerala	CO 1
7	Role of Macro and micro benthos in culture ponds	CO 1
8	Physic chemical characteristics of marine environment	CO 3
9	Effect of trawl ban on the fisheries of Kerala	CO 6
10	Chemical composition of sea water	CO 3

References

- **Verma P. S. and Agarwal, V. K. 2001, Environmental biology, S. Chand and Co. Ltd, New Delhi.**
- **Boyd C. E, 1982, Water quality management for pond fish culture, Elsevier Science Publication.**

Web resource references:

- http://www.fao.org/3/ad002e/AD002E01.htm
- http://www.fao.org/3/i3099e/i3099e02.pdf

http://www.fao.org/3/AC267E/AC267E00.htm

COURSE 2: 16P2AQCT06: Biochemistry and nutrition of fin fish and shell fish

PROGRAMME	MASTER OF AQUACULTURE & FISH PROCESSING	SEMESTER	2
COURSE CODE AND TITLE	16P2AQCT06: Biochemistry and nutrition of fin fish and shell fish	CREDIT	3
HOURS/WEEK	3	HOURS/SEM	72
FACULTY NAME	Ms. Sangeetha K. R. , Dr. P. M. Sherief		

Programme Outcome

	Programme Outcome
PO 1	Exercise their critical thinking in creating new knowledge leading to innovation, entrepreneurship and employability
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PROGRAMME SPECIFIC OUTCOMES

PSO1	Understand the taxonomy and biology of cultivable fin fishes and other organisms
PSO2	Understand the ecology and cultural practices of cultivable fin fishes, shell fishes, sea cucumber, seaweeds as well as engineering principles as applied to aquacultural structures
PSO3	Understand the harvest and post harvest technology of aquacultural organisms
PSO4	Awareness on the Nutrition, physiology and pathology of aquacultural organisms.
PSO5	Application of statistical and computer tools in the research field

	COURSE OUTCOMES	**PO/ PSO**	**CL**
CO 1	Understand the basic principles of biochemistry as applied to aquaculture organisms in relation with environmental factors	PO4 PSO 2	U
CO 2	Understand the application of different additives in aquaculture feeds	PO4 PSO4	U
CO 3	Describe the nutritional bioenergetics in fin fish and shell fish	PO4 PSO4	U
CO 4	Understand the classification of feed stuff and anti-nutritional factors present in its	PO4 PSO4	U
CO 5	Evaluation of quality of feed ingredients and finished feed	PO1 PSO4	E

CO 6	Analyse the feed formulation strategies and methods	PO1, POS4 PSO4	An
CO 7	Understand the management of feeding in aquaculture arms and hatcheries	PO1, PO4 PSO4	U
CO 8	Understand the nutritional requirements of finfishes and shell fishes under culture condition	PO4 PSO4	U

CL* Cognitive Level
R- Remember
U- Understand
B- Apply
An- Analyze
E- Evaluate
Cr- Create

CO - PO/PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1				1			2			
CO 2				1					3	
CO 3				1					3	
CO 4				1					3	
CO 5	1								3	
CO 6	1								3	
CO 7	1								3	
CO 8				1					3	

Mapping Strength

0. No Mapping strength
1. Low
2. Medium
3. High

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	COURSE OUTCOME
MODULE I				
1	Atoms.	PPT	video	CO 1
2	Bonds	PPT/Lecture		CO 1
3	concepts of PH and buffers	PPT/Lecture		CO 1
4	Classification of carbohydrates.	PPT/Lecture		CO 1
5	Monosaccharides,	PPT/Lecture		CO 1
6	Reaction of monosaccharides with acid and alkali.	PPT/Lecture		CO 1
7	Disaccharides	PPT/Lecture		CO 1
8	Oligosaccharides and Polysaccharides.	PPT/Lecture		CO 1
9	Classification of lipids.	PPT/Lecture		CO 1
10	General properties of lipids.	PPT/Lecture	e-resource	CO 1
11	Oxidation of lipids.	PPT/Lecture		CO 1
12	Iodine number.	PPT/Lecture		CO 1
13	Classification of saturated and unsaturated FA.	Lecture		CO 1
14	PUFA, MUFA.	Lecture		CO 1
15	Compound lipids.	Lecture		CO 1
16	Phospholipids, Glycolipids, Spingolipids	Lecture		CO 1
17	Simple lipids, Steroids, Cholesterol, Prostaglandins.	PPT/Lecture		CO 1
18	Metabolism of lipids: fatty acid break down,	PPT/Lecture		CO 1

19	Fatty acid synthesis	PPT/Lecture		CO 1
20	Proteins. Amino acids.	PPT/Lecture		CO 1
21	Structural organization of proteins.	PPT/Lecture		CO 1
22	Globular and fibrous proteins.	PPT/Lecture		CO 1
23	Enzyme classification.	PPT/Lecture		CO 1
24	Enzyme kinetics	PPT/Lecture		CO 1
25	Seminar		Discussion	
26	Seminar		Discussion	
27	Seminar		Discussion	
28	Seminar		Discussion	
29	Seminar		Discussion	
CIA 1				
30	Principles of nutrition.., nutritional bioenergetics in finfish and shellfish.	PPT/Lecture		CO 3
31	Mechanism of food capture.	PPT/Lecture		
32	Protein quality and sources.	PPT/Lecture		CO 1
33	Nitrogen balance.	PPT/Lecture		CO 1
34	Metabolism of proteins.	PPT/Lecture		CO 1
	Metabolism of phenyl alanine sereine and glycine.	PPT/Lecture		CO 3
35	Urea cycle.	PPT/Lecture		CO 3
36	Types of enzyme inhibition.	Lecture	Quiz	CO 3
37	Isoenzymes, co-enzymes.	Lecture	Q & Ans Session	CO 3
38	Lipids, their functions	PPT/Lecture		CO 3

39	Negative aspects of lipids,	PPT/Lecture		CO 3
40	Phospholipids and sterol requirements carbohydrates; their sources and utilization.	PPT/Lecture		CO 3
41	Classification of feed stuff.	PPT/Lecture		CO 4
42	Anti-nutritional factors in feed ingredients and their effect on finfish and shell fish.	PPT/Lecture		CO 4
43	Additives in fin fish and shell fish.	Lecture		CO 4
44	Feed formulation strategies and methods.	PPT/Lecture		CO 6
45	Chemical methods of evaluation; biological methods of evaluation.	PPT/Lecture		CO 5
46	Bases and sugars, Nucleotides.	PPT/Lecture		CO 3
47	Replication of DNA.	PPT/Lecture		CO 3
48	Transcription and translation process.	PPT/Lecture		CO 3
49	Recent advances in larval nutrition	PPT/Lecture		CO 3
50	Storage and quality control of feeds.	PPT/Lecture		CO 5
51	Feed dispensing methods.	PPT/Lecture		CO 3
52	Mass culture and cyst production;	PPT/Lecture		CO 2
53	Micro diets for larvae.	PPT/Lecture		CO 2
54	Seminar		Group discussion	
55	Seminar		Group discussion	
56	Seminar		Group discussion	

57	Seminar		Group discussion	
58	Seminar		Group discussion	
CIA 2				
59	Chemical methods of evaluation.	Lecture		CO 5
60	Biological methods of evaluation.	Lecture		CO 5
61	Recent advances in larval nutrition	Lecture	Group discussion	CO 6
62	FCR/ FCE.	Lecture		CO 5
63	PER,BV,	PPT/Lecture		CO 5
64	NPU,NPR	PPT/Lecture		CO 5
65	Seminar		Group discussion	
66	Seminar		Group discussion	
67	Seminar		Group discussion	
68	Seminar		Group discussion	
69	Seminar		Group discussion	
70	Seminar		Group discussion	
71	Seminar		Group discussion	
72	Seminar		Group discussion	

GROUP ASSIGNMENTS/SEMINAR – Details & Guidelines

	Topic of Assignment & Nature of Seminar (Individual Presentation)	Course Outcome
1	Adaptations to various types of feeding in fin fishes, crustaceans and mollusc	CO 1
2.	Nutritional bioenergetics	CO 3
3	Gross protein requirements and protein quality	CO 3
4	Lipids – sources ,function and negative aspects	CO 3
5	Protein sparing action of lipids and carbohydrates	CO 3
6	Carbohydrate –sources in fish food and utilization by fishes	CO 3
7	Essential and non-essential aminoacids and their quantitative requirements	CO 5
8	Requirements of fattyacids ,steroids and phospholipids in fish food	CO 8
9	Water and fat soluble vitamins ,their function ,deficiency and hyper dosage syndrome	CO 8
10	Mineral requirements and importance in dietary level ,deficiency and hyper dosage syndrome	CO 8
11	Nutritional requirements of finfish ,mollusk and crustacean larvae	CO 8
12	Nutritive value of phytoplankton and their mass culture	CO 2
13	Nutritive value of rotifer and their mass culture	CO 2
14	Nutritive value of cladocerans and their mass culture	CO 2
15	Nutritive value of artemia and their mass culture	CO 2
16	Feed dispensing methods	CO 6

17	Feeding strategies of fish larvae in hatcheries	CO 2
18	Types of live feeds used in hatcheries	CO 7
19	Types of artificial feeds used in hatcheries and farms	CO 7
20	Feed manufacturing process –small scale and large scale	CO 6

References

- Das D. 2000, Biochemistry, Academic publishers, Calcutta.
- Dr. Snahotra M. K. Shrimp feed formulation and feeding management, CMFRI special bulletin.
- Devadasan K. 1994, Fish nutrition and bioactive substances in aquatic organisms.

Web resource references:

- https://thefishsite.com/articles/principles-of-fish-nutrition
- http://www.fao.org/in-action/globefish/fishery-information/resource-detail/en/c/338772/
- http://www.fao.org/3/ab470e/AB470E01.htm

COURSE 3: 16P2AQCT07: PHYSIOLOGY AND PATHOLOGY OF FIN FISH AND SHELL FISH

PROGRAMME	MASTER OF AQUACULTURE & FISH PROCESSING	SEMESTER	2
COURSE CODE AND TITLE	16P2AQCT07: PHYSIOLOGY AND PATHOLOGY OF FIN FISH AND SHELL FISH	CREDIT	4
HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	LITTY MARY		

Programme Outcome

	Programme Outcome
PO 1	Exercise their critical thinking in creating new knowledge leading to innovation, entrepreneurship and employability
PO 2	Effectively communicate the knowledge of their study and research in their respective disciplines to their stakeholders and to the society at large.
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PROGRAMME SPECIFIC OUTCOMES

PSO1	Understand the taxonomy and biology of cultivable fin fishes and other organisms
PSO2	Understand the ecology and cultural practices of cultivable fin fishes, shell fishes, sea cucumber, seaweeds as well as engineering principles as applied to aquacultural structures
PSO3	Understand the harvest and postharvest technology of aquaculture organisms
PSO4	Awareness on the Nutrition, physiology and pathology of aquaculture organisms.
PSO5	Application of statistical and computer tools in the research field

	COURSE OUTCOMES	PO/ PSO	CL
CO 1	Understand the basic physiology of fin fish and shell fish and its relation to cultural conditions	PO1 PSO4,PSO 1	U
CO 2	Identification of pathogens in aquacultural organisms	PO1 PSO4,PSO 2	U
CO 3	Understand the classification of disease in aquaculture systems	PO1 PSO4	U
CO 4	Describe the disease control of fin and shellfish, remedial and prophylactic measures	PO1 PSO4	U
CO 5	Comparative study of physiological characters of fin fish and shell fish	PO1 PSO4, PSO 2	E
CO 6	Understanding the biological rhythm in aquatic organisms	PO1 PSO4, PSO 2	U
CO 7	Understand the ecophysiology and environmental requirements for the metabolism of aquatic organisms	PO1 PSO4, PSO 2	U
CO 8	Understand the principles and application of eye stalk ablation and hypophysation in fin fish and shell fish hatcheries	PO1, PSO 2 PSO4	U

CL* Cognitive Level

R- Remember

U- Understand

C- Apply

An- Analyze

E- Evaluate

Cr- Create

CO - PO/PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1						2			2	
CO 2								2		3	
CO 3	2									3	
CO 4	1							2		3	
CO 5	1							2		3	
CO 6	1						1	2		2	
CO 7	1							2		2	
CO 8								1		2	

Mapping Strength

0. No Mapping strength
1. Low
2. Medium
3. High

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	COURSE OUTCOME
MODULE I- Physiology				
1	Physiology of respiratory	PPT	video	CO 1
2	Physiology circulatory system	PPT/Lecture		CO 1
3	Physiology Digestive system	PPT/Lecture		CO 1
4	Ecophysiology	PPT/Lecture	e-resource	CO 7
5	Effect of environmental factors on acid base regulation and biotic interactions	PPT/Lecture		CO 7

6	Hormonal control of osmotic regulation.	PPT/Lecture		CO 1
7	Mechanism and biology of neuron coordination.	Lecture		CO 1
8	Sense organs- Receptive mechanisms and effector systems in sense organs	Lecture		CO 1
9	Effect of biotic and abiotic factors in reproduction and metabolism.	Lecture		CO 7
10	General morphology of nerurosecretory system in crustaceans	Lecture		CO 1
11	Structure of sinus gland complex .'x' organ, 'y' organ and androgenic gland.	PPT/Lecture		CO 1
12	Seminar	PPT/Lecture	Group discussion	
13	Seminar	PPT/Lecture	Group discussion	
14	Seminar	PPT/Lecture	Group discussion	
15	Seminar	PPT/Lecture	Group discussion	
16	Seminar	PPT/Lecture	Group discussion	
MODULE II- Endocrinology				
17	Endocrine organs in fishes	PPT/Lecture		CO 1
18	Reproductive systems and secondary sexual characters	PPT/Lecture		CO 1
19	The chemical aspects of hormone action: Molting, growth and reproduction in crustaceans	Lecture		CO 8
20	Neuroendocrine control of reproduction	Lecture		CO 1
21	parasitic castration	Lecture		CO 1

22	Neurosecretory cells in mollucs	PPT/Lecture		CO 1
23	Induced maturation and spawning in molluscs	PPT/Lecture		CO 1
24	Hypophysation in fishes	PPT/Lecture		CO 8
25	Induced maturation and spawning in finfish	PPT/Lecture		CO 8
26	Induced ovarian maturation and spawning through physical, chemical methods.	Lecture		CO 8
27	Induced ovarian maturation and spawning through biological method	Lecture		CO 8
28	Use of hormonal analogues in Hypophysation of finfish.	Lecture		CO 8
29	Eyestalk ablation techniques-its principles, application of eyestalk ablation techniques in crustacean hatcheries.	Lecture		CO 8
	CIA 1			
	MODULE 1- Pathology			
30	Introduction. Definition of terms, classification of disease	PPT/Lecture		CO 3
31	Causes of diseases, aetiology.	PPT/Lecture		CO 3
32	Role of abiotic and biotic factors, generic, species and strain; environment,	PPT/Lecture		CO 3
33	Role of nutritional status foe healthy growth	PPT/Lecture		CO 3
34	Role of Intrinsic factors and extrinsic factors in disease process.	PPT/Lecture		CO 3
35	Role of stress in disease process	PPT/Lecture		CO 3
36	Nonspecific immunity: agglutinin and precipitins	Lecture	Quiz	CO 4
37	C-reactive protein, complement in fish, phagocytosis	Lecture	Q & Ans Session	CO 4
38	Acquired immunity; -Role of thymus, T-cell;	PPT/Lecture		CO 4

	receptors			
39	cell mediated immunity	PPT/Lecture		CO 4
40	Mechanism of cell mediated immunity, cytokines, T-helper function.	PPT/Lecture		CO 4
41	Role of macrophages, recirculation and ecotaxis of T-cell; T-cell markers.	PPT/Lecture		CO 4
42	Antigenic stimulation; memory cells.	PPT/Lecture		CO 4
43	Structure of antibody; types of antibody; types of antibodies produced in fish.	Lecture	video	CO 4
44	Humoral immunity-origin of B-cell, differentiation of B-cells into plasma cells, T and B-cell interaction	PPT/Lecture		CO 4
45	Immunization in fish and vaccination.	PPT/Lecture		CO 4
46	Basic vascular and cellular alterations	PPT/Lecture		CO 4
47	Cell metabolism and cell growth,	PPT/Lecture		CO 4
48	Necrosis, inflammation.	PPT/Lecture		CO 4
49	Defenses of the body against injury,	PPT/Lecture		CO 4
50	healing and neoplasms	PPT/Lecture		CO 4
51	Microbial disease in fishes	PPT/Lecture		CO 2
52	Microbial disease and their control	PPT/Lecture		CO 4
53	Viral Diseases in fishes	PPT/Lecture		CO 2
54	Viral Diseases and their control	PPT/Lecture	Video	CO 4
55	Bacterial Diseases in fishes	PPT/Lecture		CO 2
56	Bacterial Diseases and their control	PPT/Lecture		CO 4
57	Seminar	PPT/Lecture	Group discussion	
58	Seminar	PPT/Lecture	Group	

			discussion	
CIA 2				
59	Bacterial Diseases and their control	Lecture	Demo video	CO 4
60	Fungal Diseases in fishes	Lecture		CO 4
61	Fungal Diseases and their control	Lecture	Group discussion	CO 4
62	Parasites and Parasitic diseases	Lecture		CO 4
63	Parasitic diseases and their control	PPT/Lecture		CO 4
64	Nutritional disease, toxic diseases in fishes	PPT/Lecture		
65	Nutritional disease, toxic diseases their control	PPT/Lecture		CO 4
66	Prophylactic and control measures, biological and chemical treatment of disease.	PPT/Lecture		CO 4
67	Integrated disease management.	PPT/Lecture		CO 4
68	Seminar	PPT/Lecture	Group discussion	
69	Seminar	PPT/Lecture	Group discussion	
70	Seminar	PPT/Lecture	Group discussion	
71	Seminar	PPT/Lecture	Group discussion	
72	Seminar	PPT/Lecture	Group discussion	

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Topic of Assignment & Nature of Seminar (Individual Presentation)	Course Outcome
1	Neuro secretory system in crustacean.	CO 1
2.	Neuroendocrine organs in fishes	CO 1
3	Osmoregulation and excretion in fishes	CO 1
4	Defense mechanism in fishes	CO 1
5	Viral diseases in shrimp and their control measures	CO 4
6	Eyestalk ablation in crustacean	CO 8
7	Induced breeding in molluscs	CO 1
8	Gametogenesis in fishes	CO 1
9	Vaccines- their production, types and administration	CO 4
10	Extrinsic factors affecting fish growth	CO 7
11	Defense mechanism and healing in fishes	CO 4
12	Inflammation, Necrosis and basic vascular alterations	CO 4
13	Biological rhythm	CO 6
14	Lateral line system	CO 6
15	Hermaphroditism.	CO 1
16	Molting and its growth	CO 8
17	Fungal diseases and their control	CO 2
18	New generation drugs in induced breeding	
19	Biological and chemical treatment of diseases	CO 4
20	Pituitary hormones- storage, release and control of reproduction	CO 1

References

- **Biiwas K. P. (1992), Prevention and control of fish and prawn diseases. Narendhran publishing House, Delhi**

- **Snthosh Kumar and Manju (1996), Anatomy and physiology of fishes, Vikas Publishing House, Pvt. Ltd.**

Web resource references:

- http://www.fao.org/tempref/FI/CDrom/aquaculture/a0845t/volume2/docrep/field/003/ac160e/AC160E04.htm
- http://www.fao.org/3/ca4730en/ca4730en.pdf
- http://www.fao.org/3/x5738e02.htm
- https://www.sciencedirect.com/bookseries/fish-physiology/vol/4/suppl/C

COURSE 4: 16P2AQCT08: GENETICS AND BIOTECHNOLOGY OF FIN FISHES AND SHELL FISHES.

PROGRAMME	MASTER OF AQUACULTURE & FISH PROCESSING	SEMESTER	2
COURSE CODE AND TITLE	16P2AQCT08: GENETICS AND BIOTECHNOLOGY OF FIN FISHES AND SHELL FISHES.	CREDIT	4
HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	LITTY MARY, LEENA RAPHAEL		

Programme Outcome

	Programme Outcome
PO 1	Exercise their critical thinking in creating new knowledge leading to innovation, entrepreneurship and employability
PO 2	Effectively communicate the knowledge of their study and research in their respective disciplines to their stakeholders and to the society at large.
PO 3	Make choices based on the values upheld by the institution, and have the readiness and know-how to preserve environment and work towards sustainable growth and development.
PO 4	Develop an ethical view of life, and have a broader (global) perspective transcending the provincial outlook.
PO5	Explore new knowledge independently for the development of the nation and the world and are able to engage in a lifelong learning process.

PROGRAMME SPECIFIC OUTCOMES

PSO1	Understand the taxonomy and biology of cultivable fin fishes and other organisms
PSO2	Understand the ecology and cultural practices of cultivable fin fishes, shell fishes, sea cucumber, seaweeds as well as engineering principles as applied to aquacultural structures
PSO3	Understand the harvest and post harvest technology of aquacultural organisms
PSO4	Awareness on the Nutrition, physiology and pathology of aquacultural organisms.
PSO5	Application of statistical and computer tools in the research field

	COURSE OUTCOMES	**PO/ PSO**	**CL**
CO 1	Understand Induced breeding ,genetic improvement of the stock for better strains of cultural organisms	PO1 PSO1, PSO 2	An
CO 2	Genetic engineering and biotechnological principles for crop improvement	PO1 PSO1	An
CO 3	Understand the principles of genetic technique in cytogenetics	PO1 PSO1	U
CO 4	Describing different hybridization techniques	PO4 PSO1	U
CO 5	Describing different types of probiotics and its application in aquaculture	PO4 PSO1, PSO 4, PSO 2	U
CO 6	Introduction to tools and techniques in modern biotechnology	PO1 PSO1, PSO 5	U
CO 7	Analyze the developments of fish cell lines and their application in aquaculture	PO4 PSO1	An
CO 8	Understanding the different types of vaccination in fish genetics	PO4 PSO1	U

CL* Cognitive Level

R- Remember

U- Understand

D- Apply

An- Analyze

E- Evaluate

Cr- Create

CO - PO/PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1					2	1			
CO 2						1				
CO 3						1				
CO 4						1				
CO 5					1		1		3	
CO 6					1					2
CO 7	2				1					
CO 8					2					

Mapping Strength

0. No Mapping strength
1. Low
2. Medium
3. High

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	COURSE OUTCOME
MODULE I				
1	Introduction to genetics.	PPT	video	CO1
2	Practical application of Mendalian Genetics.	PPT/Lecture		CO 3
3	Principles of genetics techniques in cyto genetics.	PPT/Lecture		CO 3
4	Sex linked genes and sex.	PPT/Lecture	e-resource	CO 1
5	Quantitative phenotypes.	PPT/Lecture		CO 1

6	Limited phenotypes.	PPT/Lecture		CO 1
7	Pleiotropy,	Lecture		CO 1
8	Recent trends in genetic mutations.	Lecture		CO 1
9	Genetic improvement	Lecture		CO 1
10	Need for genetic improvement inheritance.	Lecture		CO 1
11	Inbreeding.	PPT/Lecture		CO 1
12	Selection methods.	PPT/Lecture		CO 4
13	Basis of selection and its effects.	PPT/Lecture		CO 4
14	Types of hybridization- biotechnological aspects.	PPT/Lecture		CO 4
15	Types of hybridization- biological aspects.	PPT/Lecture		CO 4
16	Chromosomal manipulation- biotechnological aspects.	PPT/Lecture		CO 1
17	Chromosomal manipulation- biological aspects.	PPT/Lecture		CO 1
18	Sex-reversal and sex control.	Lecture		CO 1
19	Naturally and artificially produced Hybrids.	Lecture		CO 4
20	Common hybrids.	Lecture		CO 4
21	Types of selection.	Lecture		CO 4
22	Gamatic manipulation.	PPT/Lecture		
23	General principles of genetic engineering.	PPT/Lecture		CO 2
24	Enzymes involved in genetic engineering.	PPT/Lecture		CO 2
25	Steps in genetic engineering.	PPT/Lecture		CO 2
26	Seminar.	Lecture	Group	

			discussion	
27	Seminar.	Lecture	Group discussion	
28	Seminar.	Lecture	Group discussion	
29	Seminar.	Lecture	Group discussion	
CIA 1				
30	Gene cloning methods.	PPT/Lecture		CO 6
31	Recombinant DNA technology.	PPT/Lecture		CO 6
32	Enzymes involved in Recombinant DNA technology.	PPT/Lecture		CO 6
33	Restriction nucleases.	PPT/Lecture		CO 6
34	Steps in recombinant technology.	PPT/Lecture		CO 6
35	Sequencing.	PPT/Lecture		CO 6
36	DNA structure.	Lecture	Quiz	CO 6
37	DNA and RNA.	Lecture	Q & Ans Session	CO 6
38	DNA fingerprinting.	PPT/Lecture		CO 6
39	Transgenic fish.	PPT/Lecture		CO 6
40	Gene transfer.	PPT/Lecture		CO 6
41	Transgenic organisms.	PPT/Lecture		CO 6
MODULE 2				
42	Introduction to Biotechnology.	PPT/Lecture		CO 1
43	Biotechnology in aquaculture.	Lecture		CO 1
44	Tools and techniques in modern biotechnology.	PPT/Lecture		CO 6

45	Different types of probiotics.	PPT/Lecture		CO 5
46	Use of probiotics in aquaculture	PPT/Lecture		CO 5
47	Bio fertilization in aquaculture	PPT/Lecture		CO 5
48	Immuno stimulants.	PPT/Lecture		CO 1
49	Immunostimulants used in aquaculture.	PPT/Lecture		CO 1
50	Bioremediation.	PPT/Lecture		CO 5
51	Bioremediation in aquaculture systems.	PPT/Lecture		CO 5
52	Bioremediation and bio fertilization in aquaculture.	PPT/Lecture		CO 5
53	Seminar.	PPT/Lecture	Group discussion	
54	Seminar.	PPT/Lecture	Group discussion	
55	Seminar.	PPT/Lecture	Group discussion	
56	Seminar.	PPT/Lecture	Group discussion	
57	Seminar.	PPT/Lecture	Group discussion	
58	Seminar.	PPT/Lecture	Group discussion	
CIA 2				
59	General principles of cell and tissue culture.	Lecture	Demo video	CO 7
60	Culture of primary cells secondary culture (subcultures).	Lecture		CO 7
61	Culture of cell lines.	Lecture	Group discussion	CO 7
62	Fish cell culture.	Lecture		CO 7

63	Development of cell lines and their applications.	PPT/Lecture		CO 7
64	PCR.	PPT/Lecture		CO 6
65	Steps in PCR.	PPT/Lecture		CO 6
66	Disease diagnosis using PCR.	PPT/Lecture		CO 8
67	Seminar.	PPT/Lecture	Group discussion	
68	Seminar.	PPT/Lecture	Group discussion	
69	Seminar.	PPT/Lecture	Group discussion	
70	Seminar.	PPT/Lecture	Group discussion	
71	Seminar.	PPT/Lecture	Group discussion	
72	Seminar.	PPT/Lecture	Group discussion	

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Topic of Assignment & Nature of Seminar (Individual Presentation)	Course Outcome
1	Bioremediation in aquaculture farms	CO 2
2.	Use of probiotics in aquaculture	CO 5
3	Androgenesis and gynogenesis	CO 3
4	Modification enzymes	CO 6
5	Genetic manipulation	CO 6
6	Solid state fermentation	CO 5
7	Genetic engineering	CO 6

8	Recombinant DNA	CO 6
9	Hybridization	CO 4
10	Fish cytogenetics	CO 3
11	Cryopreservation	CO 3
12	Polyploidy	CO 1
13	Gene expression and regulation	CO 6
14	Recombinant vaccines	CO 8
15	Cross breeding	CO 1
16	Cultural traits in hybrids	CO 4
17	Mutation and mutagens	CO 1
18	Evolution of fish karyotypes	CO 1
19	Role of steroids in sex reversal	CO 1
20	PCR	CO 6

References

- Collin E. Purdom 1993, Genetics and fish breeding, Chapman and Hall.
- Jhingran A. G. (Eds.) Fish genetics in India, 1989, Today and tomorrow printers and publishers, New Dehli.

Web resource references:

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- http://www.fao.org/3/mc856e/mc856e.pdf
- http://www.fao.org/tempref/docrep/fao/010/a1337e/a1337e04e.pdf
- **http://www.fao.org/3/ab412e/ab412e03.htm**
- **http://www.fao.org/3/CA2296EN/ca2296en.pdf**
- **http://www.fao.org/3/a-i0283e.pdf**